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Forms of accumulation and economic growth in European countries

1. Introduction

Accumulation is an economic activity which has been practised since ancient times. It means that certain economic value is put aside and not consumed in a short period of time. The aim of such consumption delays is to ensure future subsistence or welfare. Basically, this accumulated value is interpreted by economic tradition as production factor or capital of different forms (Yashin, 2020). However, it is not ensured that accumulation always fulfils its purpose. If economic value is not put into the right forms, it may evaporate before it can be used or in case of adverse external circumstances it cannot create additional values. Even so, it seems that survival or improvement of life are still impossible without accumulation activities.

Keeping notes of economic activities is also important for prudent provision for future needs, as notes may help in understanding the effects of events past, present or future (Vanoli, 2005). It is therefore crucial whether we can keep records of accumulation activities and properly account for their effects on future economic welfare and performance. In modern times economic statistics are the means of such recording for macroeconomies. Modern statistics provide detailed and structured figures on accumulation activities.

It still remains a question, whether these figures can give a satisfactory explanation of economic growth. At microeconomic levels, it is widely accepted that investments are done in order to forge future development (Davidson, 1968). Mostly this is a preconception at the macroeconomic level, as well. However, it is rarely verified accurately whether the measured accumulation activities really have a significant effect on economic growth.

The aim of this paper is to find relationship between the most aggregated accumulation statistics and GDP growth in the case of European countries. Calculations were done through panel regressions on data available through Eurostat. The first part of the paper details the importance of accumulation for economic growth in theory. The second part shows calculations on the relationship between the recorded accumulated wealth and the growth of GDP per capita in European countries. The conclusion tries to find answers to the question whether it is possible to demonstrate economic development through accumulation in these countries with the help of statistical data.

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2. The theory of accumulation

Accumulation is a complex economic activity. The process includes some more simple operations, like savings and investments. Though the ultimate aim of these operations is the same, that is to sustain or increase future wealth, they are different in content and value (Yashin, 2020). Savings constitute the starting point of accumulation, as it is the decision of putting aside a certain value instead of consumption. Investment on the other hand puts the saved amount into specific forms of production factors or capital, therefore is a decision on how the amount would be utilized in the future. Since this latter operation needs a considerable amount of expertise, saving and investment activities are done by different actors in the modern economy. Also, it needs time and effort to find the most efficient place for every saved amount, and some amounts may be piled up in the transmitting financial system, therefore the value of savings and investments will not be equal in the short run. There are some more reasons for the difference between savings and investments, as it is possible to finance investments from newly created credits, as well, and the modern financial systems are also inclined to inflate economic value without any real performance behind it. Notwithstanding this complexity, accumulation contains both savings and investments, though being closer to the ultimate purpose logically, investments are more likely to be connected to economic growth and wealth than savings. For this reason, accumulation is interpreted mostly as investment in this paper.

The importance of accumulation for future subsistence and development seems to be self-evident for all beings, even not only for humans. This can be clearly observed for example in the habits of squirrels. When squirrels create deposits of nuts, they do it in order to have some food reserves when harder times come to their survival. Clearly, this can be described as an economic activity, still it is rather primitive from many aspects. First, its purpose is sheer survival, not development. Second, it does not involve longer time periods, the nuts are to be consumed within some months. This activity therefore can be best described as only saving.

Human behaviour became more sophisticated than that of squirrels also in the field of accumulation at an early stage of development. Agriculture and the altered way of life it brought about meant a different and more complex accumulation method. Seeds deposited in the earth on purpose, multiply themselves and their value. This means that agriculturalists can achieve more wealth and higher living standards than hunter-gatherers. In the case of husbandry or tree cultivation, economic value is stored for a long period of time and also considerable amount of effort is put into these accumulation activities, which requires large scale cooperation from the individuals of the society. Savers and investors are not necessarily the same, and the capital put aside requires regular attention. This contributed to a large extent to the start of the development of human societies.

In modern times, accumulation developed further. Economic actors better understood economic value and became able to account for it in the forms of intangible assets, too. Different financing forms were elaborated and the phases of accumulation were distinguished also in the records of transactions. Now, savings and investments are done by different people and the concept of investment is continuously broadening, including newer and newer activities, whose capacity to foster economic growth is realized.

