The Information Economy and the Labor Theory of Value
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Fuchs, Christian. 2017. The Information Economy and the Labor Theory of Value. *International Journal of Political Economy* 46 (1): 65-89.

Methodological appendix: http://fuchs.uti.at/wp-content/IJPE_Appendix.pdf

Accepted version, for citation consult the published version:
http://www.tandfonline.com/doi/abs/10.1080/08911916.2017.1310475

Abstract
This article discusses aspects of the labor theory of value in the context of the information industries. First, taking the Temporal Single-System Interpretation (TSSI) of Marx's labor theory of value as methodology, the paper calculates economic demographics at the level of socially necessary labor time and prices of an example case.
Second, the paper questions the assumption that the labor theory of value cannot be applied to the information industries. This paper tests this hypothesis with an analysis of the development of labor productivity in six countries.
The paper concludes that the labor theory of value is an important tool for understanding the information economy and the peculiarities of the information commodity.

Keywords: information economy, labor theory of value, Marx, political economy, capitalism

1. Introduction

<65:> The question if and how Marx's labor theory of value applies to the information industries has been an important and contested issue in Marxist theory that has gained a new impetus with the rise of so-called "social media" platforms such as Facebook, Twitter, Weibo and YouTube (Arvidsson and Colleoni 2012; Beverungen, Böhm and Land 2015; Bolaño 2015, Carchedi 2014, Comor 2014, Foley 2013, Fuchs 2010, 2012a, 2012b, 2014a, 2015, 2016b, 2017; Huws 2014; McGuigan and Manzerolle 2014, Perelman 2002, 2003; Proffitt, Ekbia and McDowell 2015, Reveley 2013, Rigi 2014, Rigi and Prey 2015, Teixeira and Rotta 2012, Zeller 2008). As part of neo-liberal hypes of the "new economy", the Internet and the "creative industries", the actual economic relevance of the Internet and knowledge work has often been overestimated (Garnham 1998, 2005). But at the same time it cannot be dismissed that these phenomena have some relevance and that Marxist political economy therefore needs to consider and analyse them (Fuchs 2013). The theoretical question that has been discussed within Marxist theory in recent time is what Marxian categories, such as value, productive labor, rent, profit, commodification, reproductive labor, etc can be used for understanding information and the Internet. This is a complex theoretical debate that is not subject of this paper.

Fisher and Fuchs (2015) as well as Fuchs (2015, chapter 5) provide overview discussions of various aspects of this theory debate. Approaches used have for example included Dallas Smythe's <66:> (1977) theory of the audience commodity and audience labor, rent theory, Autonomist Marxism and Marxist feminism. A basic question is if labor or specific labor conducted in the information economy is productive or unproductive. This question already goes back to Smythe's (1977) works. Claims that labor in the information economy is unproductive are not new. They tend to reoccur within the contemporary political-economic debate about value in the Internet and information economy. They are often reformulations of Michael Lebowitz's (1986) criticism of Dallas Smythe's concept of audience labor. This article only discusses empirical aspects of the labor theory of value in the context of the information industries. The reader further interested in the theoretical foundations is therefore referred to the above-mentioned debate on this question.

Information, media, communication and culture are connected terms. How do they relate to each other? Culture is the process and system, in which humans produce social meanings in society. This means that it is the system, where social information is produced. The term information has a broader meaning because information also exists in living systems, as the term genetic information indicates. For the purpose of this paper, information is however understood as social information. Social information is often also termed knowledge. Information in society exists as cognitive thought patters, communicated information, and information stored in objects. Communication is the process of symbolic interaction between humans. Mediation means a relation between interacting systems. A medium is therefore a system that enables interaction. Wherever humans communicate, there is a medium of communication. Culture therefore is a social information system, in which humans produce, communicate and use information with the help of media. It is society's social information system. In this paper I will predominantly use the terms information economy and information industries.

The information economy is in this paper defined as the realm of the production of

information and technologies for the consumption and transmission of information[1]. This definition can be challenged on the ground of combining aspects of the production of physical and non-physical production, such an argument is however a form of cultural idealism that neglects the materiality of culture (Williams 1977). Raymond Williams' argument is that separating the economy and culture is idealist: Culture is produced by information workers. The emergence of cultural work and the culture industry show the importance of the interconnection of culture and economy (Fuchs 2015, chapter 2). For Williams, culture is not a superstructure that sits on top of an economic base. Culture and ideas are just like all reality material.

In discussions about the contemporary information economy, one can find tendencies that categories such as information, the digital, knowledge, cultural/information/digital/virtual labor are separated from physical labor that produces information technology. The most extreme example is the concept of immaterial labor that implies that there are parts of society that are not material, which contradicts a materialist worldview. Raymond Williams' cultural materialism is an approach that allows us to see the dialectic of categories. So for example all work has mental and physical aspects (Fuchs 2015). But a specific concrete work has a specific degree of mental and physical aspects. Culture at the same time belongs to the economy and does not belong to it: Humans produce all culture and information is created in concrete economic production processes. The created information however has effects in all parts society. Information matters, makes a difference and has meaning not just in the economy. It has emergent effects when humans interpret the world based on existing information and with the help of information technology (Fuchs 2015).

<67:> In defining the information economy, there is a difference between industry and occupation approaches (Machlup 1962). Occupation approaches consider the information economy the aggregate of the value created by all workers whose occupation is to produce information. Industry approaches in contrast define the information economy as the aggregated value produced by all companies creating information products. The occupation approach is methodological-individualist, whereas the industry approach is in line with what Marx (1867, 643) termed the collective worker, "a combination of workers" jointly creating a product. In the contemporary corporation, this includes the value created together by a variety of workers. In an information corporation, this includes both occupations that create tangible and intangible outputs that contribute together to the production of information technologies and information content.

The OECD has in the fourth revision of the International Standard Industrial Classification of All Economic Activities (ISIC) introduced an information sector (sector J) that it defines the following way: "This section includes the production and distribution of information and cultural products, the provision of the means to transmit or distribute these products, as well as data or communications, information technology activities and the processing of data and other information service activities"[2]. It, however, also defines a separate arts, entertainment and recreation

[1] In the International Standard Industrial Classification of All Economic Activities (ISIC Rev.4) these are the following categories: D18 printing and reproduction of recorded media, D26 computer, electronic and optical products, D58T63 publishing, audiovisuals, broadcasting, telecommunications, IT; D72 research, D73 advertising and marketing research, D85 education, D90T93 arts, entertainment, recreation.

[2] http://unstats.un.org/unsd/cr/registry/regcs.asp?Cl=27&Lg=1&Co=J

sector (sector R) and defines scientific research, advertising, market research, consulting, accounting as part of sector M: professional, scientific and technical activities. Given that science, art, entertainment, research, advertising, consulting and accounting all produce some form of information, such a definition is confusing and results in a narrow understanding of the information sector.

Goodridge, Hasek and Wallis (2014) have measured the investment in intangible assets ordered by year, industries and intangible asset types. In their conceptual framework, intangible assets are comprising R&D, mineral exploration, financial product innovation, design, training, artistic originals, organisational structure, software, branding. They calculated that in 2011, intangible asset investment was significantly larger in the UK economy than tangible asset investment. The core distinction in this approach is the one between tangibles and intangibles. The basic question is however if this strict separation can be upheld in the contemporary economy. A computer clearly is a tangible machine. It however is an information technology, i.e. a data processing machine. So it has to do with a tangible form that processes an intangible asset. It is therefore unclear how the computer as asset should exactly be classified in this approach.

Higgs, Cunningham and Pagan (2007, 20) define the creative economy as “human activities related with the production, distribution, exchange, and consumption of creative goods and services”. They say it is broader than the term cultural industries that focuses on artistic production and stresses the commercial use of “symbolic knowledge and skills” (4). The authors understand the Creative Trident as the total of the creative occupations in the core creative industries as well as in other industries. The definition includes in contrast to the ISIC’s understanding of the information sector a broad range of information industries (music, performing arts, film, TV, radio, advertising, marketing, software, online, publishing, architecture, design, visual arts) in the core creative industries. It furthermore combines the industry and occupation approach.

