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EVIDENCE FOR MIDDLE-INCOME TRAP NON-OCCURRENCE IN THE LIGHT OF KLEMS GROWTH ACCOUNTING FOR POLAND†

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There is an ongoing discussion that many middle-income countries are on the brink of the so-called Middle-income Trap, if not already stuck in it. The case of the Polish economy is analyzed, as an example of a Central-Eastern Europe economy, to solve whether this is actually happening. Thanks to KLEMS growth accounting datasets published by Statistics Poland an analysis on this issue became feasible, showing that for Poland the assertion of the middle-income trap threat has to be rejected after observing the growth distribution between industries, and particularly their growth decompositions into factor and MFP contributions. Extending this research to some other countries may possibly confirm that, just as for Poland, this "trap" is not taking place (or the converse). Although not solving the theoretical nexus on the middle-income trap notion, these findings can be interesting for Central-Eastern Europe economies' researchers and the possible ongoing discussion.

JEL Codes: E01, O11, O47

Keywords: middle-income trap, KLEMS, productivity

1. INTRODUCTION

Much of the ongoing discussion concerning the middle-income countries is focused on the economic problem coined the Middle-income Trap. It is often asserted that economic growth in the long run can be resource (mainly labor), investment or innovation driven, and that when it is investment driven it can become exhausted, as observed at the macroeconomic level, leaving the given country's economy in the mentioned trap, and preventing it from achieving prosperity.

But first, what is it really? The term *middle-income trap* has been introduced by the World Bank in 2006 (Gill and Kharas, 2007, 2015) and since then there has been a profusion of discussions and commentaries about it, both in the scientific and journalistic milieus. One possible definition is based on observing the growth rate. If the economy of a given middle-income country grows at an insufficient rate to catch up with

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the economies of more developed countries in a decent scope of time, then it can be considered to be stuck in the so-called middle-income trap (Felipe *et al*., 2012). This is a quantitative, otherwise called empirical definition, but a theoretical definition is also possible (Glawe and Wagner, 2016, p. 6). A workable definition of this kind characterizes a middle-income trap country as being *squeezed between the low-wage poor country competitors that dominate in mature industries and the rich-country innovators that dominate in industries undergoing rapid technological change* (Gill and Kharas, 2007, p. 5). Following Glawe and Wagner (2016, p. 7), countries are caught in the middle-income trap if they *cannot make a timely transition from resource-driven growth, with low-cost labor and capital, to productivity-driven growth*. Despite the existence of theoretical definitions, these must be related to the empirical ones and the notion of middle income itself. Since absolute thresholds such as given by the World Bank are getting outdated, because of a continuous progress that leads to a continuous increase in the highest potential level of income, relative definitions of the middle income are also advanced as the ratio of a given country income to the US income (e.g., Woo, 2012, p. 314).

Many researchers contend that this is something which is actually happening and therefore it is worth being tested somehow to make economic policy better informed. In the case of European middle-income countries such as Poland this economic question is worth examining to generally assess whether these countries are converging with western developed economies as far as their gross domestic product (GDP) per capita is considered. The study is also meant to support the view that KLEMS growth accounting is a valuable tool for this kind of analysis. It is so because KLEMS growth accounting is being done by industries, which deliver the possibility to carry out the analyses on the sources of growth at industry level.

To iterate as close as possible to an appropriate answer to the issue, we undertake to carry out an observation of the growth distribution between different industries, and particularly of the individual industries' growth rates decompositions into factor contributions and multifactor productivity (MFP) contribution. The assumption of the study is, that if industries that are growth supporting engines in the economy, are mainly driven by MFP contribution in their growth rates, not by capital contribution, and further if that MFP contribution is decisive for their ranking in the relative speed of growth, then the process called the middle-income trap is very unlikely to materialize itself. Otherwise said, if the aggregate economic growth is mainly innovation or at least imitation driven, not investment driven, in the fast-growing industry contributors to that aggregate growth the outcome in the form of the middle-income trap will not coalesce. The possibility of capital outflow will not undermine the growth supporting industries because of its little contribution for them, and because in such conditions over-investment together with capital profitability decrease is unlikely to develop as a major impacting factor on the growth. This assumption is based on the established interpretation of MFP as generally representing organizational and technological progress and therefore embodying most of the innovation conducive to economic growth. There may be innovations not conducive to economic growth, but the use of MFP (or TFP as a close similarity in some other studies) is weighing them in a single entity as far as their economic growth impact is considered.

To increase the value of the conclusions the findings for the Polish economy have been benchmarked against some other economies. However, this benchmarking has to be limited because the KLEMS growth accounting is performed only for

a few Central-Eastern Europe countries and for many of them with very short time series. This is also one of the reasons why the value-added-based not the gross-output-based MFP has been chosen for the study, as the compared countries of Central-Eastern Europe carry out only the estimation of the former. The other reason is that this phenomenon can be linked with the inability to produce more high-value-added products (Lin and Treichel, 2012, pp. 40–41), therefore linking it with the process of value-added capture, also internationally in the scope of global value chains (Gill and Kharas, 2007, p. 14). We can link this process to more sophisticated product offer (indicated by: Felipe *et al*., 2012, pp. 39–43). Rather than technological change itself, the value-added-based MFP reflects an industry's capacity to translate technical change into income (see: OECD, 2001, pp. 27–28). Therefore, for the analysis of the middle-income trap phenomenon the chosen MFP measure seems more appropriate than the gross-output-based one.

In the second section, the methodology of KLEMS growth accounting relevant to the present study was presented and the methodology of presenting the data has been explained, including compound growth rates methodology. Also, some introductory information on Polish KLEMS productivity accounting were included there. In the third section, we will undertake to present the literature overview and indicate the relevance of KLEMS growth accounting for this discussion. In the fourth section the empirical findings have been presented and discussed. Finally, the paper ends with a conclusion section. In order not to overburden the main text, the result data in tables and their presentation on graphs for countries other than Poland are in the Appendix.

2. KLEMS Productivity Accounting and the Methodology of Result Data Presentation

2.1. *The Basic KLEMS Growth Accounting Methodology*

The basic KLEMS formulation applicable in our analysis is the gross value added (GVA) growth decomposition formulae:

$$\Delta lnV_{jt} = \overline{w}^{K}_{jt}\Delta lnK_{jt} + \overline{w}^{L}_{jt}\Delta lnL_{jt} + \Delta lnA^{V}_{jt} \tag{1}$$

where V is the GVA, K—capital services, L—labor services and where A^V stands for multifactor productivity. These values are subscripted by j for industries and t for years. $\overline{w}$ with appropriate subscripts are average value shares of the individual factors in the GVA defined in the superscripts by K and L for two discrete time periods *t-1* and t, which are calculated through linear interpolation as $w = \left(w_{t-1} + w_t\right)/2$ (for simplicity the subscripts and superscripts of (1) have been omitted here). Since the growth of A^V is residually calculated, the equation (1) is always met in practice.

The capital services' contribution has been decomposed into two sub-factors' contributions as following:

$$\overline{w}^{K}_{jt}\Delta lnK_{jt} = \overline{w}^{KIT}_{jt}\Delta lnKIT_{jt} + \overline{w}^{KNIT}_{jt}\Delta lnKNIT_{jt} \tag{2}$$

where *KIT* stands for ICT capital and *KNIT* for non-ICT capital services (notations taken from Timmer *et al*., 2007), treated as separate factors, which fact is expressed also by their different shares. Capital services are calculated as values of different types of capital assets aggregated at industry level with the use of the Törnqvist quantity index. Because the different types of assets can have different relative income shares, accompanied by their different growth rates, capital services' growth rates do not have to be the same as growth rates of the straightforward sums of asset stocks at industry level. In practice one of the three contributions, usually the non-ICT capital one, can be residually calculated as the subtraction between the other values in the equation (2), in order to avoid mathematical tool problems, so the equation (2) is always met. But, since the equation (2) is a kind of a Törnqvist quantity index as well with only two components, the way to calculate independently ICT capital and non-ICT capital services first and add them up later gives in fact the same results.