All these mean that the concept of accumulation is closely tied to economic growth by definition (Lequiller-Blades, 2014). There is no point in accumulating anything if it cannot improve our future life, or only replicates the existing regularities at the same living standard. It seems that keeping up subsistence is just a minimal expectation towards accumulation activities and achieving growth and improvement is equally required from them. If an investment does not bring positive profits, only returns at the margin, it will hardly be deemed to be economically feasible (Davidson, 1968). Therefore savings, investments and all kinds of accumulation are utilized effectively if only they ultimately generate an increase in economic performance and wealth, greater than the value consumed by this utilization.

The beneficial effect of capital accumulation on economic growth that way was emphasized throughout the classical era of the science of Economics. However, neoclassical models applied the rule of diminishing returns on investments, as well, stating that the effect of accumulation on growth drops, when the economy approaches its optimal point of the accumulation rate. This view also includes the belief in a stationary equilibrium situation, which is characteristic to the economy.

The existence of such a stationary equilibrium point, however, has been questioned in Keynes' time. First, Keynesianism emphasized the time dimension of the relationship, stating that savings actually may cause lower growth in simultaneous time, because higher saving rates mean lower consumption rates and consumption drives demand, which can generate economic growth. Therefore, in the years of parsimony economic performance would stagnate (Villalobos Céspedes, 2020). However, if savings are efficiently transmitted to investments, their beneficial effect can come in subsequent years when investments start to produce adequate returns. As investments can be financed from other sources than savings it is also possible to keep up growth continuously, though the extra source of financing investments has to be found.

The nature and effects of accumulation were then further elaborated on in economic models, such as the Solow-model. However, this model only calculates with physical capital investment as true accumulation. Other important factors, human capital and technological development were regarded as exogenous, not investments done on purpose, though at least they were already realized as existing factors (Solow, 1957).

The evolution of the System of National Accounts (SNA) gained momentum in the 1950s, approximately at the same time as the development of the Solow-model (Stone, 1986). In this statistical framework, the figures of accumulation play an important role,

as data has to be provided for the analysis of economic growth and its most important factors. Consumption and accumulation (later called investments in the macroeconomic terminology) constitute the main uses of created economic value in a year and are presented as the third way of grouping GDP in an SNA framework.

In the second half of the 20th century, research on growth factors and refinement of the statistical framework in order to provide data for analysis proceeded simultaneously. From 1968, inclusion of balance sheets in the SNA has been considered and finally, in 1993, the statistics of assets appeared in it. This was an important step from the point of view of accumulation, because accumulated value is embodied in balance sheet assets. In principle, keeping records of balance sheet items enables us to track the way of saved amounts into real investments and find the causes of their difference (Yashin, 2020). However, the balance sheets drawn up by statistics are still far from being complete. There are ongoing debates on the types of assets to be included in the balance sheet and therefore universally accepted as accumulation. Expenditures, which are not spent on a balance sheet asset, are considered to be consumption, therefore we lose the opportunity to connect them numerically with our future development. In 1993, the SNA balance sheets consisted of only physical assets and some intangibles in a very limited number (Vanoli, 2005). In 2008, Research and Development assets were capitalized after a longish debate. The most important rationale behind this gradual broadening of the asset circle is to identify and account for as many types of accumulated growth inducing factors as possible.

3. Question, data and methodology

Is it possible to show the relationship between overall accumulation and economic growth on the latest available data? Generally, a positive relationship is assumed in the literature between accumulation and growth while examining a range of specific issues (Guellec-Pottelsberghe, 2001), but aggregate level data from the SNA framework for the representation of accumulation are not yet used. The purpose of this paper is to verify on recent data, what kind of relationship can be detected using these aggregates. For this purpose, the basic model of Bassanini et al. is used with modifications. First the standard equation used by Bassanini et al. was estimated again with newer European data, then a new level variable is added in order to use newly available stock data (Bassanini et al., 2001).

Data were extracted from the Eurostat database. Though the longest available time series run from 1995 to the present, this range is available only for three countries, therefore a shorter period was chosen. Finally, 20 European countries were examined between 2000 and 2019. The extracted data are summarized in Table 1.