Baskhshi, Freeman and Higgs (2013) take a comparable approach that suggests measurements of the creative intensity of creative occupations in any industry. They make creative talent the defining feature of a creative occupation. The defining qualities of creative activity are <68:> that it is a novel process, mechanisation resistant, non-repetitive, non-uniform, independent of context, and that it involves interpretation not mere transformation (24). “This confers a unique and important quality on the creative worker within the creative process, namely that it is difficult to *mechanise* the creative process and hence to substitute machines or devices for the humans, reversing a trend that has dominated much of history. Implementing a creative decision is not really a creative role, we would argue, but making one is” (Baskhshi, Freeman and Higgs 2013, 22). Based on this approach the authors calculated that in 2010, 8.7% of the UK workforce was part of the creative economy and that the majority of these workers were employed outside the core creative industries.

The two latter approaches have a strong focus on measuring occupations. However, in capitalism, “the commodity-form of the product of labour […] is the economic cell-form” (Marx 1867, 90). The commodity is the economic form that objectifies value generated by humans and whose sale results in the realisation of monetary profit. Like Marx, it therefore makes sense to start economic analysis with the commodity

form. Speaking about the information sector, this means that one must have a look at the commodity form of information as the economic cell-form of the information sector. The focus on creative occupations makes individual activities throughout the entire economy that generate novel information based in highly skilful and qualified manner the cell-form of this sector. The notions of creative labor, creative industries and the creative economy overestimate the role of highly educated and qualified non-replaceable labor. Many information commodities are generated in a division of labor that involves occupations that produce information, services and physical products, that have varying forms of qualification (low, medium, high skill), etc. The point is that for the production of certain information commodities, the labor time of a diverse set of workers is needed. All of their labor-time is reflected in the commodity. A labor theory of value applied to information sector must therefore start with the information commodity produced by a collective (but diverse) information worker as the basic focus.

"Editing a film is a creative task – but operating a 6 plate 35mm Steenbeck editing table under the direction of the editor is not" (Baskhshi, Freeman and Higgs 2013, 22). The point here is that both the editor and the operator's labor-time is objectified in the film as commodity and that they work in the same division of labor of the movie industry. To argue that the first's labor is creative and the second is not can easily create the impression that only skilled workers are creating surplus-value and unskilled ones do not. In the production of an information commodity such as a film both of them are however productive workers, i.e. the exploitation of their labor that is expended in time results in commodities that are sold in order to accumulate capital.

There are certainly informational occupations that do not result in the production of an information commodity, but rather in different commodity types. They are part of a collective workforce outside the information sector. The distinction between the occupational and the industry definition of industries certainly is feasible and can be combined. The question however is which one fits best for a Marxist understanding of the economy.

To avoid an elitist definition of creativity, one can also resort to Marx (1867, 284), who argued that at the "end of every labour process, a result emerges which had already been conceived by the worker at the beginning, hence already existed ideally". All human labor requires mental planning and anticipation of the result, albeit with different qualities. All occupations <69:> have information dimensions and are creative in the general understanding of the word that Marx hints at, namely that they *create* use-values that satisfy needs.

This brief non-exhaustive discussion shows why this paper uses a framework, in which the information industry is defined as the realm of the production, circulation and consumption of information products, both information goods and services. Many information products take on the form of commodities. There is however a growing sector of the information economy that transcends the commodity form and in which peer produced information takes on the form of an informational commons. Given this definition of the information economy, the share of the information industry in total national value added was in 2010 15.6% in Finland, 14.1% in France, 12.4% in Germany, 12.0% in Italy, and 10.6% in Norway (data source: OECD STAN)[3]. The

[3] Comparable results can be obtained for other countries. OECD STAN at the moment of writing (January 2014) only provides data for 15 countries because ISIC Rev. 5 is still a relatively new metric introduced in 2008 that

total employment share of this sector was in the same year 16.3% in Finland, 13.8% in France, 13.2% in Germany, 11.7% in Italy, and 14.2% in Norway (ibid.). One may now say these are significant, but not overwhelming shares. Let's, however, compare these data to the manufacturing sector[4]: It accounted in 2010 for 14.8% of value added in Finland, 9.7% in France, 14.8% in Finland, 20.0% in Germany, 17.1% in Italy, and 7.3% in Norway. Manufacturing comprised in the same year 13.4% of total employment in Finland, 10.2% in France, 15.9% in Germany, 15.1% in Italy, 8.8% in Norway. 6 out of 10 country-specific variables in these example calculations have higher values in the information than in the manufacturing sector.

In this paper, section 2 studies an example case – the German information economy – with the help of the labor theory of value in order to formulate some assumptions. Section 3 tests based on the same case the assumption that the labor theory of value cannot be applied to the information sector.

2. The Information Industry and Marx's Labor Theory of Value

Some representatives of Autonomist Marxist theory argue for example that the law of value does not apply to the information economy because it is networked and based on co-operation. Antonio Negri (1991, 172) writes for example that Marx in the *Grundrisse* argues for the death of the law of value. Paolo Virno (2004, 100) says that the development of capitalism refutes the law of value. Hardt and Negri (2004, 145) claim that the law of value in contemporary capitalism "makes no sense". Vercellone (2010, 90) speaks of capitalism's "crisis of measurement". But Marx (1857/1858, 705) in the specific passage that these authors refer to does not talk about the law of value in capitalism, but rather about the death of the law of value in a communist society (Rosdolsky 1977, 428). The law of value is a foundation of all forms of capitalism (Postone 2008, 126).

A comparable argument has been made by Nicholas Garnahm, who assumes that the labor theory of value is invalid in the information industries. Nicholas Garnham is one of these scholars. Garnham (1998, 103) says that the labor theory of value works if "labour time is largely a matter of energy and expended" and productivity rises due to saving of human energy expenditure based on technology. He questions whether this works in a "non-entropic economy of bits". The labor theory of value for Garnham works well "in an economy based […] on the measurable increase in the productivity of human work-time and especially on the saving of human energy inputs through the substitution of natural energy sources" (Garnham 2000, 146). "In an economy dominated by <70:> information production any stable relation between labour and value breaks down" (Garnham 2000, 146). Garnham (2011, 47-48) writes that the economic concepts of productivity and efficiency cannot be applied to culture because of an "uncertain relationship between labor inputs and outputs" (Garnham 2011, 47). Information labor could not easily be automated and mechanised.

In a newer version of his argument, Garnham argues that the labor theory of value "served a useful analytical function and within the relatively simple material

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has not been applied to older data and is not used for statistical purposes in all countries. No data is available for the UK. The data for the USA is not sufficiently disaggregated for use. See the appendix to this paper for a methodological discussion (http://fuchs.uti.at/wp-content/IJPE_Appendix.pdf).

[4] I calculated value added of manufacturing based on ISCI Rev. 5 aggregated category D10T33 minus D18 and D26 that according I consider to be part of the information economy.

economies of the day bore some relevant relationship to relative prices and the division of the surplus and thus to class relations. […] In an economy based upon a complex division of labour, on a growing ratio of dead labour to living labour and on the application of knowledge, it made, and makes, less and less sense" (Garnham 2016, 295-296; for a response see Fuchs 2016a). Garnham argues that Piero Sraffa (1960) in his book *Production of Commodities by Means of Commodities* has shown that "the inequalities of capitalism can be generated within the process of commodity production and exchange without recourse to an exploitation theory of labour" (Garnham 2016, 297; for a critique see Fuchs 2016a).