The labor services' contribution has been decomposed somehow differently as following:

$$\Delta lnL_{jt} = \Delta lnH_{jt} + \Delta lnQ_{jt} \tag{3}$$

where L stands for labor services aggregated with the use of the Törnqvist quantity index over standard KLEMS 18 types of labor according to gender, three age groups and three education attainment levels ($2 \times 3 \times 3 = 18$), H—for the straightforward sum of hours worked, and Q—for labor quality, otherwise called labor composition. Because the different types of labor can have different relative income shares, accompanied by their different growth rates, labor services' growth rates do not have to be exactly the same as growth rates of the straightforward sums of hours worked at industry level. Similarly, to equation (2) one of the terms in equation (3), i.e., labor composition contribution, is calculated residually as the subtraction between the other values in equation (3), so this equation is always met. The difference in comparison with equation (2) is that the sub-factors in equation (3) are all treated as a single factor, which is expressed by their same share $\overline{w}_{jt}^{L}$ as for L. This difference in comparison with the capital factor decomposition (2) is however of no importance as far as the linear additivity of the sub-factor contributions to the GVA growth is considered. The equation (15) in O'Mahony and Timmer (2009, p. F378) also expresses this difference, but instead of "labor quality" (Q) term as here, we have there "labor composition" (LC) term, which is more often used in the EU KLEMS version of KLEMS growth accounting. If we join equations (2) and (3) with equation (1) we will have a GVA growth decomposition into five contributions altogether.[1]

One important feature of this growth accounting methodology is that it is done at industry level which delivers the possibility to study the distribution of

[1]According to Jorgenson *et al*. (2005, p. 297), there can be two kinds of decompositions. One in which both labor and capital contributions are decomposed into quantity and quality components and one in which these factors are decomposed into different types of labor and capital inputs. In the adopted KLEMS methodology we have a mixed approach: for labor, the first kind of decomposition is used and for capital the second.

factor and MFP contributions to growth across industries—this has been found to be most essential for the analysis carried out in this paper.

2.2. *Additional Calculations for the Analysis*

At first, data in the present analysis shall be presented as simple averages over some years, e.g., Figure 1 for Poland and similarly for the other countries. This method has the merit of simplicity and the lack of mathematical tool problems. However, it is to some extent controversial, because it gives the same weight to all yearly vintages of economic growth and the related contributions. This can become a problem if the time series are quite long. Therefore, it has to be compared to and checked with the results of the calculations made on a compound basis, e.g., Figure 2 for Poland and similarly for the other countries, that give more weight to later vintages of economic growth, which can be considered as a more appropriate procedure on theoretical grounds. Chaining was used according to the following formulae:

$$\Delta lnV_{(1,n)} = \prod_{t=1}^{n} \left(1 + \Delta lnV_t\right) - 1$$

(4)
$$FC_{\Delta lnV_{(1,n)}} = \prod_{t=1}^{n} \left(1 + v_t^F \Delta lnF_t\right) - 1$$

$$\Delta lnA^V_{(1,\,n)} = \Delta lnV_{(1,n)} - \sum_F FC_{\Delta lnV_{(1,n)}}$$

where V stands for GVA in discrete time periods t or the entire time span (1,n); F—for factors such as hours worked, labor composition, ICT capital or non-ICT capital; FC—for factor contributions to GVA growth $\Delta lnV_{(1,n)}$. v with appropriate subscripts and superscripts are the shares of the given factors F in the GVA V in the given discrete time periods t. A^V stands for value-added-based multifactor productivity (MFP) in the given time span (1,n), and its contribution is calculated residually as a subtraction between the GVA growth and the sum of factor contributions (FC) to that growth (the last of the three formulae (4)). The multifactor productivity A^V contributions have been calculated residually for the entire time span to avoid mathematical tool problems. It is because the compound calculation method is a kind of chaining. Therefore, the compound sub-aggregates do not add up to the compound aggregate exactly. To avoid this, it is best to calculate the compound MFP contribution residually from the other compound values.
The division of the entire time series of 12 years (2005–2016) into two equal six-year periods for Poland was adopted since it allows to avoid the superfluous discussion on whether the average values method is better for the analysis over the theoretically more justified method of compound values, as the results for the entire 12-year period would be rather substantially different for the two methods, whereas for the six-year periods these differences are not substantial enough to

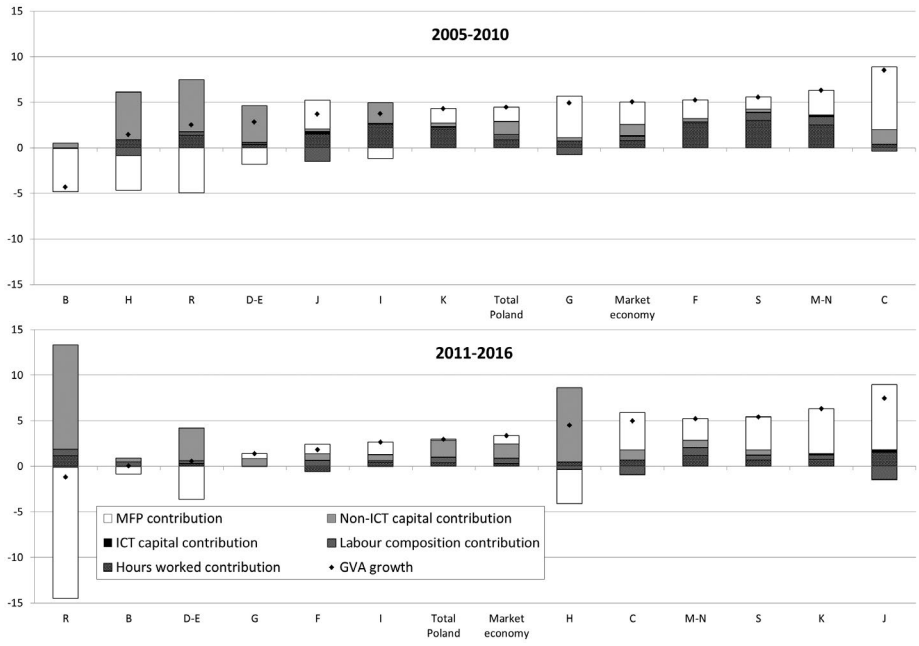

Figure 1. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp) for Poland

Notes: The NACE 2 classification wide industries are in order of growing average GVA growth rates from the left to the right. These are: B—mining and quarrying, C—manufacturing, D—electricity, gas, steam and air conditioning supply, E—water supply; sewerage, waste management and remediation activities, F—construction, G—wholesale and retail trade; repair of motor vehicles and motorcycles, H—transportation and storage, I—accommodation and food service activities, J—information and communication, K—financial and insurance activities, M—professional, scientific and technical activities, N—administrative and support service activities, R—arts, entertainment and recreation, S—other service activities.

Source: Own contribution based on Statistics Poland website data for Poland.

contradict the paper's findings, and which was shown later in the paper. In the analysis performed in Jorgenson *et al*. (2005, Chap. 7, pp. 291–360) averages were used, but the use of shorter sub-periods there, together with the option of compound values would complicate immensely the analysis there done basically in more details and with more disaggregation. In the present paper however, where the disaggregation is simpler, the entire time span shorter and the methodology limited to value-added-based MFP, it was possible to strengthen the paper methodology, thanks to computing both average and compound values over the selected periods. The additional benefit is the possibility to capture some evolution of economic conditions in time. The possibility to divide the 12-year period into three 4-year periods was rejected as complicating to much the analysis, however. What was needed in the present study was only to lift the controversy associated with the two methods. At the same time, it had to be proven that for the present study the adopted subdivision is sufficient, which is not necessarily the case for all countries

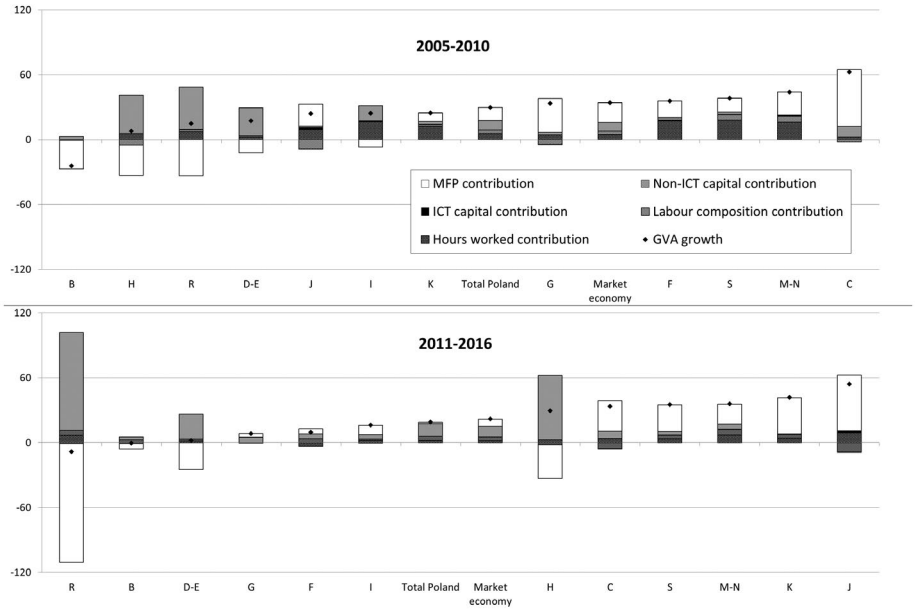

Figure 2. Decompositions of COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp) for Poland

Notes: The NACE 2 classification wide industries are in order of growing compound GVA growth rates from the left to the right. These are: B—mining and quarrying, C—manufacturing, D—electricity, gas, steam and air conditioning supply, E—water supply; sewerage, waste management and remediation activities, F—construction, G—wholesale and retail trade; repair of motor vehicles and motorcycles, H—transportation and storage, I—accommodation and food service activities, J—information and communication, K—financial and insurance activities, M—professional, scientific and technical activities, N—administrative and support service activities, R—arts, entertainment and recreation, S—other service activities.