Table 1: Location of data used, European countries 2000-2019

Data	*Sheet*	*Full name*	*Unit*
Nass and 13 asset types	nama_10_nfa_st	Total fixed assets (net) and various asset types (net)	million euro, previous year replacement cost
GCF	nama_10_gdp	Gross capital formation	current price million pps
GDP	nama_10_gdp	GDP at market price	current price million pps
GDPc	nama_10_pc	GDP at market price per capita	current price pps

Source: Eurostat

Following Bassanini et al., for economic growth the yearly difference in the logarithm of GDP per capita was used. For GDP and related flow type data (gross capital formation) measurement at current prices in pps was chosen. For the stock type balance sheet data of total net fixed assets and different types of assets the evaluation of previous year's replacement cost was chosen in million euros. The chosen measurements were closest to real values, which also can ensure the comparison between countries, as best as possible.

In order to demonstrate the relationship between accumulation and economic growth, panel regressions were done. The panel regression seems most appropriate in this case, because there is considerable heterogeneity between the units. There were no missing data within this range of analysis.

The variables included in the regression equations were put together by some modifications of the extracted data. These are summarized in Table 2, as follows:

Table 2: Variables applied in the regressions

Variable	*Name*	*Calculation*
dLGDPc	GDP per capita growth	yearly difference in lg (GDPc)
LGCFGDP	Gross Capital Formation per GDP	lg (GCF/GDP)
LNA_1 and Asset types_1	Net Fixed Assets and Asset types	lg (NAss) with 1 year lag and lg (Asset types) with 1 year lag
LGDPc_1	GDP per capita	ln (GDPc) with 1 year lag
dLcap	population growth	yearly difference in ln (GDP/GDPc)

Source: own construction

For the variables, calculated values (GDP per capita) were applied directly from the database where such data were available. In order to get the scales of measurements closer, logs were taken. Finally, the gross capital formation % was calculated as the logarithm of the percentage of GDP in order to get the proportional value of asset investment comparable to other countries and time periods. Due to that the difference variables were not calculated in the database the length of the examined period in the economic software was only 19 years, though data used cover 20 years. For the calculations the GRETL software was applied.

The growth of GDP per capita represents economic growth in the calculations, as for GDP per capita is a universally accepted measurement (Bassanini et al., 2001). It is true, however, that GDP and its derivatives do not capture improvement in life in its entirety. For the purpose of this paper, it is still acceptable, as accumulation in its present interpretation serves primarily the provision of tangible requirements of a society. The per capita version of the figure was applied as to make it meaningful and comparable in space and time.

Accumulation can be represented by various variables. Per capita versions are mostly suitable to compare to GDP per capita based variables and dividing by the number of population is also good to get comparative data. However, a more meaningful measurement can be obtained by dividing the measured value of accumulation by GDP, which shows the relative importance of the accumulation activity within the economies (Bassanini et al., 2001). Both methods ensure comparability in space and time, here the latter was applied in accordance with Bassanini et al. Accumulation can be measured by a flow figure, the value of gross capital formation in a time period. The measurement applied here gives the value of capital formation for a whole year and as an aggregate of the SNA, measures capital formation in the form of all assets accepted as storage of economic value for the future.

Another possibility to capture accumulation is the application of a stock figure from the SNA, which is Net fixed assets in the balance sheet in the most aggregate form. This figure is measured at one point in time, more specifically at the end of a year. As a stock figure, it represents all the economic value accumulated in previous periods, which have not yet disappeared, therefore can be utilized in the examined and future periods. Though this variable was not included in estimates previously, for the purpose of this paper it is important to see its effect separately from the capital accumulation of the year when growth occurs. Assuming that the level of accumulated capital affects future growth, this stock type variable was included in the estimated equation with one year lag. For the sake of further analysis, the various types of accumulated assets were also taken into consideration, all measured as stock type variables with a 1-year lag.

4. Calculating the effect of accumulation on economic growth

On the basis of economic knowledge compiled so far, it is highly likely that a relationship exists between accumulation and economic growth. The direction and strength of this relationship, however, are less straightforward. Most of the researchers agree, that the relationship should be basically positive, as the inherent purpose, the very raison d'etre of accumulation is growth, even if it could be necessary only for survival in hard times of decreasing wealth, as well (Lequiller-Blades, 2014).