One should bear in mind that Cantabrigian economics (Pierro Sraffa, Joan Robins, John Eatwell, and others) has resulted in Marxist critique. In this approach, "people as human beings – and, more importantly, as historical social classes – are given no role in the process of production" (Roosevelt 1975, 7). The Cantabrigians separate "relations between things from relations between people" (Roosevelt 1975, 19), which results in a commodity-fetishistic model of capitalism, in which "things produce things" (19). "However ingenious the Cantabrigians are in analyzing price phenomena, they never connect such phenomena with social relations in the way that Marx did in *Capital*" (20). Sraffa and Robinson's approaches constitute a "[p]rice theory without value theory" (19). Robinson (1966, 22) revises Marx theory and argues that "no point of substance in Marx's argument depends upon the labour theory of value". For Marx, distribution and production are intertwined social processes, for the Cantabrigians they are separate, production being technical in nature and distribution social. For Sraffa (1960, 9), surplus is not surplus-value, but a physical "surplus production" of commodities, "a surplus of some commodities" (26). In contrast, for Marx surplus is surplus-value that stems from capital's exploitation of labor in class relations.

For Marx, there is a social production process, in which humans enter social relations of production and in these social relations use means of production for creating new goods that are distributed in relations of distribution (Fuchs 2016b). Production and distribution are interrelated social processes grounded in human activity. For Marx, human creativity and activity sustains any economy. Capitalism is a mode of production that is based on the general production of commodities that reflects socially necessary labor time, i.e. an average quanta of human labor that is exploited by capital. Production is a social process, in which humans work together in order to produce a good or service. In capitalism, this involves a division of labor. In addition, in complex economies there are multiple organisational units of production creating similar types of goods and services. In capitalism, this involves a social process of competition for productivity levels, price advantages, markets, customers and profits. Marx's labor theory of value is a theory of time in capitalism (Fuchs 2016b; Fuchs 2015, chapter 4). It distinguishes between necessary labor-time and surplus labor-time. The first constitutes the value of labor-power and the value of the necessary means of production. The second is surplus-value that is unremunerated labor time. Parts of the working day are not paid, which results in monetary profit and a surplus product owned by the capitalist class. Capitalism means a struggle focused <71:> on paid and unpaid labor-time. The working class has the interest that all of its time is remunerated, whereas the capitalist class has the interest that no labor time is paid at all. The class struggles oscillates depending on the power of the involves forces somewhere between the poles of maximum wage and maximum profit that

corresponds to the two extremes of the payment of all labor-time on the one end and the payment of no labor-time at all on the other end.

To argue that increasing importance of the information economy invalidates Marx's labor theory of value means that time and labor-time do no longer play any role in the economy. Consequently, the class conflict must have come to an end and the production of information must have become autonomous from humans. But none of the two can be observed today. There are several reasons why the labor theory of values continues to apply in information capitalism and digital capitalism (see Fuchs 2014a, 2015, 2016b, 2017 for details of these arguments):

- First, commercial software and other information goods are not just produced once and then copied, but there are often new versions, constant updates, and forms of support labor.
- Second, one has to see that large parts of the Internet's political economy are based on targeted advertising. Google and Facebook are not communications corporations. They are the world's largest advertising companies. Advertising is not just based on the labor-time of marketing professionals, but also on the attention time of audiences and on commercial Internet usage time that is (unpaid) labor time.
- Third, there is an international division of digital labor, in which various forms of labor are organised. It ranges from the exploitation of enslaved miners in the Congo, Tayloristic ICT assemblers at Foxconn in China, or software engineers in India or the Silicon Valley to various forms of unpaid online labor (Fuchs 2014a, 2014b, 2015). The production of information technology is highly exploitative and time-consuming.
- Fourth, there are various forms of irregular, unpaid, precarious, outsourced, crowdsourced, and click-worked digital labor. Examples include the usage of Facebook, Google, YouTube, Weibo, LinkedIn, Pinterest and Instagram; online customer reviews on Amazon or Yelp; work via freelancer platforms such as Upwork, PeoplePerHour, Amazon Mechanical Turk and ClickWorker; the participation in customer surveys, installing software updates, deleting spam, unsubscribing from spam lists, the time spent on online daring platforms such as match.com or Tinder, answering professional e-mails via the mobile or tablet out of regular working hours, working on the train, tube or in cafés; online travel booking, etc.

  Consumer and prosumer labor is shadow work because it does not in an obvious way feel like work, but creates value for corporations. It takes time. And it takes time away that could be used outside the commodity culture. It substitutes paid labor by precarious and unpaid labor and by reducing corporations' wage-sum helps increasing their profits. Consumers and users have become part of the working class.

The digital law of value has created new forms of exploitation as well as contradictions that allow the creation of new spheres of non-commercial, alternative, co-operative production and a solidarity, commons-based, and peer production economy outside the realm of capitalism that undermine the law of value. The political aim of destroying the law of value is not an automatism that flows from information and information technology. It can rather only be achieved in conscious political struggles for the decommodification of information, the economy and the world. It requires the dialectical political unity of the social movement "crowd" and the party (Dean 2016).

<72:> To show that the labor theory of value applies to the information economy, I employ in this paper the Temporal Single-System Interpretation (TSSI) of Marxian value theory for the analysis of the German information economy. One could certainly discuss if the TSSI is the right methodology or if another one should be used, which is a more scholastic discussion that I leave to others. One could simply in an equal manner apply other interpretations and check the feasibility of the results. The space of this paper allows however to just apply one method of analysis and the TSSI seems to be an interesting approach.

The TSSI is a version of Marxian value theory. It assumes a dynamic character of accumulation. It has been created by a group of economists around Andrew Kliman and Alan Freeman. Some of the basic insights of this interpretation are:

- Marx's theory is not erroneous or inconsistent. It does not require a correction or revision with external assumptions, but is in itself consistent.
- Claims that Marx's theory is inconsistent or erroneous often serve the purpose to suggested that it should not be used today and that its political implications are wrong. The consequential assumption of such approaches is that capitalism and class should not be abolished.
- Critics of Marx's theory often either argue that his theory of the tendency of the rate of profit to fall, the labor theory of value, or his solution to the transformation problem (the transformation of labor values into prices) are false and therefore invalidate his theory.
- The TSSI shows that all three aspects are internally consistent on the grounds of Marx's theory.
- The TSSI assumes the existence of a single-system of labor values and prices. Values and prices are not seen as being independent, but standing in a relationship to each other. The Monetary Expression of Labor Time (MELT) is a variable that can be calculated for an economic system and that allows the transformation of labor values (calculated in hours) into prices (calculated in monetary units) and vice-versa.
- The TSSI is temporal because it assumes a dynamic character of the capitalist economy. This means that the outputs of one time period (typically one full year) act as inputs into and influence the outputs of the next time period. This means that the total hours worked during one period of time create means of production that are typically used during the next period of time. One therefore does not have to assume that the values and prices of the economic inputs have to equal those of the outputs during a certain period of time.

Alan Freeman (2010, 592) argues that the price of a commodity "at time t1 must be equal to the sale price at time t0" (Freeman 2010, 592), i.e. there is a connection between output and input prices of one production period and the next. "In each period, new prices are established in circulation on the basis of the values arising thus from the immediately preceding phase of production" (Freeman 1998, 11). The TSSI also assumes, as Marx did, that commodities do not necessarily sell at their value, but can be sold above or below their value: "the production price of a commodity is not at all identical with its value. [...] It has been shown that the production price of a commodity may stand above or below its value and coincides with it only in exceptional cases" (Marx 1894, 892).

<73:> In the TSSI, the "value is quite distinct from the price, and the difference is a

quantitative one. In exchange the values that have arisen in the manner we have just described will be exchanged against money and this money, in exactly the same way but with new proportions, will represent value, measurable in hours. Some will realize more hours than their value, and some will realise less. Conversely, since every amount of value may equally well be represented in money, we may assign a money magnitude to their value and we will find that their value, measured in money, is in general systematically different from their price" (Freeman 1998, 11).