Source: Own contribution based on Statistics Poland website data for Poland.

of the world. For the benchmarking countries the second later period was shortened because of data availability. For two benchmarking countries a single period only was adopted because of data availability on the EU KLEMS main internet site.[2]

2.3. *Input Data Issues*

In general, input data for Poland KLEMS growth accounting have been provided by official statistical bodies in a similar way as for the other countries

[2]www.euklems.net. There is a more recent KLEMS site with longer time series (https://euklems.eu/). However, this last source could not be used in the present study for two main reasons. Firstly, data for Poland are incomplete on this latter site—specifically, they do not include a GVA growth decomposition. Secondly, a different methodology is applied in this latter data release, focused mainly on intangibles, that, although a very interesting matter, are redundant in the present analysis, and the different kinds of capital contributions (altered by introducing the intangibles) impact on the resulting levels of MFP contribution making data from this release inconsistent with the previous one. Data for Poland are however consistent with the earlier release.

performing this accounting. However, two major issues arose during input data preparation.

The first one is the unavailability of the entire labor-market data divided into different labor types, according to sex, three age groups and three education attainment levels (making $2 \times 3 \times 3 = 18$ labor types), as required in the standard KLEMS growth accounting methodology. However, a representative survey is carried out from 2004 onward called the Z-12 survey, concerning contractually employed persons. This survey satisfies all the KLEMS requirements as far as labor types are concerned, but two assumptions are to be adopted. The first is that the structure of the entire labor market (i.e., together with the self-employed persons) as far as labor types are considered is the same as the structure of the contractually employed. Since the self-employed are a minority, of which the structure is not very much different, this assumption does not seem to deviate substantially the final results concerning the total labor resource of the economy and was accepted as plausible. The second assumption to be adopted here is that the survey is truly representative, and we rely here on the solidity of Statistics Poland services.

The second issue is that the three types of ICT capital, i.e., computer equipment, communication equipment and software are not being extracted in the Polish national accounts. Therefore, a prothesis for that data insufficiency had to be adopted. From the supply and use tables (SUT) data on ICT investments were taken, added up and depreciated,[3] and distributed by industries thanks to the structure of software services taken from the same SUT. This turn assumes that the sold software services are quite proportional to the clients' ICT capital stocks, which seems to us plausible on the condition not to draw over-extensive conclusions from the final results. This way of estimating ICT capital stocks leads, however, to a narrow understanding of ICT capital, but this narrow understanding is already present for some KLEMS performing countries such as, e.g., Italy, and just as for the Italian economy the role of ICT capital for the Polish economy, as seen through KLEMS growth accounting, is little, as far as its contribution to growth is considered. At present there is no statistical methodology that could overcome this limitation. The role of the ICT capital as such is not impacting substantially on the MFP, therefore the possible biases that could be presumably expected do not contradict the final growth accounting results for the present analysis.

3. Literature Overview and the Possible Role of KLEMS Accounting

Griffith (2011, p. 39) suggests that the implied causes of a given country's falling in the so-called middle-income trap are associated with the adverse effect of increased wages related with the first transition of the given country from a low-income to the middle-income level of economic development, which process causes a cost increase in production and therefore a decline in competitiveness, that prevents the given

[3]We followed the rates provided by Timmer *et al*. (2007, pp. 36, 55). They are provided as exact values for some asset types (including ICT assets) or as ranges of values to be exactly fixed for individual countries, which has been done for Poland in the National Accounts Department of Statistics Poland. As provided in http://www.euklems.net/TCB/2018/Metholology_EUKLEMS_2017_revised.pdf the depreciation rates for ICT capital have not changed.

country from successfully achieving the second transition from the middle-income to a high-income level of development. This phenomenon concerns therefore rapidly growing economies stagnating at the middle-income levels and failing to graduate into the rank of high-income countries (Aiyar *et al*., 2013, p. 3). In some other formulation this is caused by the inability of the given country to structurally upgrade from low-value-added to high-value-added products (Lin and Treichel, 2012, pp. 40–41), the latter being driven by productivity are immune to the mentioned cost increase.

According to Agénor (2016, pp. 3–10) the evidence on the existence of the middle-income trap is strong and its cause can be attributed to a combination of factors: *diminishing returns to physical capital, exhaustion of cheap labor and imitation gains, insufficient quality of human capital, inadequate contract enforcement and intellectual property protection, distorted incentives and misallocation of talent, lack of access to advanced infrastructure and lack of access to finance* (Agénor, 2016, p. 10). Should all of this not happen the productivity would rise and therefore economic growth as well.

A more detailed analysis of Eichengreen *et al*. (2013) shows that the incidence of a deceleration of economic growth can occur in steps so more countries are at risk, not only from a narrow income category. Han and Wei (2017) find that the evidence about the middle-income trap is varied and that it depends on the given country fundamentals and policy dependent regimes. According to this study, the trap concerns also the low-income countries. These varied situations lead sometimes to a conclusion that the notion of a trap is not really the right one, and instead what distinguishes economies in their transition from middle to high income is fast versus slow transitions (Felipe *et al*., 2014). This sceptic attitude towards the term, based on the same or similar grounds, was expressed before also by Im and Rosenblatt (2013), and Bulman *et al*. (2017). However, a statistical definition of the term is still possible according to Robertson and Ye (2013). Perhaps the slowdown is more general and originates in developed economies. This process concerns in particular the US economy and has been mirrored in other parts of the world, in a way explained by Byrne *et al*. (2016, p. 149). This would mean that the rich and wealthy economies are no longer the "milky cows" for the developing ones to such an extent as before. This approach would explain some of the slowdowns but has nothing to do with the idea of the middle-income trap considered as an endogenous phenomenon. Perhaps only a comparative approach is the right one. For instance, it has been well observed that Asian countries have been in general more successful than Latin American countries in their transitions from middle to high income levels of economic development (Jankowska *et al*., 2012) and therefore not caught in the middle-income trap thanks to structural change.

The definition of Glawe and Wagner (2016, p. 7) gives the opportunity to analyze this problem in the light of KLEMS growth accounting or similar growth decomposition methods that assess the residual productivity contribution. A wide consensus is adopted that the differences in capital accumulation and productivity growth result in differences in income levels. These will be high at the aggregate level, if high-value-added products are displacing low-value-added ones. Because these categories can be studied through growth accounting of KLEMS type this methodology seems to be truly relevant here. Since capital-accumulation growth resource can be exhausted together with cheap-labor growth resource, because of

falling rates of capital returns, at last only the productivity growth remains as the sustainable growth resource in general, apart from infrastructure capital growth delivering growth in the very long run. This productivity growth resource can consist between others of human capital upgrading (as mentioned e.g., by Zhang *et al*., 2012), but directly mostly reflects productivity growth due to innovation.

Therefore, the "cure" of the ailment known as the middle-income trap seems to be related to entities mostly contained in the MFP contribution to growth, with the possible exceptions of labor quality and ICT capital in KLEMS growth accounting. The other important exception is also the infrastructure of which the contribution is rather contained in the capital contribution to economic growth, although its development is also considered as a preventive measure from falling into the middle-income trap. We can confirm this general stand by reviewing other researchers' works advancing such "cures" (e.g., Eichengreen, 2011; Agénor and Canuto, 2012; Zhuang *et al*., 2012; Paus, 2014; Vivarelli, 2014; Atalay, 2015; Liu *et al*., 2017, and similarly, many others). In this setting, for a given country, to escape from the middle-income-trap incidence, the contribution of MFP to growth has to be high. But we assume in our study that it concerns high-growth and growth-supporting industries rather than the entire economy. At the aggregate level high-productivity industry contributors may be shadowed by, e.g., high contributions of capital investment in the infrastructure (which process is also conducive to escaping the middle-income trap). Also, necessary capital outlays in restructured government-supported and government-led activities may also shadow out the contribution of productivity at the aggregate level. This capital shadowing shall be explained later on.