Negative relationship may exist in case of crises, when even basic economic activities' performance can drop, as they are not necessarily due to a generally high volume of accumulation done earlier, which is visible in high values of asset stock variables. Also, accumulation may even be harmful, as far as it diminishes consumption and demand, which may cause a deepening crisis. In case the neoclassical model of diminishing returns on investment holds, accumulation also may cause a decrease in economic growth if the economy is near to or over of its equilibrium point of optimal capital accumulation. Finally, increased growth will not be driven by unproductive investments.

In normal cases, however, we expect that accumulation generates growth in the future and at least in the long run. If we take into consideration the dynamic aspect of the relationship, it is expected that accumulation of the previous periods has a positive effect, while accumulation may cause lower economic performance in its simultaneous year due to a possible limiting of instantaneous demand. If so, accumulation of a certain year may lower economic performance in its period, while increases it in subsequent years. This would reinforce a higher growth between present and future, therefore a positive relationship could be reinforced in the dynamic approach this way. The effects are shown in Figure 1.

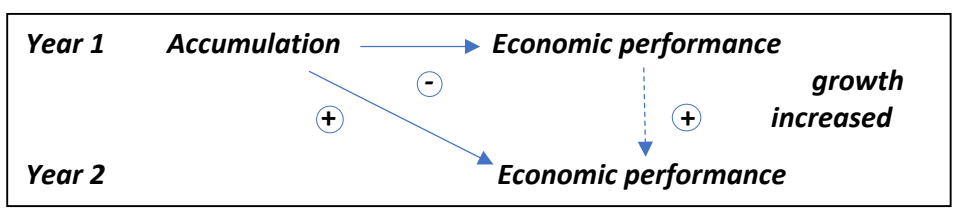

Figure 1: The effect of accumulation on economic performance
Source: own construction

However, it is important to remark, that simultaneous negative effect of accumulation on performance can be neutralized by demand-oriented economic policy. If the government is determined to keep up demand for example by monetary tools, accumulation is possible to boost without squeezing demand for consumption, thus increasing both

investments and economic performance in the examined year. This policy, however, may cause inflation and or government indebtedness later on, therefore careful implementation is necessary.

On the basis of the above, here first the standard equation of an earlier study was reproduced and estimated with newer data (Bassanini et al., 2001.):

$$dLGDPc = LGCFGDP + LGDPc\_1 + dLcap \qquad (1)$$

In equation (1) *dLGDPc,* the GDP per capita growth representing economic growth is the dependent variable. *LGCFGDP* stands for accumulation. It is measured in the year, when the dependent variable was measured. It has to be remarked that this is a flow type variable, and its effect is examined only in the same year when the dependent variable, still its value is regarded to be representative of all time accumulation in this basic equation. Its impact was significant and positive in the study, which was taken as the basis of this paper, though it also could be negative on the above theoretical basis. *LGDPc_1* is a control variable in this point of view. It is included here, because it is widely assumed that countries with higher GDP per capita will produce lower growth due to the higher level from where they start. As the main variable of interest here is capital accumulation regardless of the GDP per capita level obtained before, the inclusion of this variable is justified. It was also part of earlier studies to measure the rate of slowdown in growth at higher GDP per capita levels.

Equation (2) attempts a modified approach to measure the effect of accumulation on economic growth and the following equation was constructed to estimate the dynamic relationship described above on the data:

$$dLGDPc = LGCFGDP + LNA\_1 + LGDPc\_1 + dLcap \qquad (2)$$

In this equation, the dependent variable is *dLGDPc,* the growth of GDP per capita, just like in the case before. Accumulation is represented by *LGCFGDP,* which shows the relative importance of accumulation spending in the year of the dependent variable. Higher values of this variable could lower economic growth of the year, though in previous studies its coefficient was positive. The growth of GDP is also assumed to be affected by previous accumulation, which is *LNA* with a one-year lag in this model. This is a stock type variable containing the accumulated economic strength, which may induce and make possible potential economic growth in the subsequent periods. It is lagged because it is expected to have a positive impact later than accumulation. The nature of a stock type variable ensures that there is no need to include earlier values, because all the relevant accumulation of previous years is included. *LGDPc_1* is a control variable of the GDP per capita level of the country and period when the observation was made. Similarly to equation (1), the expected sign of its coefficient is negative.