Two main assumptions of the TSSI are that:
1) "valuation is temporal, so input and output process can differ",
2) "values and prices, though quite distinct, are determined interdependently" (Kliman 2007, 2).

As indicated in the introduction, there is an ongoing theory debate in Marxist political economy about value-creation in the information economy. This discourse has theoretical importance, but has remained on a purely philosophical and theory level devoid of applications to empirical economic analysis, especially mathematical and statistical political economy. This paper takes a different approach and is especially interested in empirical analysis of available statistical data. The TSSI is an approach that is grounded in the labor theory of value and mathematical and statistical analysis. The TSSI is the most thorough and rigorous mathematical formulation of the relationship between labor and time, for which it uses the category of the Monetary Expression of Labor Time (MELT), a category introduced first by Ramos (1998/99). Furthermore the TSSI allows conceiving the information economy as value-creating, which stands in contrast to some other contemporary approaches such as certain versions of Autonomist Marxism.

The TSSI implies that for calculating the value of a commodity (measured in hours or units of money) and how it differs from the commodity price (also measured in hours or units of money), the wage (variable capital) needs to be transformed into "the value of the money used to purchase that worker's labour power" (Freeman 2010, 595), which is done based on a ratio called the Monetary Expression of Labor Time (MELT): The MELT is obtained by calculation ratio of the whole economy's total money to total labor-time (measured in hours) during a specific period of time, such as one year (Freeman 1998, 13). It indicates the degree of value measured in money that workers create on average in one hour of labor. The MELT's unit of measurement is £/hour (or another currency). When Marx speaks about value, he mostly means units of labor time, but sometimes also monetary values. The MELT is a way of connecting these two measures of economic value.

The TSSI implies that value is produced in the production process and not when the commodity is sold (Kliman 2007, 37). The latter interpretation has been given recently by Michael Heinrich (1999, 2012) in what can be characterized not as a labor theory of value, but a money theory of value that implies that the worker is not exploited if the commodity s/he produces cannot be sold on the market (for a critique, see Kliman et al. 2013).

I will outline how the labor theory of value can be mathematically applied to information industries with the help of an example. I have chosen data for specific industries in Germany for the years 2001-2011 that were obtained from the OECD's Database for Structural Analysis (STAN). I have chosen Germany because the

required data is relatively complete for this <74:> country and the time period 2001-2011 because data is available for it based on the International Standard Industrial Classification of All Economic Activities (ISIC), Revision 4, that in contrast to ISIC Revision 3 provides more detailed data for the information industries. The appendix of this paper discusses differences between the ISIC Revisions 3 and 4 in relation to the information economy and the classification codes used for defining the information sector in this paper. It also discusses the role of the finance/insurance/real estate industry in the model underlying the article. The appendix is available at http://fuchs.uti.at/wp-content/IJPE_Appendix.pdf

The method applied to this data was inspired by Freeman (1998) and Kliman (2007, 25-26) and included the following steps:

- The following data was obtained from OECD STAN and taken to represent as suggested by Shaikh and Tonak (1994) the following Marxian variables:
  INTI=intermediate inputs: corresponds to constant capital c,
  LABR=compensation of employees: corresponds to variable capital v,
  NOS=net operating surplus: corresponds to profit p,
  HRSE=hours worked by employees h.
- All data was available in aggregated form at the level of industries as defined by ISIC Rev. 4.
- Not all labor is productive and therefore there are industries that add no value to the economy in a Marxian framework, but either produce no value or consume it. This question is contested in Marxist value theory and the empirical results one obtains depend on the theoretical choices one makes. I am in favour of a relatively broad concept of productive labor (Fuchs 2014a, 2014b, 2015), but assume that the financial and insurance industry as well as real estate do not create value. Data for these industries is however included in STAN (categories D64-D66 Financial and insurance activities, D68 Real estate activities). I therefore transformed the obtained data in such a way that I excluded data for these categories and recalculated the totals for all variables. Finance produces interest and real estate creates rent. Interest and rent are paid for by wages and profits, they consume and do not create surplus and value.
- At a specific time t, the MELT can be calculated as (Freeman 1998):
  MELT (t) = (c_p(t) + v_p(t) + p_p(t) [in prices]) / (c_h(t-1) + v_h(t-1) + p_h(t-1) [in years or hours]
  c_p(t)… total constant capital at the price level at point of time t (measured in monetary units)
  v_p(t)… total variable capital at the price level at point of time t (measured in monetary units)
  p_p(t)… total profit at the price level at point of time t (measured in monetary units)
  c_h(t-1)…total constant capital at the level of labor-time at the point of time t-1 (measured in hours or years)
  v_h(t-1)…total variable capital at the level of labor-time at the point of time t-1 (measured in hours or years) (=necessary labor-time at the level of wages)
  p_h(t-1)…total profit at the level of labor-time at the point of time t-1 (measured in hours or years) (=surplus labor-time)
- I calculated the economy-wide MELT for the German economy for the years 2000-2011 (t=0, 1, 2….10). Table 1 gives an overview. The initial MELT (0) in the years 2000 was calculated as:
  MELT (0) = (c_p(0) + v_p(0) + p_p(0) [in prices]) / (c_h(0) + v_h(0) + p_h(0)) [in hours]

<75:> The total hours worked during a year (=h) in the economy represent the hours during which living labor creates the value of its labor power (wages, necessary labor time) and new value (surplus-value, surplus labor time):
$h(t)= v_h(t) + p_h(t)$
h(t)…total hours worked in year t
$v_h(t)$…necessary labor time in year t
$p_h(t)$… surplus labor time in year t
Living value per hour: $lvph(t) = (v_p(t) + p_p(t))/h(t)$ [€/hour]
$v_p(t)$…total wages in year t
$p_p(t)$…total profits in year t
h(t)…total hours worked in year t
The value of constant capital has already been created at this point of time. It is transferred to commodities and represents specific amounts of value:
$c_h(t)=c_p(t)/lvph(t)$
$c_h(t)$…constant capital in year t, measured in hours
$c_p(t)$…constant capital in year t, measured in monetary units (€)
lvph(t)…living value per hour in year t, measured in €/hour
Given all these assumptions, MELT(t) can be calculated for t=0 and then iteratively for all other points of time t=1…n.

- I selected the following information industries and industry aggregates for analysis:
  D58T63 Information and communication
  D58T60 Publishing, audiovisual and broadcasting activities
  D58 Publishing
  D59T60 Audiovisual and broadcasting activities
  D61 Telecommunications
  D62T63 IT and other information services
  D73 Advertising and marketing research
  D90T93 Arts, entertainment and recreation
- In the next step of analysis, I calculated several measures for all time periods and for all of these industries:
  Sum of commodity prices $pr_p(t) = c_p(t) + v_p(t) + p_p(t)$ [€]
  $c_h(t)=c_p(t)/MELT(t)$ [h]
  $v_h(t)=v_p(t)/MELT(t)$ [h]
  Surplus-value: $s_h(t)=h(t) – v_h(t)$ [h]
  Surplus-labor: $s_p(t)=s_h(t) * MELT(t)$ [€]
  $pr_h(t) = pr_p(t) / MELT(t)$ [h]
  $p_h(t) = p(t) / MELT(t)$ [h]
  Value of output: $w_p(t)=c_p(t) + v_p(t) + s_p(t)$ [€]
  <76:> Value of output: $w_h(t)=c_h(t) + v_h(t) + s_h(t)$ [h]
  Difference between value and price: $\Delta_p = pr_p(t) – w_p(t)$
  Difference between value and price: $\Delta_h = p_h(t) – w_h(t)$
  Value rate of exploitation: $e_v = s_h(t) / v_h(t) = s_p(t) / v_p(t)$ (surplus labor / necessary labor)
  Price rate of exploitation: $e_p = p_h(t) / v_h(t) = p_p(t) / v_p(t)$
  Organic composition of capital: $oc_v = c_h(t) / v_h(t) = c_p(t) / v_p(t)$ (constant capital / variable capital)
  Value rate of profit: $rp_v = s_h(t) / (c_h(t) + v_h(t)) = s_p(t) / (c_p(t) + v_p(t))$ (surplus / (constant capital + variable capital))
  Price rate of profit: $rp_p = p_h(t) / (c_h(t) + v_h(t)) = p_p(t) / (c_p(t) + v_p(t))$ (profit / (constant capital + variable capital))