The use of KLEMS growth accounting with MFP identification by industries seems therefore to be truly relevant for the study of the middle-income trap phenomenon, which is also the major and new proposal of the present paper. This methodology allows the analysis of this phenomenon quantitatively not only qualitatively as it is mostly done by the cited authors. The positive impact on productivity of the different and disparate but narrowly identified factors are weighed together in MFP, lifting blurring details from the analysis, and delivering a consistent universal platform, despite the natural limitations of the growth accounting methodology. The present analysis can be considered as a variant of the analysis presented in Jorgenson *et al*. (2005), Chap. 7.[4]

4. Empirical Findings

The results of the calculations have been presented in Table 1 for Poland, and for the other countries included in the discussion in the Appendix (Table A1 for Czechia, Table A2 for Slovakia, Table A3 for Latvia, Table A4 for Slovenia,

[4]The basic KLEMS growth accounting methodology was developed by Dale W. Jorgenson and associates as outlined in Jorgenson (1963), Jorgenson and Griliches (1967), Jorgenson *et al*. (1987), Jorgenson (1989), and Jorgenson *et al*. (2005). The OECD growth accounting methodology is also quite relevant; see OECD (2001, 2009, 2013), Wölfl and Hajkova (2007). This methodology has been summarized by Timmer *et al*. (2007), and O'Mahony and Timmer (2009) for the EU KLEMS. For Poland, this methodology has been developed and presented in Kotlewski and Błażej (2018). Recently was published Kotlewski and Błażej (2020), where issues were explained in more detail.

TABLE 1

DECOMPOSITIONS OF AVERAGE AND COMPOUND GROSS VALUE ADDED (GVA) GROWTH RATES INTO FACTOR AND MFP CONTRIBUTIONS AT CHOSEN NACE 2 WIDE INDUSTRIES IN THE LIGHT OF KLEMS GROWTH ACCOUNTING (IN PP) FOR POLAND

	AVERAGE							COMPOUND						
	GVA Growth Rate	Contributions to Growth					Rank	GVA Growth Rate	Contributions to Growth					Rank
		Hours Worked	Labor Composition	ICT Capital	Non-ICT Capital	MFP			Hours Worked	Labor Composition	ICT Capital	Non-ICT Capital	MFP	
NACE Rev. 2	*2005–2010*													
B—mining and quarrying	−4.3	−0.1	0.0	0.0	0.5`	−4.7	14	−24.4	−0.6	−0.1	0.0	2.9	−26.5	14
C—manufacturing	8.5	0.4	−0.4	0.0	1.6	6.9	1	62.4	2.3	−2.3	0.0	9.8	52.6	1
D–E—electricity, gas, etc.*	2.8	0.3	0.2	0.0	4.1	−1.8	11	17.2	2.0	1.2	0.1	26.0	−12.2	11
F—construction	5.2	2.7	0.1	0.0	0.3	2.0	4	35.6	17.2	0.7	0.1	2.1	15.6	4
G—wholesale and retail trade, etc.**	4.9	0.7	−0.7	0.0	0.4	4.6	6	33.3	4.5	−4.4	−0.2	2.2	31.1	6
H—transportation and storage	1.5	0.9	−0.9	0.0	5.2	−3.8	13	8.0	5.4	−5.1	0.1	35.6	−27.9	13
I—accommodation and food services activities	3.7	2.6	0.1	0.0	2.2	−1.2	9	24.2	16.6	0.4	0.2	13.9	−7.0	9
J—information and communication	3.7	1.5	−1.5	0.3	0.2	3.2	10	23.9	9.0	−8.9	1.8	1.4	20.5	10
K—financial and insurance activities	4.3	2.0	0.2	0.1	0.4	1.6	8	24.5	12.4	1.3	0.4	2.5	7.8	8
M–N—professional, scientific, etc.***	6.3	2.5	0.9	0.1	0.1	2.7	2	44.0	16.1	5.3	0.8	0.6	21.3	2
R—arts, entertainment and recreation	2.5	1.4	0.3	0.1	5.7	−4.9	12	14.8	7.2	2.0	0.3	39.0	−33.6	12

(Continues)

TABLE 1 (CONTINUED)

	AVERAGE							COMPOUND						
		Contributions to Growth							Contributions to Growth					
	GVA Growth Rate	Hours Worked	Labor Composition	ICT Capital	Non-ICT Capital	MFP	Rank	GVA Growth Rate	Hours Worked	Labor Composition	ICT Capital	Non-ICT Capital	MFP	Rank
S—other service activities	5.6	3.0	0.8	0.1	0.3	1.3	3	38.0	17.8	5.1	0.4	1.9	12.8	3
Market economy	5.0	0.8	0.5	0.0	1.2	2.5	5	34.1	4.6	3.1	0.3	7.6	18.4	5
Total Poland	4.4	0.9	0.6	0.0	1.4	1.6	7	29.7	5.3	3.5	0.2	8.6	12.2	7
NACE Rev. 2	*2011–2016*													
B—mining and quarrying	0.0	0.0	0.5	0.0	0.5	−0.9	13	−0.6	−0.5	2.7	−0.1	2.5	−5.2	13
C—manufacturing	5.0	0.7	−0.9	0.0	1.1	4.1	5	33.4	4.1	−5.3	0.0	6.7	28.0	5
D–E—electricity, gas, etc.*	0.6	0.3	0.3	0.0	3.6	−3.6	12	1.8	1.6	1.9	−0.1	23.1	−24.7	12
F—construction	1.8	−0.6	0.6	0.0	0.7	1.1	10	9.4	−3.6	3.9	0.0	4.2	4.9	10
G—wholesale and retail trade, etc.**	1.4	0.0	0.0	0.0	0.8	0.6	11	8.3	0.1	−0.1	−0.1	5.0	3.4	11
H—transportation and storage	4.5	0.4	−0.3	0.0	8.1	−3.8	6	29.2	2.7	−2.1	0.1	59.3	−30.9	6
I—accommodation and food services activities	2.6	0.4	0.2	0.0	0.7	1.3	9	16.1	2.3	1.2	0.0	4.1	8.5	9
J—information and communication	7.5	1.5	−1.4	0.3	−0.1	7.1	1	53.8	9.3	−8.4	1.9	−0.4	51.5	1
K—financial and insurance activities	6.3	0.7	0.5	0.1	0.0	4.9	2	41.7	4.4	3.1	0.9	0.0	33.4	2
M–N—professional, scientific, etc.***	5.2	1.2	0.8	0.1	0.8	2.4	4	35.5	7.3	4.9	0.3	4.7	18.2	3

TABLE 1 (CONTINUED)

	AVERAGE							COMPOUND						
	GVA Growth Rate	Contributions to Growth					Rank	GVA Growth Rate	Contributions to Growth					Rank
		Hours Worked	Labor Composition	ICT Capital	Non-ICT Capital	MFP			Hours Worked	Labor Composition	ICT Capital	Non-ICT Capital	MFP	
R—arts, entertainment and recreation	−1.2	1.1	0.7	−0.1	11.4	−14.4	14	−8.7	6.9	4.5	−0.7	90.7	−110.0	14
S—other service activities	5.4	0.7	0.5	0.0	0.5	3.6	3	35.1	3.8	3.2	0.3	3.2	24.6	4
Market economy	3.3	0.3	0.6	0.0	1.6	0.9	7	21.8	1.7	3.5	0.2	9.7	6.6	7
Total Poland	2.9	0.4	0.6	0.0	1.9	0.1	8	18.9	2.2	3.8	0.1	11.7	1.2	8

*Electricity, gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities.
**Wholesale and retail trade; repair of motor vehicles and motorcycles.
***Professional, scientific and technical activities; administrative and support services activities.
Source: Own contribution based on Statistics Poland website data for Poland.