The equations were tested by fixed effect panel regressions. There are two versions of the model. Time dummies were included to filter out effects which may have an impact on all units in the same time. This version also enhances the effect measured in the cross-section dimension. This was important for getting valuable information, because the time span includes the years of the global financial crisis, which started in 2008 lowering the growth rates of all countries and altering the nature of the mechanisms significantly. HAC robust standard errors were applied to address autocorrelation and heteroskedasticity problems. The Hausman test indicated in both cases that fixed effect regressions were preferred to the random effects methods.

The countries included were: Belgium, Bulgaria, Czechia, Germany, Estonia, Greece, France, Italy, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Slovenia, Slovakia and Finland. These were the countries for which detailed and comparable data were available on Eurostat. The choice of this sample seems suitable as nine countries are from the Eastern European region with a past experience of soviet type economic organization, while eleven countries always belonged to the group of market economies. There is also a wide range of size in the examined sample of countries.

The results of the regression estimations are summarized in Table 3, 4 and 5.

Table 3: Regression results for the estimation of the effect of capital formation on economic growth in 20 European countries, 2000-2019

Fixed effect panel regression, dependent variable: *dLGDPc*				
Variable	***Coefficient***	***Std. error***	***p-value***	
LGCFGDP	0,08	0,02	0,0002	***
LGDPc_1	- 0,1	0,01	0,0000	***
dLcap	0,17	0,44	0,7017	
Hausman test: χ^2 = 34,1 p = 0,0000 Durbin-Watson: 1,48				

Source: own construction

Table 4: Regression results for the estimation of the effects of accumulation level and capital formation on economic growth in 20 European countries, 2000-2019

Fixed effect panel regression, dependent variable: *dLGDPc* Result with time dummies				
Variable	***Coefficient***	***Std. error***	***p-value***	
LGCFGDP	0,07	0,02	0,0006	***
LNA_1	- 0,05	0,02	0,0048	***
LGDPc_1	- 0,06	0,01	0,0000	***
dLcap	0,18	0,43	0,6770	
Hausman test: χ^2 = 52,6 p = 0,0000 Durbin-Watson: 1,57				

Source: own construction

Table 5: Regression results for the estimation of the effects of accumulation level and capital formation on economic growth in 20 European countries, 2000-2019

Fixed effect panel regression, dependent variable: *dLGDPc* Result without time dummies				
Variable	***Coefficient***	***Std. error***	***p-value***	
LGCFGDP	0,1	0,03	0,0016	***
LNA_1	0,02	0,03	0,4462	
LGDPc_1	- 0,06	0,03	0,0281	**
dLcap	- 0,47	0,85	0,5852	
Hausman test: χ^2 = 21,4 p = 0,0003 Durbin-Watson: 1,56				

Source: own construction

The results of the regression analysis are very straightforward and expressively show the opposite conclusions to expectations. Simultaneous flow type variables of investments and accumulation have a positive effect on economic growth of the same period in this sample, contrary to the concerns. The sign agrees with that in the earlier study, while the coefficient is much lower (0.08, while it was 0.39 earlier), though still significant statistically (Bassanini et al., 2001). This may be due to the fact that investments are not financed exclusively from the households' savings, therefore it is possible to keep up consumption and demand when investments are growing. Another explanation for this result may be that the figure of GDP contains the value of newly produced investment assets, as well, therefore consumption demand does not have to increase to boost this figure of economic performance.

The coefficient of *LNA_1,* the stock type variable of accumulation is negative, which is in contradiction with expectations. This, however, is true only for the version with time dummies, which means that the negative sign is true only for the cross-country dimension. Explanation of this result is more difficult than in the previous case because it is the most important reason for making investments at all, that economic performance should increase due to their impact in the long run. It seems to work in time comparison but does not hold between countries. Here are some possible explanations for the negative sign of the *LNA_1* variable.

According to the neoclassical view of accumulation, after a certain time at higher economic development levels the returns to investments start to diminish. As the economy approaches higher and higher levels of relative capital endowment, their overall growth rate slows down. Being at a high economic development level, European countries may be in a situation, where high levels of accumulated capital is still beneficial, generating further growth, though the increase in economic performance is smaller than at lower development stages. Once the development level is high enough for the issue of diminishing returns to be present, higher accumulated capital levels may produce lower growth rates in case of the same GDP per capita level.