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
29.1	29.9	29.5	30.4	31.8	33.0	35.0	36.8	37.2	33.0	36.1	34.6

Table 1: The German economy's MELT, 2000-2011 (in € per hour)

In the presentation of the results that follows, I will use the following conventions for industries:
1 D58T63 Information and communication
2 D58T60 Publishing, audiovisual and broadcasting activities
3 D58 Publishing activities
4 D59T60 Audiovisual and broadcasting activities
5 D61 Telecommunications
6 D62T63 IT and other information services
7 D73 Advertising and market research
8 D90T93 Arts, entertainment and recreation

In order to make the results easier to understand, I converted labor hours into full time-equivalent labor years, assuming a full-time working week of 35 hours and 48 working weeks per year. In Germany, the minimum statutory leave is 4 weeks, so 1 working year = 35 * 48 hours = 1680 hours

Table 2 presents a comparison of the German information industries' output value in the years 2001-2011. Table 3 gives the same data, but not calculated in years, but in monetary units (€). The data show that in all analysed information industries, information tends to be sold at prices higher than values. Table 4 shows how much larger prices are than values. Prices tend to be between 1.3% and 47.0% higher than values. There is only one case, where the total value is higher than the total price (industry #6, 2008). The annual average differences vary between a minimum of 8.2% in 2008 and a maximum of 20.6% in 2002. The annual average price-value-difference for all information industries cumulated over the years 2001-2011 is around 13%. The price-value-difference is on average largest in the IT industry (26.3%) and lowest in the telecommunications industry (5.1%).

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1											
w:	2458	2385	2471	2344	2393	2282	2345	2452	2758	2620	2773
p:	2896	2875	2792	2701	2672	2556	2575	2670	3252	2934	3105
2											
w:	1008	961	909	882	852	838	831	841	928	862	N/A
p:	1113	1036	973	942	923	896	905	950	1143	1021	N/A
3											
w:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p:	622	592	557	538	524	511	542	592	714	625	N/A
4											
w:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p:	491	444	416	404	398	385	363	359	428	396	N/A
5											
w:	700	710	852	770	814	725	750	777	938	840	N/A
p:	950	1043	1067	1043	996	929	896	900	1111	967	N/A
6											
w:	750	714	710	692	727	720	764	835	892	918	N/A
p:	833	796	752	716	753	730	774	820	998	945	N/A
7											
w:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p:	474	447	427	425	412	410	408	405	416	387	N/A
8											
w:	603	601	586	584	584	586	598	616	665	658	698
p:	690	697	675	665	649	635	627	646	741	701	772

Table 2: Comparison of the value of output $w_h(t)$ and prices $p_h(t)$ in the German

information industries, in thousand years

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1											
w:	123	118	126	125	133	134	145	153	153	159	161
p:	145	143	143	144	148	150	159	167	180	178	180
2											
w:	51	48	46	47	47	49	51	53	51	52	N/A
p:	56	51	50	50	51	53	56	59	63	62	N/A
3											
w:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p:	31	29	29	28	29	30	34	37	40	38	N/A
4											
w:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p:	25	22	21	22	22	23	22	22	24	24	N/A
5											
w:	35	35	43	41	45	43	46	49	52	51	N/A
p:	48	52	55	56	55	55	55	56	62	59	N/A
6											
w:	38	35	36	37	40	42	47	52	49	56	N/A
p:	42	39	39	38	42	43	48	51	55	57	N/A
7											
w:	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
p:	24	22	22	23	23	24	25	25	23	23	N/A
8											
w:	30	30	30	31	32	34	37	38	37	40	41
p:	35	35	35	35	36	37	39	40	41	43	45

Table 3: Comparison of the value of output $w_p(t)$ and prices $p_p(t)$ in the German information industries, in billion €

	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**ø**
1	17.8%	20.6%	13.0%	15.2%	11.6%	12.0%	9.8%	8.9%	17.9%	17.8%	12.0%	*13.7%*
2	10.4%	7.8%	7.0%	6.8%	8.2%	7.0%	8.9%	13.1%	23.1%	18.5%	N/A	*11.1%*
5	35.8%	47.0%	25.3%	35.4%	22.4%	28.2%	19.4%	15.9%	18.5%	15.3%	N/A	*26.3%*
6	11.0%	11.5%	5.8%	3.5%	3.6%	1.5%	1.3%	-1.8%	11.8%	2.9%	N/A	*5.1%*
8	14.4%	16.1%	15.1%	13.9%	11.0%	8.3%	4.9%	4.9%	11.4%	6.5%	10.6%	*10.7%*
ø	*17.9%*	*20.6%*	*13.2%*	*14.9%*	*11.4%*	*11.4%*	*8.9%*	*8.2%*	*16.5%*	*11.0%*	*11.3%*	*≈ 13%*

Table 4: Differences between prices $p_{p,h}(t)$ and values of output $w_{p,h}(t)$ in the German information industries, in %

Table 5 shows the organic composition of capital – the relationship of constant to variable capital – in the German information industries in the years from 2001 until 2011. It ranges between 0.2 and 4.9. The annual average for all industries is 1.9, which means that on average constant capital tends to be almost twice as large as variable capital. The organic composition tends to be especially high in broadcasting and telecommunications and rather low in IT and information services as well as advertising and market research. This is an indication that broadcasting and telecommunications are particularly technology-intensive, whereas IT, advertising and market research are particularly labor-intensive industries.

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	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**ø**
1	1.7	1.5	1.7	1.7	1.8	1.7	1.7	1.8	2.0	2.0	2.0	1.8
2	2.6	2.4	2.4	2.4	2.4	2.4	2.5	2.9	3.0	2.8		2.6
3	2.1	2.0	1.9	1.9	1.9	2.0	2.2	2.7	2.9	2.7		2.2
4	3.5	3.1	3.1	3.1	3.1	3.3	3.1	3.2	3.1	3.1		3.2
5	2.4	2.5	3.5	3.3	3.7	3.3	3.5	3.8	4.8	4.9		3.6
6	0.8	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.8		0.7
7	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		0.2
8	1.1	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.2
ø	1.8	1.7	1.8	1.8	1.9	1.8	1.9	2.1	2.2	2.2	1.7	*≈ 1.9*

Table 5: Organic composition of capital c/v in the German information industries, 2001-2011, in %

The rate of profit is the relationship of output-surplus to input, the ratio of profit to investments. There is a difference between the price rate of profit and the value rate of profit (Kliman 2007, 26). The value rate of profit calculates the output-surplus based on total surplus-value, whereas the profit rate of profit uses total monetary profits:
value rate of profit $rp_v = s_h(t) / (c_h(t) + v_h(t)) = s_p(t) / (c_p(t) + v_p(t))$
price rate of profit $rp_p = p_h(t) / (c_h(t) + v_h(t)) = p_p(t) / (c_p(t) + v_p(t))$
Tables 6 and 7 show the value and price rates of profit for the German information industries in the years 2001-2011.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	ø
1	-2.1%	-3.8%	-3.4%	-2.2%	-1.0%	0.5%	2.2%	1.8%	-3.0%	-0.6%	-3.0%	-1.3%
2	0.0%	-1.0%	-0.6%	0.5%	1.6%	2.6%	3.5%	3.4%	-0.6%	1.5%	N/A	1.1%
3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5	-0.4%	-1.6%	-1.1%	-0.1%	0.5%	1.1%	2.1%	1.8%	-1.1%	0.1%	N/A	0.1%
6	-6.4%	-9.3%	-9.0%	-7.5%	-5.5%	-2.5%	1.0%	0.2%	-7.3%	-3.2%	N/A	-4.9%
7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8	12.3%	11.4%	12.8%	16.6%	22.1%	26.7%	31.9%	31.4%	20.0%	24.2%	17.5%	20.6%
ø	0.7%	-0.8%	-0.3%	1.5%	3.5%	5.7%	8.2%	7.7%	1.6%	4.4%	7.2%	*≈3%*