Table A5 for Germany, and Table A6 for Italy), containing both average and compound values next to each other, so one can easily compare the results of the two methodologies of calculating the data—this was done in order to extend the results applicability. Averages provide a rather historical information on what happened over a period of time, whereas compound values inform more about the present result of a historical process—the two are not exactly the same in relative terms and can give divergent results. Carrying out both calculi and achieving similar results can free from this issue in the interpretation. However, it had to be proven for each instance that the two methods give similar outcomes, as the more volatile are the input data, the more different are the results from the two methods, so there may by countries that could not be included in the present study (the results are already controversial for Latvia and Slovenia). Data from the tables are visualized on the figures following the tables, marked (a) for average values and (b) for compound values, over time periods of 2005–2010 and 2011–2016 for Poland, that are equal six year periods. Similarly, for the two other Visegrad countries—Czechia and Slovakia—but the second period has been shortened (to 2011–2014 and 2011–2015, respectively). For the two other Central-Eastern Europe countries—Latvia and Slovenia—only single periods were adopted (2009–2014 and 2009–2013 respectively). And finally, for the two Western European countries—Germany and Italy—the second period has been shortened also (to 2011–2015 and 2011–2014 respectively). These limitations result from data availability on the EU KLEMS site. For Poland, the input data are taken from Statistics Poland internet site,[5] whereas for the other countries of the region from EU KLEMS internet site.[6]

A wide-industry approach has been applied in the paper, i.e., at section level from the NACE 2 classification system. Agriculture, forestry, and fishing (NACE section A) has been omitted because the KLEMS methodology meets data issues in this specific economic activity, as all decomposition methodologies based on the neoclassical economic theory. It is so, because of huge self-employment in agriculture which causes that the adjustment of labor remuneration (compensation) by means of hours worked proportion gives very controversial results (see ILO, 2014, p. 173). Also, activities not belonging to the so-called "market economy" according to the standard approach in the KLEMS framework, have been omitted—these are: real estate activities, public administration and defense, and compulsory social security, education and human health and social work activities (L, O, P and Q). The activities of households as employers and undifferentiated goods- and services-producing activities of households for own use and the activities of extraterritorial organizations and bodies (T and U), have been omitted too, because of their little importance. However, commercialized activities, but under strong public control or with heavy government supports have been included—these are: mining and quarrying (B), electricity, gas, steam, and air conditioning supply (D), water supply, sewerage, waste management and remediation activities (E), transportation and storage (H) and arts, entertainment, and recreation (R). In general, these wide industries have huge investment outlays, which are directly or indirectly supported by the government. All wide

[5]https://stat.gov.pl/en/experimental-statistics/klems-economic-productivity-accounts/.
[6]http://www.euklems.net/. See footnote 2.

industries (represented by NACE sections) have been displayed on all figures from the left to the right, in order of their increasing GVA growth rates. In the tables columns with industries ranks (as far as GVA growth rates are considered) are provided.

For Poland, in mining and quarrying (B) in the period 2005–2010 can be observed in Table 1 negative GVA growth rates (average: −4.3 percent or compound: −24.4 percent) related to this industry restructuring carried out mainly under government control. So, despite some investments (mainly non-ICT capital contributions—average: 0.5 pp or compound: 2.9 pp) the residual MFP contribution value is negative (−4.7 pp or −26.5 pp, respectively). This situation, however, ameliorates in the later period 2011–2016 as far as GVA growth is concerned (0.0 percent or −0.6 percent, respectively, and −0.9 pp or −5.2 pp, respectively). In electricity, gas, steam and air conditioning supply and water supply, sewerage, waste management and remediation activities (D–E), that are network services, there are also important and necessary upgrading outlays in 2005–2010 that are not accompanied by huge GVA growth rates (2.8% or 17.2%, respectively), therefore here as well the contribution of the residually computed MFP is negative (−1.8 pp or −12.2 pp, respectively)—here the situation becomes even more constrained in the period of 2011–2016 (0.6 percent or 1.8 percent, respectively, and −3.6 pp or −24.7 pp, respectively). In transportation and storage (H) in 2005–2010 there are also important public outlays (mainly non-ICT capital contributions—5.2 pp or 35.6 pp, respectively), only partly accompanied by a direct increase in transport services (GVA growth rates—1.5 percent or 8.0 percent, respectively), therefore here as well one can observe negative MFP contributions (−3.8 pp or −27.9 pp, respectively). However, in this wide industry the situation improves, as large increases of capital services' contributions (mainly non-ICT capital contributions—8.1 pp or 59.3 pp, respectively) in the later period 2011–2016 move it to an above total economy (2.9 percent or 18.9 percent, respectively) and even above market economy (3.3 percent or 21.8 percent, respectively) GVA growth rates (i.e., 4.5 percent or 29.2 percent, respectively). Also a capital-oriented public support (mainly non-ICT capital contributions—5.7 pp or 39.0 pp, respectively) for arts, entertainment and recreation (R) does not lead fully to production increase (i.e., GVA growth rates—2.5 percent or 14.8 percent, respectively in period 2005–2010) in this group of specific industries, which inevitably leads to negative MFP contribution showoffs (−4.9 pp or −33.6 pp, respectively) —here the situation does not improve in the later period of 2011–2016 but gets worse (−1.2 percent or −8.7 percent, respectively, and −14.4 pp or −110.0 pp, respectively).

Those negative MFP contributions, observed in Table 1, and visualized on both Figures 1 and 2 for Poland, are compensated by positive ones in the other industries, therefore the results for the total Polish economy (GVA growth rates—4.4 percent or 29.7 percent, respectively in 2005–2010, and 2.9 percent or 18.9 percent, respectively in 2011–2016 in Table 1) are situated somewhere in the middle of the graphs. Activities not included in the market economy contribute also negatively to the overall GVA growth and this is the reason why the market economy bars are situated to the right-hand side from total Poland bars on both figures (GVA growth rates—5.0 percent or 34.1 percent, respectively in 2005–2010, and 3.3 percent or 21.8 percent, respectively in 2011–2016). Even more important is the observation

here that the MFP contributions for the market economy are greater (2.5 pp or 18.4 pp, respectively in 2005–2010, and 0.9 pp or 6.6 pp, respectively in 2011–2016) than these contributions for the total Polish economy (1.6 pp or 12.2 pp, respectively in 2005–2010, and 0.1 pp or 1.2 pp, respectively in 2011–2016), which indicates that these omitted activities have an overall negative MFP contribution.

One important observation on both Figures 1 and 2 for Poland is that manufacturing (NACE section C) has the highest MFP contribution in the period 2005–2010 (6.9 pp or 52.6 pp respectively in Table 1). Because manufacturing (C) stands out as the largest wide industry in the Polish economy (accounting for about a quarter of it) it weighs very substantially on the total-economy MFP contribution (1.6 pp or 12.2 pp, respectively). Manufacturing in relative terms has also the highest GVA growth rate (i.e., 8.5 percent or 64.4 percent, respectively) from all wide industries in that period. Manufacturing remains highly supporting growth in the second period 2011–2016 (4.1 pp or 28.0 pp, respectively, and 5.0 percent or 33.4 percent, respectively), being outperformed only by the service sector (K, S and M-N) and particularly by information and communication (J) activity (7.1 pp or 51.5 pp, respectively, and 7.5 percent or 53.8 percent, respectively). Information and communication (J), having already a high MFP contribution in 2005–2010 (3.2 pp or 20.5 pp, respectively), becomes the leader between all wide industries both as far as the GVA growth rate and the relative share of the MFP contribution are considered in the later period 2011–2016. In general, these changes can be considered as a continuation of an evolution towards a service and information driven economy.

On all graphs for Poland, the contribution of MFP seems to be more than substantial and almost decisive in the ranking of the specified industries, as far as the speed of GVA growth is considered. In the later period 2011–2016, apart from capital driven transportation and storage (H) wide industry (GVA growth rates—4.5 percent or 29.2 percent, respectively and non-ICT capital contribution—8.1 pp or 59.3 pp, respectively), only the industries with preponderant MFP contributions can be considered as supporting economic growth, as they lie on the graphs to the right from bars for total Poland and for market economy. Both Figures 1 and 2 confirm these results in the same way, with only one but of secondary importance exception—the other service activities (S) precede the professional, scientific, and technical activities, and the administrative and support service activities (M–N) on Figure 1 for Poland, which is not the case on Figure 2. The time spans of this analysis are therefore not long enough to discard the conformity of the analytical outcomes arising from the two adopted methodologies in presenting the data, i.e., average and compound.

Although the Polish economy as a whole seems to be to a large extent capital driven in 2005–2010 (non-ICT capital contribution—1.4 pp or 8.6 pp, respectively in Table 1), and by far more so in 2011–2016 (1.9 pp or 11.7 pp, respectively), this picture becomes more sophisticated if it is analyzed at the industry level. Investment outlays go mostly to government-supported activities, and they are often of a necessary restructuring or modernization-alike character.[7] These investments, often

[7]There is a great deal of literature on restructuring of the Polish outdated heavy industries. Most of it is in the Polish language and it usually served the Polish Government's policies. Scientific literature on the issue usually orbited around and there is a profusion of disparate documents. For a concise overview of the mining (mainly coal) industry in this scope see: Paszcza (2010); for a concise overview of the power sector in this scope see: Szymla (2013).

based on European Union co-financing, are expected to deliver positive growth rates in the long run, such as e.g., investment in the transportation infrastructure (H), already delivering substantial growth in the later period 2011–2016 (4.5 percent or 29.2 percent, respectively). In many cases they are associated with restructuring of outdated activities that will not be expanding, and therefore these presently unproductive investment outlays will dwindle in the future when the restructuring process of the inherited old economy entities will mostly terminate. In some industries such as electricity, gas, steam, and air conditioning supply, and water supply, sewerage, waste management and remediation activities (D–E) government-supported investment outlays are meant to modernize these activities, so as they become profitable in economic terms in the long run. The burden for the economy associated with capital outlays, therefore will be dwindling. The process of capital investment evasion abroad caused by its profitability decrease associated with labor cost increase should not be substantial in those government-steered activities. Rather a converse situation is to be expected. The burden for the economy of costly unproductive activities is conditioned to become lower and capital financing should become more available for the remaining economy. Obviously, if no unpredictable catastrophic event shall materialize.