Some investments also may be unproductive in the long run. Even if investment decisions are done through careful calculations on future returns, many of them may have finally a slower payback than thought before, even if their value is corrected for prospective returns annually. Also, in those countries with relatively high living standards luxury spendings are more frequent. Some luxury fixed assets have high market values as reserves, even though they will never generate economic growth.

Table 6 summarizes the results of a series of regressions done with the help of detailed data from the SNA statistics. In order to gain more information on net assets, the stock values of different types of accumulated net assets were regressed with economic growth and the other control variables described above. The coefficients of the various asset types reveal how the different assets relate to economic growth and which of them played prominent roles in showing a negative sign between accumulated assets and the change in the GDP per capita.

Table 6: Regression results of different asset types regressed to economic growth in European countries, 2000-2019

Fixed effect panel regressions, dependent variable: *dLGDPc*

Asset types	L Net asset type_1	LGCF/ GDP	LGDPc1	dLcap	L Net asset type_1	LGCF/ GDP	LGDPc1	dLcap
	with time dummies				without time dummies			
Total assets	-0,05***	0,07***	-0,06***	0,18	0,02	0,10***	-0,06**	-0,47
	(0,02)	(0,02)	(0,01)	(0,43)	(0,03)	(0,03)	(0,03)	(0,85)
Construct	-0,04**	0,07***	-0,07***	0,16	0,02	0,10***	-0,06**	-0,45
	(0,02)	(0,02)	(0,01)	(0,41)	(0,02)	(0,03)	(0,02)	(0,86)
Dwelling	-0,04***	0,08***	-0,07***	0,06	-0,02	0,09***	-0,02	-0,59
	(0,01)	(0,02)	(0,01)	(0,38)	(0,02)	(0,02)	(0,02)	(0,83)
Other buildings	0,00	0,08***	-0,10***	0,17	0,03**	0,11***	-0,08***	-0,50
	(0,01)	(0,02)	(0,01)	(0,45)	(0,01)	(0,03)	(0,02)	(0,87)
Machines weapons	-0,04*	0,07***	-0,06***	0,25	-0,03	0,09***	-0,01	-0,45
	(0,02)	(0,02)	(0,02)	(0,51)	(0,03)	(0,03)	(0,03)	(0,88)
Transport equip.	-0,03***	0,08***	-0,06***	0,55	-0,03*	0,10***	-0,00	-0,09
	(0,01)	(0,02)	(0,01)	(0,57)	(0,02)	(0,02)	(0,02)	(0,91)
ICT equip.	-0,01	0,08***	-0,09***	0,11	-0,03**	0,10***	-0,02	-0,71
	(0,01)	(0,02)	(0,02)	(0,47)	(0,01)	(0,02)	(0,01)	(0,85)
Computer hardware	-0,01	0,08***	-0,09***	0,12	-0,02*	0,10***	-0,02*	-0,62
	(0,01)	(0,02)	(0,01)	(0,47)	(0,01)	(0,02)	(0,01)	(0,90)
Telecom. equip.	-0,00	0,08***	-0,09***	0,12	-0,00*	0,07***	-0,02	-0,27
	(0,01)	(0,02)	(0,01)	(0,44)	(0,00)	(0,01)	(0,01)	(0,50)
Other machines	-0,01	0,07***	-0,08***	0,15	0,01	0,10***	-0,06*	-0,47
	(0,02)	(0,02)	(0,02)	(0,43)	(0,02)	(0,03)	(0,03)	(0,87)
Bio resources	-0,01	0,08***	-0,09***	0,17	-0,01**	0,10***	-0,03***	-0,93
	(0,01)	(0,02)	(0,01)	(0,51)	(0,01)	(0,02)	(0,01)	(0,78)
Intellect. property	0,01	0,08***	-0,11***	0,12	0,06***	0,11***	-0,15***	-0,66
	(0,01)	(0,02)	(0,02)	(0,39)	(0,01)	(0,02)	(0,02)	(0,60)
Research & Dev.	0,01	0,08***	-0,11***	0,24	0,04***	0,12***	-0,12**	-0,12
	(0,01)	(0,02)	(0,02)	(0,41)	(0,01)	(0,02)	(0,02)	(0,83)
Software, databases	0,01	0,08***	-0,11***	0,08	0,03***	0,11***	-0,10***	-0,83
	(0,01)	(0,02)	(0,02)	(0,36)	(0,01)	(0,02)	(0,02)	(0,59)

Source: own calculations on the basis of Eurostat data

According to the calculations, net assets can be divided broadly into three groups. In the first group buildings, structures and real estates can be found. These represent a large portion of net assets and determine the sign of the total net assets coefficient in the regressions. The second group consists of machinery and other portable tangible assets. Their share in the total value of net assets is significant, their coefficients' sign in the regressions is generally negative. The third group is the group of intangibles. They are only a small part of net assets, but their coefficients' sign is positive.