Table 6: The value rate of profit rp_v in the German information industries, 2001-2011, in%

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	ø
1	24.4%	26.4%	14.5%	20.3%	16.5 %	20.0%	19.4%	16.8%	21.4%	17.0%	12.9%	19.1%
2	14.4%	9.6%	9.1%	10.3%	14.2 %	13.7%	17.9%	22.8%	29.9%	27.4%	N/A	16.9%
3	14.5%	12.3%	12.8%	15.1%	16.0 %	17.2%	22.8%	33.6%	41.7%	40.1%	N/A	22.6%
4	14.4%	6.5%	5.0%	5.1%	12.3 %	9.9%	11.6%	8.1%	13.6%	11.3%	N/A	9.8%
5	49.7%	62.4%	30.7%	46.0%	29.1 %	38.5%	28.1%	22.6%	20.8%	18.5%	N/A	34.6%
6	9.0%	3.1%	-9.5%	-11.1%	-5.2%	-2.6%	5.9%	-3.8%	8.3%	-0.7%	N/A	-0.7%
7	83.7%	71.7%	83.0%	75.4%	65.4 %	79.8%	86.1%	87.1%	64.1%	63.8%	N/A	76.0%
8	54.3%	57.0%	57.6%	62.4%	66.1 %	67.8%	68.4%	68.1%	59.9%	57.0%	52.2%	61.0%
ø	33.0%	31.1%	25.4%	27.9%	26.8 %	30.6%	32.5%	31.9%	32.5%	29.3%	32.6%	*≈30%*

Table 7: The price rate of profit rp_p in the German information industries, 2001-2011, in%

The average value rate of profit in the German information industries for the years 2001-2011 is 3%, the average price profit rate 30%. This means that in terms of value calculated as average socially necessary labor time, the surplus tends to be around 3% of investments, whereas in terms of monetary prices it is around 30%. This difference derives from the previously presented result that there is a tendency that information commodities are sold above their values. In the German information industry, particularly high profit rates have continuously been achieved in the first decade of the 21st century in advertising and market research as well as arts, entertainment and recreation.

In the case of information, because of a sunk-cost rule the initial copy or prototype tends to be cost-intensive. This means that the value measured as labor-time that is required for <78:> information production is high. But once information is created, the value for reproducing it is extremely small or almost zero. There are only costs and labor-time for reproducing and circulating information or for updating it, but not for

originally creating it because it is not used up during consumption. A mechanism that is therefore of particular importance for achieving profit by selling information is to secure copyrights and to sell copies and licenced usage of information at prices that stand above labor-values. The difference between the low production-price of a copy guaranteed by low labor inputs and in comparison a relatively high sales-price is an important principle of capital accumulation in the information industries.

This mechanism can be observed in the data presented in this section: I showed for the German information industries that on average during a period of ten years, the difference between <79:> commodity values and commodity prices was about 13%. The price/value difference reached an average maximum of 26.3% in telecommunications, where the peak difference was 47.0% in 2002. In publishing, audiovisuals and broadcasting the average price/value difference was 11.1%, in IT/information services 5.1%, and in arts, entertainment and recreation 10.7%. We can in comparison calculate the price/value difference for the entire German economy (excluding finance and renting that we consider as unproductive sectors) and the manufacturing <80:> sector (table 8). We can see that on average manufacturing goods tended to be sold 4.8% above their values. In the total economy, values on average roughly equalled prices. This is not a proof, but a potential indication that the information industries tend to be especially characterised by selling commodities above their average values and to accumulate surplus-profits. To substantiate this assumption, further research will be needed in the future with data from different countries. The assumption that the information industries use a special form of capital accumulation is further substantiated by the fact that the price profit rate in manufacturing was on average around 7% and in the total German economy (excluding finance and real estate) around 13% (table 9), whereas the average in the information industries was around 30% (table 7). In these data, profits tend to be quite higher in relation to investment costs in the information industries than both in the total German economy and the manufacturing industry.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Ø
M	3.3%	4.1%	4.4%	4.5%	4.4%	5.3%	5.1%	3.6%	4.1%	5.6%	8.0%	*4.8%*
E	-0.3%	-1.8%	-1.1%	-0.3%	0.3%	1.0%	2.1%	2.5%	-1.1%	1.0%	-1.9%	*0.1%*

Table 8: Differences between prices $p_{p,h}(t)$ and values of output $w_{p,h}(t)$ in the German manufacturing industry (=M) and the entire economy (=E; excluding finance and real estate), in %

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Ø
M	5.0%	4.9%	5.5%	6.5%	7.1%	8.4%	9.1%	7.2%	3.8%	7.8%	8.5%	6.7%
E	11.5%	11.8%	11.6%	12.4%	13.0%	14.0%	14.5%	13.4%	11.0%	12.4%	11.8%	12.5%

Table 9: The price rate of profit rp_p in the German manufacturing industry (=M) and the entire economy (=E; excluding finance and real estate, =E), 2001-2011, in%

The average organic composition of capital c/v was around 2 in the German information industries (table 5) and according to my calculations in the same time period (2001-2011) 1.8 in the entire economy (excluding finance and real estate). The average monetary profit generated per working hour was 9.0€ in manufacturing, 8.6€ in the total economy and 10.7€ in the information industries. The average labor costs per hour were 30.9€ in manufacturing, 24.7€ in the total German economy and 30.7€ in the information industries. So both labor costs and profit per hour were in the information industries somewhat higher than in the total economy. These differences are not striking, the German information industry overall is an average industry in

terms of the average organic composition, monetary profit per hour and wages per hour.

Tables 10 and 11 show the average differences between total prices and total investment costs in the information industries, manufacturing and the total German economy:
d=(prices / (c+v)) – 1
d measures to which percentage degree prices are on average higher than investment costs.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	ø
1	15.3%	16.0%	9.2%	12.7%	10.5%	12.5%	12.2%	10.8%	14.3%	11.3%	8.6%	12.1%
2	10.4%	6.8%	6.4%	7.3%	10.0%	9.7%	12.8%	16.9%	22.4%	20.3%		12.3%
3	9.8%	8.2%	8.4%	10.0%	10.5%	11.4%	15.6%	24.6%	31.0%	29.1%		15.9%
4	11.2%	5.0%	3.8%	3.9%	9.3%	7.6%	8.8%	6.2%	10.3%	8.5%		7.4%
5	35.3%	44.7%	23.8%	35.3%	23.0%	29.6%	21.9%	17.9%	17.2%	15.4%		26.4%
6	3.9%	1.2%	-3.7%	-4.2%	-2.1%	-1.0%	2.4%	-1.6%	3.6%	-0.3%		-0.2%
7	62.7%	53.1%	59.6%	55.1%	48.4%	58.7%	62.8%	62.0%	46.2%	46.2%		55.5%
8	28.4%	29.2%	29.9%	32.8%	35.6%	37.3%	38.3%	37.8%	33.7%	32.3%	30.0%	33.2%
ø												20.3%

Table 10: Rates at which prices are higher than investments in the German information industries, 2001-2011, in%

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Ø
M	5.0%	4.9%	5.5%	6.5%	7.1%	8.4%	9.1%	7.2%	3.8%	7.8%	8.5%	6.7%
E	11.5%	11.8%	11.6%	12.4%	13.0%	14.0%	14.5%	13.4%	11.0%	12.4%	11.8%	12.5%

Table 11: Rates at which prices are higher than investments in German manufacturing and the total economy (excluding finance and real estate), 2001-2011, in%

The data show significant differences in that in all except one industry (IT), d is on average quite higher than in manufacturing and the total economy. Whereas prices are on average <81:> 12.5% higher than investments in the total economy and 6.7% in manufacturing, the price/investment ratio is on average 20.3% in the German information industries.