In mining and quarrying (B) the negative MFP value should become reduced which is already confirmed on the lower graphs of both figures for Poland (corresponding to lower part of Table 1), as investment here are meant to stabilize coal extraction at a sustainable level—they were already heavily reduced as coal mining has been already well restructured before. In what concerns network services (D–E) economic sustainability is also a priority, together with the wider energy-related policy issues. Investment outlays in transportation and storage (H) can be considered as long-term-return infrastructural investments that are counteracting one of the causes of the middle-income trap—this is confirmed already, as supporting general growth rates are reported on the lower graphs of both figures for Poland in that wide industry. Capital outlays public support for arts, entertainment, and recreation (R) does not directly lead to production increase but is also meant to increase economic sustainability of these activities in the longer run. The negative MFP contributions associated with the above-mentioned activities are conditioned to be reduced in the future and even presently they are compensated by positive ones in the other wide industries included in the analysis.

These observations already indicate that a middle-income trap driven by capital disinvestment caused by its reduced profitability is not the mechanism that is likely to operate in Poland. But the other one observation discussed further is by far more important. Manufacturing (C) is the largest wide industry in the Polish economy, and it weighs very importantly on the total economy. It accounts for something close to 25 percent of the total Polish GVA and its share is growing, because this wide industry grows faster (8.5 percent or 62.4 percent, respectively in 2005–2010 and 5.0 percent or 33.4 percent, respectively in 2011–2016 in Table 1) than both the total economy (4.4 percent or 29.7 percent, respectively in 2005–2010 and 2.9 percent or 18.9 percent, respectively in 2011–2016) and the market economy (5.0 percent or 34.1 percent, respectively in 2005–2010 and 3.3 percent or 21.8 percent, respectively in 2011–2016). It can be asserted that manufacturing industries, because they are very technological

(i.e., they use a lot of machinery, being generally more dependent on it), have in general the greatest technological progress, with some possible but not numerous exceptions. This should translate into an important contribution of MFP in GVA growth in this category, but the fact that this MFP contribution dominates entirely over other contributions is an important novelty observation (6.9 pp out of 8.5 percent of GVA growth or 52.6 pp out of 62.4 percent of GVA growth resp. in 2005–2010 in Table 1). This relative domination of MFP contribution remains for manufacturing in the period 2011–2016 (4.1 pp out of 5.0 percent of GVA growth or 28.0 pp out of 33.4 percent of GVA growth, respectively). Only for the service industries (K, S and M–N), and information and communication (J) this MFP domination becomes similar in this later period, but these wide industries are even more evolutionarily (service sector) or technologically (section J) progressive than manufacturing, so this change can be considered as a positive one for the sustainable long-run economic growth too.

This suggests that manufacturing is being intensively upgraded and modernized in Poland, and this happens regardless of whether it is replicative through imitation and acquiring of foreign technologies or innovative. These changes seem to be the basic growth engine for this wide industry rather than new capital outlays. Therefore, capital investment evasion is not expected to undermine decisively the economic growth in manufacturing, because of its secondary contribution in comparison with MFP contribution (1.6 pp/6.9 pp or 9.8 pp/52.6 pp, respectively in 2005–2010, and 1.1 pp/4.1 pp or 6.7 pp/28.0 pp, respectively in 2011–2016 in Table 1). Because of that, manufacturing is also not overinvested, so it is unlikely that a capital evasion can happen in the scope necessary for the economy to stop growing. Once again, it seems that this mechanism of capital loss of profitability and its evasion specific for the middle-income trap is not going to operate in Poland. It goes without saying that this logic operates also for the growth-supporting service industries and the information related industries. Since information and communication distinguishes itself by its high MFP contribution (3.2 pp out of 3.7 percent of GVA growth or 20.5 pp out of 23.9 percent of GVA growth, respectively, in 2005–2010 in Table 1) and the position of this wide industry happens to strengthen decisively (7.1 pp out of 7.5 percent of GVA growth or 51.5 pp out of 53.8 percent of GVA growth, respectively) as a leader in GVA growth and MFP relative contribution in the period 2011–2016, the views expressed above on the unlikeness of a middle-income trap occurrence in Poland seems well reinforced, because it means that a substantial modernization of the economy, associated with information and telecommunication technologies, is on track.

In general, we can observe that in all supporting-growth activities the MFP contribution dominates, i.e., also in the other fast-growing wide industries. Therefore, MFP can be considered as the main *growth engine* in the economy at industry level and this domination remains in the second half of the entire analyzed period, i.e., in the years 2011–2016. Moreover, MFP contribution is usually and relatively the largest in the most growth-supporting activities, and therefore decisive for their ranking (see Table 1) as far as growth rates are considered. This MFP contribution dominates over all other contributions taken together and therefore capital contributions as well. Since the economic growth seen at industry level is not capital driven, nor

other resources driven, the cause of a slowdown associated with the middle-income trap, as outlined in Section 3, is indeed very unlikely to become a reality.

The rationale standing behind this interpretation is based on the following logic. The high relative contribution of value-added-based MFP at industry level means that a given industry has a high value-added capture (which is mostly the result of technological and organizational progress, but not only). Therefore, this industry has also high profitability margins. Therefore, firms belonging to it are more immune to economic slowdowns. But what is particularly important, this industry attracts more financing, which speeds up further its growth. If the industries that grow faster have higher relative contributions of MFP, i.e., higher value-added capture, then the entire economy is conditioned to increase its value-added capture as well. And this process is contrary to the process lying behind the middle-income trap phenomenon, i.e., the lack of transition from low-value-added products to high-value-added products, as above mentioned. Since, this is observed for the Polish economy, then we can deduce that Poland is escaping the middle-income trap.[8]

However, at the aggregate level of the Polish economy these important industry-level MFP contributions are being levelled by industries that do not contribute importantly or positively to economic growth. This effect has remained and even strengthened in the period 2011–2016. In real terms, the Polish economy grew by about 20 percent in the period 2011–2016, which is lower than in the period 2005–2010 when it grew by about 30 percent, but the fundamentals of this economic growth are even stronger than before, as MFP contributions became even more decisive in supporting growth at industry level.

The more general implication is that the Polish economy is developing well and intensively modernizing in well-growing wide industries on the one hand, and on the other hand the share of the other industries not greatly contributing to economic growth or contributing negatively is perhaps too large, which would be a *government-failure* paradigm supporters' view (understood here as a rather neoclassical and liberal theoretical stand in economics; see e.g., Datta-Chaudhuri, 1990; Barak, 2013; Clifford, 2006). However, some contenders might assert that there is no trouble at all since in general the MFP negative contributions in some industries are well counterbalanced by MFP positive contributions in other industries, which would be rather a *market-failure* paradigm supporters' view. Government-supported activities are however dwindling, and investments are making them more sustainable in the long run. Reduced General Government support is a growth resource for the future, whether because of increased economic sustainability of the State supported activities or because of the upcoming reduced burden associated with them. The Polish economy is therefore conditioned to avoid stagnation in the long run or at least

[8]The process of supporting growth high-MFP-contribution industries has been observed in Jorgenson *et al*. (2005, pp. 334–340). But there it concerned particularly the ICT industries. In a developed economy there is no case of middle-income trap evasion, but rather of a temporary growth resurgence due to the development of a new frontier technology (that pervades quite many industries). Otherwise, in such developed economy we observe rather only some rearrangements in rankings. In the mentioned reference gross-output-based MFP was computed, so it is more related with technological progress by definition.

in the middle one. Only a very discouraging-growth new economic policy, some extremely tight foreign-related conditions or an unexpected exogenous catastrophe (as Covid-19 may happen to be, but not necessarily in comparison to other economies) may substantially impact on these settings.

The results for Poland can be compared with those of some other countries of the region, but to a limited scope. For only five Central-Eastern Europe countries other than Poland growth decompositions are performed in the framework of KLEMS growth accounting.[9] These are Russia, Latvia, Slovenia, Czechia, and Slovakia. The Russian case is specific to the extent that any comparison with Poland would require extensive additional work on both the Russian and Polish data (perhaps a transnational co-operation would be required to operate this undertaking) in order to make them consistent with each other. In the case of Latvia and Slovenia very short time series are available and these time series are straddled over the two adopted periods. In addition a discrepancy between average and compound values is conspicuous for these countries that would even become larger if times series were extended. Therefore, only the data for Czechia and Slovakia can be effectively compared in the present study with the data for Poland, as the only limiting difference is that the time series end for Czechia in 2014 and for Slovakia in 2015 (but some possible comparisons with Latvia and Slovenia will be made too). To ease the main comparisons in Table 2 data on GVA growth rates and MFP contributions for the three Visegrad countries were collected.