On the basis of Table 6, the following findings can be formulated: the main contributors of the negative sign of the coefficient of net assets are dwellings and transportation equipment. These are assets representing big value and are the main parts of the infrastructure. The infrastructure consists of assets which are necessary even for the very basic level of economic operation, but normally do not stimulate fast growth directly in themselves. This may explain a reversed relationship between the value of these assets and economic growth. Some luxurious dwellings or comfortable vehicles may increase the value of accumulation, still the increase in the GDP per capita is lower, as they are not as productive as expensive. Still, this is true primarily in the cross-section context, as higher valued infrastructure may show less productivity between countries rather than in time in the case of a specific country, where productivity may not change as fast as the value of net assets.

It is also true, that apparently intangible assets may generate growth most. Their coefficient is significantly positive both in the time and cross-country dimension. The products of research and development and other intellectual operations directly motivate growth through providing more productive means for the economies. In the postmodern era, these are those assets of which the classical economic concept of accumulation contemplates, signifying that intangibles took over the place of tangible assets in today's economic development.

Another important finding is that machinery, together with the most up-to-date telecommunication equipment and hardware are not the basis of further fast development. The more "iron" we have around us, which depreciates rapidly, the more we pollute our environment without any detectable development. It seems still true that tangible welfare is only a necessary "evil", needed for development, but their quantity should be minimized in order to boost productivity. This is also true for biological resources, that is cultivated land.

Another group of explanations may be technical in nature. This means, that the variables applied to represent economic concepts do not cover sufficiently the meaning attached to the concept in economic models. This is true primarily for GDP and GDP per capita. Investments may well be useful, still their beneficial effect is not captured by the measurement of GDP. GDP does not contain a range of useful activities which may be productive and facilitated by earlier investments. If an economy conducts such activities to a great extent, then all the effects of the fixed assets supporting them will

not be seen in GDP growth, still the value of the fixed assets is part of the value of total fixed assets in the SNA balance sheet. Therefore, an increase in the value of such fixed assets (similarly to the infrastructure) may not facilitate a measured growth activity as anticipated in the general theory.

Another measurement problem arises in connection with accumulation. Total fixed assets contain a number of truly unproductive (still valuable luxury) items, as explained above. On the other hand, there are important intangible assets which are not accounted for in this figure and generate tangible economic growth (e.g. practical knowledge). In the latter case, the accumulation of knowledge is not recorded in the assets category, still its continuous effect is measured in increased GDP (Vanoli, 2005). In this case we can see higher growth rates along with the lower accumulated value of fixed assets. This also indicates that there are a lot of different growth generating assets which are still not captured by statistical measurement properly.

5. Conclusion

Economic thinking relates the future changes in positive directions to investments and accumulation in the present. In fact, future improvement is the only purpose and raison d'etre of accumulation, as it requires sacrifice in the preceding periods of time. If improvement is not to come, accumulation becomes unjustified.

Measurement of accumulation and its effect is therefore a vital point of Economics. Still, in spite of the universal meaning of the concept, theories of accumulation seem to be born to explain only some specific phenomena of economies. These theories may be right under certain circumstances, still their universal application seems to be problematic (Temple, 1999).

In this paper, I attempted to find the beneficial effect of accumulation on economic growth. However, using the most aggregate and easily available figures for this purpose, this attempt was not successful. According to the findings, the measured values of earlier accumulation affected GDP growth in a negative way between 2000 and 2019 in the majority of European countries.

The main reason behind this is that assets used for production have great variability. The highest valued assets, like real estates or transport equipment are mostly necessary, but less productive and do not generate faster growth at higher levels of economic development. The truly growth motivating intangible assets (like intellectual property) represent only a small part of the measured accumulated value.

All these indicates that economic research has not found yet the way to monitor the true drivers of economic growth, though it is likely that these factors should be looked for among intangible assets.

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