Selling information has high initial development and investment costs (sunk cost rule). It is also highly uncertain if audiences and users will have interest in a specific book, film, record, software, television series, advertisement, mobile phone because human tastes and cultural preferences are complex and cannot be calculated in advance (hit rule, nobody knows anything rule, see also Caves 2002). Initial labor costs and requirements are high, whereas the costs and hours for reproducing information goods (except live performances and unique pieces of art) are fairly low. The data presented in this section are empirical indications for the tendency that information companies try to set off the risks involved in their form of production by selling their commodities at prices above their output values (on average around 13% higher), at prices that are significantly higher than investment costs (on average around 20% higher) than in the total economy, which given successful sales results in higher profit rates. The price rate of profit in the German information industries was in the observed data therefore on average around 30%, whereas it was on average only around 7% in the manufacturing industry and 12.5% in the total economy.

3. Labor Productivity in the Information Sector

The question arises whether it is possible or rather difficult to increase productivity in

the information sector. The hypothesis of limited productivity increases in the cultural sector has become known as Baumol's disease. William Baumol has described a "disease" of the information industries, namely that they have problems increasing their productivity because of the peculiar <82:> features of information. Baumol and Bowen (1965) argued that no productivity increases in a sector or company mean that the output per hour does not increase so that increasing wages will cause additional costs that most be offset somehow. The performing arts would typically have problems of increasing their wages and face "Baumol's cost disease". "It is apparent that the live performing arts belong to the stable productivity sector of our economy. The legitimate theater, the symphony orchestra, the chamber group, the opera, the dance-hall can serve as textbook illustrations of activities offering little opportunity for major technological change. The output per man-hour of the violinist playing a Schubert quartet in a standard concert hall is relatively fixed, and it is fairly difficult to reduce the number of actors necessary for a performance of Henry IV, Part II" (Baumol and Bowen 1965, 500). The result would be rising prices: "Certainly, in most of the industries in which productivity is stable, we would expect the price of the product or service to rise relative to the general price level. And there is a widespread impression that the arts have indeed behaved in accord with this anticipation" (Baumol and Bowen 1965, 501).

From a theoretical perspective, the assumption of limited productivity increases seems to be only partly true for information, art and culture: Journalists can be made to work faster, i.e. to write more articles, cut and paste them online or from press releases, etc. Art and culture can be digitally reproduced and thereby become commodities that can be reproduced faster. Advertising is content that can be made more efficient by targeted advertising that allows presenting different advertisements at once to many people. Designers and architects can be made to work on more projects simultaneously. Freeman (2008, 3) argues in this context that "reproduction, transmission and recording" have "eroded handicrafts limits beyond the point at which the handicraft concept remain viable". The Internet is a medium enabling the creation, production, transmission and consumption of information in one space as well as the convergence of these processes (prosumption). Freeman argues that in the Internet age service productivity "is free to expand without natural impediment" (Freeman 2008, 3).

The labor productivity index is an OECD statistical indicator that uses the following definition of labor productivity: "Labour productivity is here calculated as the ratio of value added volumes to number engaged. Labour productivity represents the amount of output per unit of input, output being here defined as value added while the input measure used is total employment"[5]. So it measures value added per employed person. The statistical definition acknowledges that it would be better to use hours worked data at the industry level, but says such data are thus far not available in the OECD STAN database. The number of employed persons is however a good approximation for the total hours worked in an industry so that the labor productivity index is a feasible measure for understanding the productivity development in the information economy.

The labor productivity index increased in printing and publishing in the USA from 68.9

5 http://stats.oecd.org/OECDStat_Metadata/ShowMetadata.ashx?Dataset=STANINDICATORS&Coords=[VAR].[IPTY]&ShowOnWeb=true&Lang=en

in 1980 to 137.0 in 2007, in post and telecommunications from 44.8 in 1977 to 158.8 in 2007, in computing services (including software engineering) from 105.5 in 1998 to 173.7 in 2007 (data source: OECD STAN). It decreased from 101.8 to 99.6 in other community, social, <83:> and personal services that include recreational, cultural and sporting activities, such as film production, sound recording, motion picture projection, production and broadcasting of television and radio programmes, live theatre, concerts, art production and exhibition, entertainment parks, etc (data source: OECD STAN). In the UK, the same services increased their labor productivity index from 66.7 in 1980 to 102.0 in 2003, post and telecommunications increased the index from 29.3 in 1980 to 109.7 in 2003 (data source: OECD STAN). In Germany, the labor productivity index increased in printing and publishing from 69.0 in 1970 to 100.9 in 2007, in post and telecommunications from 21.5 in 1970 to 129.1 in 2007, in computing services from 47.2 in 1970 to 95.5 in 2007 etc. (data source: OECD STAN). In community, social and personal services, it decreased from 106.9 in 1970 to 90.3 in 2008 (data source: OECD STAN). In France, the labor productivity index increased in printing and publishing from 69.7 in 1970 to 125.1 in 2007, in post and telecommunications from 13.8 in 1970 to 168.4 in 2008, and in community, social and personal services from 80.6 in 1970 to 101.9 in 2007 (data source: OECD STAN).

Such service data are somewhat hard to interpret because they include besides broadcasting, arts and live entertainment also sanitation, sewage and refuse disposal, activities of membership organisations, hairdressers, funeral services, washing and cleaning services, porters, shoeshiners, solariums, baths, etc. But overall they could be indicators that live entertainment and arts can have problems increasing labor productivity, whereas publishing, computing and telecommunications seem to be doing better in this respect.

It is not straightforward to measure the productivity of some information sectors. So for example Microsoft constantly releases software updates of its Windows operating system, but only once in a while a new version such as Windows 10 and even more rarely a completely new type of software. So depending on if our unit of measure is the number of software updates, versions or different software types, one will get very different productivity measures for Microsoft. A unified and standardised measure of productivity based on measuring the output of use-values per unit of time is therefore very difficult to obtain. However, all capitalist companies produce commodities that yield a specific amount of profit per year. So if one measures the monetary output per labor input (e.g. US$/hour), then one can arrive at a unified and standardised measure of productivity that can be applied to the information sector.

Such a measure can be obtained by combining two variables from OECD's STAN database, namely value added in current prices (national currency) [VALU] and total hours worked by employees [HRSE]. I downloaded these data for six countries and then calculated:
labor productivity = VALU / HRSE [national currency/hour]
Tables 12-13 present the results.