Just as for Poland the two methods of preparing the data, i.e., average versus compound values have delivered for Czechia very similar results (see Footnote 2). Only for three industries represented by NACE sections B, F, and I on the lower graphs (of Figures A1a and A1b in the Appendix) the ranking is different for the two methods, but these differences are nor substantial enough to impact the conclusions. In general, the picture for the Czech economy is less optimistic than that for the Polish one. In the period 2005–2010 the general aggregate growth is lower (average 3.1 percent or compound 19.1 percent, respectively, against 4.4 percent or 29.7 percent, respectively, for Poland, as can be seen in Table 2), there are less growth-supporting industries, and quite many with negative MFP contributions. The positive features are the role of manufacturing (C), which is similar as for the Polish economy (GVA growth of 7.6 percent with MFP contribution of 4.9 pp or 50.7 percent with 32.4 pp, respectively, in 2005–2010), and the role of information and communication wide industry (J) of which the position is even stronger in supporting growth than in the case of Poland (GVA growth of 6.1 percent with MFP contribution of 3.3 pp or 41.6 percent with 24.1 pp, respectively, in 2005–2010), but that changes in the second period. The second period for Czechia is shorter (2011–2014) but some comparative conclusions can be drawn, however. This is a period of stagnation for the Czech economy. As seen on the lower graphs (Figures A1a and A1b) the role of MFP seems to have nothing to do with the ranking of the different wide industries as far as their growth is concerned. Clearly, this is a picture of a middle-income trap operating, in light of this paper's main ascertainment

[9]As available on the EU KLEMS and World KLEMS sites: http://www.euklems.net/, http://www.worldklems.net/ and for Russia: https://www.hse.ru/en/russiaklems/. The more recent https://euklems.eu/ site could not be used as explained in footnote 2.

TABLE 2
Comparison Between Visegrad Countries AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates, and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

	AVERAGE						COMPOUND					
	Poland		Czechia		Slovakia		Poland		Czechia		Slovakia	
	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution
NACE Rev. 2	*2005–2010*											
B—mining and quarrying	−4.3	−4.7	−5.2	−1.0	4.3	0.5	−24.4	−26.5	−29.2	−2.3	12.4	−10.6
C—manufacturing	8.5	6.9	7.6	4.9	7.8	6.3	62.4	52.6	50.7	32.4	50.8	41.4
D–E—electricity, gas, etc.*	2.8	−1.8	−1.5	−1.8	−2.2	−2.9	17.2	−12.2	−10.1	−12.2	−23.1	−27.3
F—construction	5.2	2.0	1.2	−2.0	7.6	3.1	35.6	15.6	7.4	−12.2	50.5	21.9
G—wholesale and retail trade, etc.**	4.9	4.6	5.1	1.8	5.2	1.1	33.3	31.1	32.8	12.6	33.9	8.8
H—transportation and storage	1.5	−3.8	−0.7	−4.1	0.5	−4.7	8.0	−27.9	−5.2	−26.4	−1.2	−33.1
I—accommodation and food services activities	3.7	−1.2	−5.3	−7.9	−1.9	−5.4	24.2	−7.0	−30.6	−46.6	−13.0	−35.0
J—information and communication	3.7	3.2	6.1	3.3	6.4	1.9	23.9	20.5	41.6	24.1	44.0	15.7
K—financial and insurance activities	4.3	1.6	7.0	0.9	4.1	3.6	24.5	7.8	48.6	19.0	26.0	24.0
M–N—professional, scientific, etc.***	6.3	2.7	1.0	−3.3	11.4	5.9	44.0	21.3	5.5	−21.2	87.6	52.9

(Continues)

TABLE 2 (CONTINUED)

	AVERAGE						COMPOUND					
	Poland		Czechia		Slovakia		Poland		Czechia		Slovakia	
	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution
R—arts, entertainment and recreation	2.5	−4.9	−2.0	−5.4	16.6	12.6	14.8	−33.6	−12.0	−33.2	97.6	72.9
S—other service activities	5.6	1.3	−2.0	−4.6	−0.8	−1.9	38.0	12.8	−13.4	−28.9	−4.6	−10.9
Market economy	5.0	2.5	3.6	0.6	5.6	2.5	34.1	18.4	22.5	4.1	37.1	18.0
Total economy	4.4	1.6	3.1	0.3	5.1	2.2	29.7	12.2	19.1	1.9	33.8	16.2
NACE Rev. 2	*2011–2016*											
B—mining and quarring	0.0	−0.9	−0.5	−1.4	2.4	4.1	−0.6	−5.2	−7.7	−11.3	12.0	20.1
C—manufacturing	5.0	4.1	2.4	1.0	6.3	4.2	33.4	28.0	9.3	3.7	34.9	23.8
D–E—electricity, gas, etc.*	0.6	−3.6	−5.5	−9.0	−2.1	−5.2	1.8	−24.7	−20.5	−34.8	−10.9	−26.1
F—construction	1.8	1.1	−1.7	0.6	0.0	0.1	9.4	4.9	−6.9	1.9	−1.5	−1.2
G—wholesale and retail trade, etc.**	1.4	0.6	3.7	3.1	−3.5	−4.1	8.3	3.4	15.6	13.1	−16.6	−19.5
H—transportation and storage	4.5	−3.8	−3.8	−3.5	10.1	9.5	29.2	−30.9	−14.3	−13.1	59.6	56.8
I—accommodation and food services activities	2.6	1.3	−1.4	−0.9	2.8	−1.5	16.1	8.5	−5.7	−3.9	12.6	−9.2
J—information and communication	7.5	7.1	2.7	−12.5	0.5	−0.3	53.8	51.5	11.1	−60.3	1.2	−2.2
K—financial and insurance activities	6.3	4.9	2.5	1.4	6.1	4.4	41.7	33.4	10.3	5.8	33.8	25.3

TABLE 2 (CONTINUED)

	AVERAGE						COMPOUND					
	Poland		Czechia		Slovakia		Poland		Czechia		Slovakia	
	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution	GVA Growth Rate	MFP Contribution
M–N—professional, scientific, etc.***	5.2	2.4	1.8	−3.6	2.7	−1.5	35.5	18.2	7.3	−15.5	13.9	−7.8
R—arts, entertainment and recreation	−1.2	−14.4	1.7	1.0	6.6	2.4	−8.7	−110.0	6.6	3.9	37.3	15.0
S—other service activities	5.4	3.6	0.2	−0.9	1.1	1.5	35.1	24.6	0.5	−3.7	5.6	7.6
Market economy	3.3	0.9	1.0	−0.9	3.1	1.4	21.8	6.6	4.1	−3.9	16.1	7.6
Total economy	2.9	0.1	1.0	−1.2	2.2	0.5	18.9	1.2	3.8	−5.0	11.7	3.1

*Electricity, gas, steam and air conditioning supply; water supply, sewerage, waste management and remediation activities.
**Wholesale and retail trade; repair of motor vehicles and motorcycles.
***Professional, scientific and technical activities; administrative and support services activities.
Source: Own contribution based on Statistics Poland website data for Poland and EU KLEMS data for Czechia and Slovakia.

(on the existence of a link between the good prospects for the given economy and the matching of the increasing importance of MFP with the given sector speed of growth). Although for Poland a slowing growth can also be observed in the second period (having in mind that it is longer than for Czechia, i.e., 2011–2016), we can observe that at the same time the role of MFP in supporting growth has even strengthened in comparison with the period 2005–2010 (as seen on graphs from Figures 1 and 2).

For Slovakia, the two methods of preparing the data also have delivered very similar results. Industries represented by NACE sections B and K on the upper graphs (Figures A2a and A2b) and sections I and M–N on the lower graphs have slightly different positions, depending on whether average or compound method is used, but this is unsubstantial for the present analysis. In the first period (2005–2010) the Slovak economy seems to be in an even stronger position than the Polish one, but only slightly. The general growth level is slightly higher (5.1 percent or 33.8 percent, respectively, against 4.4 percent or 29.7 percent, respectively, for Poland, as can be seen in Table 2) and the increasing role of MFP well matched with the industries' growth ranks, as seen on the upper graphs of Figures A2a and A2b. However, the role of manufacturing (C) is slightly weaker than for Poland (7.8 percent or 50.8 percent, respectively, against 8.5 percent or 62.4 percent, respectively, for Poland), which is important because of the considerable share of this industry in the overall economy. In the second period (having in mind that it is shorter for Slovakia—2011–2015), the situation worsens in comparison with Poland, but the positive role of MFP in industries' growth ranking is to a large degree maintained in contrast to Czechia.

Some limited comparisons can also be made with the other two countries, i.e., Latvia and Slovenia. In the case of both Latvia and Slovenia the GVA growth rates are negative in the adopted periods (−1.0 percent or −7.3 percent, respectively, for Latvia and −1.8 percent or −1.8 percent, respectively, for Slovenia[10]—Tables A3 and A4). Growth is not strongly supported by MFP contribution in the case of Latvia (0.1 pp or 0.5 pp, respectively) and in the case of Slovenia MFP contribution (−1.7 pp or −20.4 pp, respectively) precipitates the economy into negative growth. The market economy dwindles even faster (−1.9 percent or −13.6 percent, respectively, for Latvia and −2.6 percent or −11.2 percent, respectively, for Slovenia), which is also precipitated by negative MFP contributions (−0.6 pp or −4.4 pp, respectively. and −2.0 pp or −2.1 pp, respectively). Therefore, the private sector does not support economic growth and is contracting in relative terms. As seen on the graphs (Figures A3a or A3b for Latvia and Figures A4a or A4b for Slovenia), there is no clear correlation between the relative speed of growth of the given wide industry (NACE section) and the relative importance of MFP contribution to its growth. Therefore, the MFP engine of growth is not operating in these economies in the considered periods of 2009–2014 and 2009–2013, respectively. This is particularly true for Slovenia where MFP is negative for almost all activities, including the two macroaggregates. According to the rationale on the importance of MFP presented before in this paper, it would mean that these economies depend

[10]There exists such possibility that average and compound data are the same, although it is rare.

entirely on impulses from abroad—however, one should take into consideration that the scope of data is not large and that this issue here should be uttered cautiously, also because of greater differences between average- and compound-based graphs in comparison to the previously mentioned countries (time series extension would rather not help in this situation, therefore, the results for these two countries are less reliable—if it is not a data problem then it is the result of greater data volatility more often observed for small countries).

Comparisons are also possible to some Western Europe economies for which the KLEMS growth accounting is performed. However, including them all would greatly inflate this paper. One possible solution is to choose one or two such countries—this rationale assumes that these western countries are quite similar to each other at least by the general nature of their economies as they are all mature economies. We have additionally performed the calculations for Germany and Italy (Tables A5 and A6 followed by their respective figures) being in geographical proximity to the Central-Eastern Europe countries and representing two groups of western countries—the presently more prosperous northern group and the presently less prosperous southern group.[11] In the case of Germany, the situation is similar to the three mentioned Visegrad countries, i.e., the growth of a given wide industry seems strongly correlated with the role of MFP which impacts on their ranking with only one or two exceptions. Therefore, the economic growth in this country seems sustainable (endogenously). However, all bars on the graphs are shorter than in the case of the Visegrad countries, especially for Poland and Slovakia. This can be explained by the fact that the German economy is mature, whereas the Visegrad economies are still maturing, therefore having greater growth resources. Italy is also a well-ordered economy following the rationale presented in this paper, as the ranking of wide industries as far as the speed of their growth is considered is not less correlated with the role of MFP than for Germany but in the case of Italy most of the wide industries have negative MFP contributions, with only 3 or 4 exceptions (depending on the graph), whereas for Germany 8 or 9 wide industries (depending on the graph) included in the study have positive MFP contributions. This means that in Italy the productivity is falling throughout the economy because of non-structural reasons.

5. Conclusion

Much of the ongoing discussion concerning the middle-income countries is focused on the economic issue coined the Middle-income Trap. This concerns in particular the Central-Eastern Europe countries and therefore Poland as well. However, in the case of Poland the assertion of the middle-income trap has to be rejected, after observing the growth distribution between different industries, and particularly the individual industries' growth decompositions into

[11]This is a generalization to some extent. In fact, it would be more appropriate to perform a regional KLEMS type analysis, e.g., at the level of individual provinces. By doing this, it would be possible to capture important differences between Southern Italy and the more economically prosperous Northern Italy and similarly between Western and Eastern Germanies. However, no data as yet are available to carry out this analysis at province level.

factor contributions and multifactor productivity (MFP) contribution. It has to be rejected because we have been able to observe that industries that can be considered as growth supporting are mainly MFP-contribution driven in Poland, not capital-contribution driven, and that the contribution of MFP is decisive for their growth rates ranking.

For Poland, capital contribution is particularly high in industries that cannot be considered as supporting growth and they are mostly State-supported activities. Therefore, the possible solution for the eventual slowing down of the economy, from the point of view of market-oriented researchers, is to simply limit the share of these activities by lifting some of the State support delivered to them, whereas those who contend for the *market-failure* case can argue that the balance between these activities and the growth-supporting industries is well maintained, so there should not be any major concern on the supply side of the economy even in the longer run. Investments go mostly to stagnant industries that are being modernized, to some degree from temporary necessities that may dwindle in the future, and for infrastructure development that will eventually deliver growth in the very long run.

The economic growth in Poland is therefore innovation, or at least imitation driven, not investment driven. The possibility of capital outflow will not undermine the growth-supporting industries because of its little contribution to their growth and because there are not overinvested. This is particularly conspicuous for manufacturing, which is the largest section in the Polish economy, and which grows fastest, apart from service industries, and particularly information and telecommunication wide industry that took this leadership in the period 2011–2016. But this last change is also a kind of good news for the issue.

Extending this research to other Central-Eastern Europe countries, may possibly help to assess whether the process of the middle-income trap is actually occurring for these countries. The findings suggest that it might be so for Czechia in the period 2011–2014, but new data from more recent years are needed to confirm this assertion. The findings for Slovakia are much more optimistic, just as good, or even better, as for Poland in the 2005–2010 period, but in comparison with Poland the situation deteriorates there in the later period 2011–2015, remaining however better than that for Czechia in the (slightly shorter) period 2011–2014.

The situation of the Visegrad countries is decisively better than that for Latvia and Slovenia—these latter two countries seem to be not undergoing the positive process consisting in industry MFP contributions being orderly correlated with the industries' ranking in the pace of their growth. The Visegrad countries' situation is also better than that of Western mature economies as far as relative-growth rates are considered, but for a different reason—they are rather orderly in the mentioned way, but since they are mature less growth resource is left for them, as they are more frontier alike economies depending on the actual technological progress.

Perhaps a mixed approach to some countries of the region, also well developing in the long run, but not relying only on MFP, would be appropriate, as in the case of Russia (see Timmer and Voskoboynikov, 2014), where we have two main

drivers of economic growth—one is natural-resource-based, whereas the other is MFP-based[12] and where some economic patterns are similar to resource-abundant countries such as Canada and Australia (Voskoboynikov, 2017). Many of these findings, therefore, can be interesting for the Central-Eastern Europe economies' researchers and the possible ongoing discussion.

One more important conclusion arises from these findings. It is that the KLEMS growth accounting seems to be the appropriate tool for this kind of study. However, there is the challenge of missing growth-decomposition data for many countries and of often very short time series. Should the use of KLEMS growth accounting spread for more middle-income countries, then a much more comprehensive analysis could be carried out in the future.

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[12]The Russian economy's growth seems to be MFP-driven similar to the Polish economy, but in the latter the aggregate growth is not so substantially disturbed by changing fortunes associated with commodity prices. In Timmer and Voskoboynikov (2014) a discussion on the issue of capital services vs capital stocks is carried out, from which arises another difference in comparison with the Polish economy, where labor services' contribution is substantially different from hours worked contribution whereas capital services' contribution is almost the same as capital stock contribution (which may be the effect of quite proportional growth of different capital types in Poland).

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Table A1. Decompositions of AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the light of KLEMS Growth Accounting (in pp)

Figure A1a. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A1b. Decompositions of COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Table A2. Decompositions of AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A2a. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A2b. Decompositions of COMPOUND Gross Value Added (GVA) growth rates (GVA) into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Table A3. Decompositions of AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A3a. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A3b. Decompositions of COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Table A4. Decompositions of AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A4a. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A4b. Decompositions of COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Table A5. Decompositions of AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A5a. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A5b. Decompositions of COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Table A6. Decompositions of AVERAGE and COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A6a. Decompositions of AVERAGE Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)

Figure A6b. Decompositions of COMPOUND Gross Value Added (GVA) Growth Rates into Factor and MFP Contributions at Chosen NACE 2 Wide Industries in the Light of KLEMS Growth Accounting (in pp)