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Av. growth**
G	53.8	56.2	57.4	52.0	56.7	55.8	58.2	60.2	57.9	62.1	62.3	61.4	14.0%
AT	44.4	50.6	52.0	55.2	54.7	57.8	58.5	60.1	61.7	60.8	61.6		38.6%
F	68.1	69.0	75.3	78.1	79.7	80.9	82.7	82.9	82.2	82.3	83.7	81.8	20.1%
I	59.4	61.2	67.3	69.0	72.3	74.4	72.3	73.0	72.9	70.4	73.3	70.0	17.8%

NL	46.6	48.8	57.2	64.4	67.4	68.2	69.2	71.2	69.4	67.1	71.0	70.2	50.5%
S	398.2	412.9	457.7	503.4	533.5	560.3	568.8	574.4	588.0	591.1	619.4	667.1	67.5%
													34.8%

Table 12: Labor productivity in the information and communication sector, in national currency per hour (G=Germany, AT=Austria, F=France, I=Italy, NL=Netherlands, S=Sweden)

	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Av. growth**
G	48.1	49.4	50.4	50.1	53.0	53.1	54.0	54.9	55.3	52.2	53.6	54.3	11.4%
AT	34.0	33.8	36.1	37.9	37.9	39.8	41.9	43.0	45.9	46.0	48.0		41.0%
F	29.9	30.1	32.3	34.2	35.2	37.2	38.2	38.6	38.8	39.4	40.2		34.4%
I	44.5	45.3	47.8	48.8	50.0	51.1	48.9	50.7	50.1	48.6	50.5	53.3	19.9%
NL	28.3	30.4	32.7	33.4	34.8	35.1	35.6	36.3	36.1	37.3	37.9	38.0	34.2%
S	269.9	246.8	260.7	281.3	285.7	298.5	325.5	336.8	343.0	344.3	342.9	358.1	32.7%
													28.9%

Table 13: Labor productivity in the arts, entertainment and recreation sector, in national currency per hour (G=Germany, AT=Austria, F=France, I=Italy, NL=Netherlands, S=Sweden)

In the ISIC 4 classification that OECD STAN uses, the information and communication sector consists of publishing, motion picture, video and television programme production, sound recording and music publishing activities, programming and broadcasting activities, telecommunications, computer programming, consultancy and related activities, information service activities. These are all sectors where computing, media and information processing play a role. The growth of information storage capacity per integrated circuit with falling costs (Moore's Law), the growth of data transmission speed, and the possibility for mediation, digitisation, computerisation of outputs and labor activities can increase productivity in many of these sub-industries.

<84:> In the ISIC 4 classification, the arts, entertainment and recreation sector consists of art, live entertainment and performance, libraries, archives, museums, gambling and betting activities, sports and amusement. It is rather difficult to increase productivity in arts, live entertainment and in contrast easier in publishing, audio-visual and broadcast media, telecommunications, IT. Live entertainment such as the operation of theatres, concert halls,
museums, archives, libraries, exhibition sites, gambling and betting, sports clubs and facilities, sports events, amusement and team parks, discotheques and clubs include consumption at the moment of production, human co-presence, non-storage and non-reproducibility. Such culture is just like art production that is also included in this sector based on highly original creativity. These characteristics make Baumol's disease – the assumption that it is difficult to increase productivity in the arts (Baumol and Bowen 1965) – more likely in this sector than in other information industries. Live events can certainly be recorded and then sold as commodities, but such activities then belong to and statistically enter the publishing, audio-visual and broadcast media sector.

The data in tables 12 and 13 indicate that in all analysed countries, absolute productivity is significantly higher in the information/communication sector than in the arts and live entertainment sector. Also the cross-country-10 year average productivity growth rate is with 34.8% higher in the first sector than in the second, where it is 28.9%.

The production and diffusion of content (radio, television, telecommunications, software, Internet, advertisements, newspapers and print publications) is based on specific qualities of information, especially that it can be shared, easily copied, and is not used up in <85:> consumption. In this sector, productivity tends to rise, which is reflected in the empirical results presented for the information and communication sector in table 8. We have found empirical indications that productivity can rise in the information and communication sector. Therefore his argument that the labor theory of value does not apply because of a productivity paradox does not hold. In contrast, the labor theory of value works wherever capital is accumulated and so profit is made.

4. Conclusion

This paper has produced empirical example case data that could be interpreted as providing some indications that the information economy has peculiar characteristics that need to be taken into account when applying the labor theory of value to it. The high initial costs and the high uncertainty of popularity and possible audience rates seem to make *information companies try to set off the risks involved in their form of production by selling their commodities at prices way above their output values and at prices that are significantly higher than investment costs than in the total economy, which given successful sales results in higher profit rates.*

How can we interpret this phenomenon? Some observers argue that the information economy is in general based on rent and not on productive labor and profits and therefore consumes and robs the profits of other sectors (e.g. Foley 2013, Rigi 2014, Teixeira and Rotta 2012). I showed in this paper that there are indications that productivity can be increased in the information-processing-based part of the information economy that uses computing and data transmission and is rather difficult to achieve in the live entertainment sector and the arts sector. Storage growth and transmission acceleration are factors helping to increase productivity in these sectors that are themselves partly creating ICT innovations and are among the first to use them. As a result, the productivity level can be increased in this industry, which allows to produce more value per unit of labor-time in comparison to many other industries and to <86:> thereby gain surplus-profits. Table 15 provides empirical indications for selected countries and regions that productivity measures as monetary value per hour worked has in the information and communication (I&C) sector been growing significantly faster than in the total economy.

	1980	*1990*	*2000*	*2010*	*Latest (2013 or 2014)*
I&C EU28			*80.8*	*114.5*	*117.2*
Total EU28			*9.2*	*104.4*	*107.9*
I&C Germany		*55.0*	*94.5*	*127.4*	*145.4*
Total Germany		*77.0*	*91.3*	*103.9*	*107.7*
I&C France	*46.8*	*61.6*	*79.0*	*110.2*	*120.3*
Total France	*53.0*	*71.3*	*93.2*	*102.4*	*106.2*
I&C UK			*80.1*	*115.7*	*112.4*
Total UK			*86.9*	*105.3*	*106.8*
I&C Finland	*34.2*	*51.2*	*82.9*	*110.2*	*120.3*
Total Finland	*41.8*	*58.4*	*87.3*	*98.7*	*103.8*
I&C Ireland			*47.5*	*162.2*	*165.2*
Total Ireland			*91.8*	*118.9*	*121.0*
I&C Norway	*28.3*	*43.1*	*69.6*	*124.5*	*139.6*
Total Norway	*48.1*	*66.2*	*89.4*	*92.2*	*91.3*

Table 15: Index of gross value added per hour worked, 2005=100, total economy = non-agriculture business sector excluding real estate (data source: OECD.Stat)

More productive companies and industries produce more commodities per hour than the average company or industry. Reasons can for example be specific organisation and management methods that make the workers produce faster, the use of more efficient machines, or more skilful workers. The value of the their single commodity will therefore be lower than the average commodity. If the more productively produced commodity is sold at an average price, then more profit tends to be achieved. More use-values have then been created per hour and therefore yield more profit. More developed productive forces in one industry allow the workers in it or in a company belonging to it to produce more use-values in less time than others. Increasing productivity means the creation of more or qualitatively richer use-values and potentially also profit per hour. The more productive industries can reduce their labor costs and investment-costs. As a consequence, they can increase the share of profit in the price and the share of surplus-labor time in the total labor-time. Companies producing less productively have problems to compete. In order to try to catch up, they have to reduce the labor-costs so that their rate of surplus-value increases and they can still yield some profit when selling at the prices set by the more competitive companies.

> If, therefore, the capitalist who applies the new method sells his commodity at its social value of one shilling, he sells it for 3d. above its individual value, and thus he realizes an extra surplus-value of 3d. […] Nevertheless, even in this case, the increased production of surplus-value arises from the curtailment of the necessary labour-time, and the corresponding prolongation of the surplus labour. […] The exceptionally productive labour acts as intensified labour; it creates in equal periods of time greater values than average social labour of the same kind. […] Hence the capitalist who applies the improved method of production appropriates and devotes to surplus labour a greater portion of the working day than the other capitalists in the same business. […] On the other hand, however, this extra surplus-value vanishes as soon as the new method of production is generalized, for then the difference between the individual value of the cheapened commodity and its social value vanishes (Marx 1867, 434-436).

Empirical data provides indications that it is rather difficult to increase productivity in arts, live entertainment and in contrast easier in publishing, audio-visual and broadcast media, telecommunications, IT. We also have tried to show that the assumption that the labor theory of value is inapplicable to the information industries is not feasible.

The overall conclusion that we can draw is that we need approaches that combine the Marxian labor theory of value and empirical economic analysis of macro-economic data. Such approaches should also think of how to critically theorise and measure the information economy's value.

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