TOTAL FACTOR PRODUCTIVITY CHANGE OF LONG-TERM CARE SYSTEM IN SELECTED OECD COUNTRIES

Kordić, Lana; Višić, Josipa

Source / Izvornik: **Ekonomska misao i praksa, 2023, 32, 3 - 18**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.17818/EMIP/2023/1.1

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:124:636866

Lana Kordić, PhD

Associate professor
University of Split
Faculty of Economics, Business and Tourism
E-mail: lana.kordic@efst.hr
Orcid: https://orcid.org/0000-0001-5398-4152

Josipa Višić, PhD

Associate professor
University of Split
Faculty of Economics, Business and Tourism
E-mail: josipa.visic@efst.hr
Orcid: https://orcid.org/ 0000-0002-2536-8317

TOTAL FACTOR PRODUCTIVITY CHANGE OF LONG-TERM CARE SYSTEM IN SELECTED OECD COUNTRIES

UDC / UDK: 364.4-053.9:005.361.1
JEL classification / JEL klasifikacija: I10, J14, D24
DOI: 10.17818/EMIP/2023/1.1
Original scientific paper / Izvorni znanstveni rad
Received / Primljeno: August 31, 2022 / 31. kolovoza 2022.
Accepted / Prihvaćeno: November 22, 2022 / 22. studenoga 2022.

Abstract

The population is ageing, which has many social and economic implications, and one of them is an increase in demand for institutional long-term care for the elderly. Therefore, the aim of this paper is to analyse the change and to detect whether there are differences between twelve selected OECD countries in the period 2014-2019 in regard to the values of total factor productivity of long-term care system for the population aged 65 and over these countries. The Malmquist – DEA performance measure, under the assumption of the variable returns to scale (BCC model) and by using the input-oriented model, has been used to obtain the patterns of productivity change. The number of long-term workers and the number of beds in residential long-term care facilities are selected as input variables, while the number of long-term care recipients has been used as an output variable. According to obtained results, the total factor productivity in selected OECD countries increased by 1.023% in the analysed period. The increase is mainly a consequence of a 1.018% increase in technical efficiency, which emphasises an increase in managerial relative efficiency. Results obtained for Turkey indicate the highest productivity increase, accompanied by both a rise in technical efficiency and in technological change. Additionally, an increase in technical change that reflects a catch-up effect and a modest increase in

technological change, indicating a lack of innovation altogether, resulted in an average productivity increase of 1.02% over the analysed period.

Keywords: long-term care, OECD countries, DEA model, Malmquist index, panel data

1. INTRODUCTION

Observed on a world level, 9.56% of the population is older than 65, while in developed economies, this portion is twice as high (20.27%) (United Nations Conference on Trade and Development [UNCTAD] Handbook of Statistics, 2021). At the same time, the old-age dependency ratio, defined as the number of older persons per hundred persons of working age, is 15 on a world level and 31 in developed regions, and according to UNCTAD by 2050 it will increase by 67%, i.e. 48%. In many developed countries, the structure of the family changes along with the ageing of the population, which results in an increase of elderly that need institutional long-term care (LTC). Long-term care refers to a wide range of services required by individuals due to their reduced capacity to function independently in daily activities, and it is mostly related to age. This care can be provided informally by family members and friends, but since family structures transform over decades, children live distant from their parents, and more females enter the labour market, there is a decline in the supply of informal caregiving (Costa-Font, Courbage & Swartzet, 2015). Therefore, demand for formal, i.e. institutional LTC service continues to rise.

The need for LTC services rises at the same time, many countries have problems attracting workers and retaining them in the LTC sector. According to OECD (Organisation for Economic Co-operation and Development [OECD] iLibrary, b)), to keep the current ratio of five LTC workers for every 100 people aged 65 and older across OECD countries, the number of workers in the sector will need to increase by 13.5 million by 2040. Further, besides labour as one of the main inputs, capital investments in LTC care also require significant resources, especially since this service is needed in urban and rural areas of each country. However, technological progress might help address the problem, at least to some point. Assistive technology, e.g. monitoring alarm systems provide the possibility to increase productivity, improve the working conditions of LTC workers and enhance the quality of care for LTC users.

The nature of LTC service makes it extremely labour-intensive and expensive in general, and from an economic perspective, it is interesting to analyse how efficiently the resources to provide such service are used. However, the efficiency of long-term care institutions is mainly analysed from an institutional perspective, and there are scarce findings regarding the compared countries. In that sense, this paper provides an overview of the total factor productivity change of the long-term care system in the selected OECD countries observed from 2014 to 2019. Since health-related services, among other services,

also include LTC, this study adopts a standard way of analysing the total factor productivity change using a nonparametric method (Malmquist index based on input-oriented BCC DEA model). The number of beds and the number of formal workers are used as input variables, while the number of recipients in LTC institutions is used as an output variable.

The obtained results will not solve the problem of increasing demand for LTC service accompanied by shortages of workers in this sector, but can serve as a valuable additional tool to design and adopt policy recommendations and form the models that will result in a more efficient LTC system observed from the perspectives of all stakeholders – recipients', workers', owners' of LTC institutions and governments. Further, the comparison of the total factor productivity change and its elements among several countries provides an additional advantage for policymakers since they will be able to compare the effects of different models of the LTC system. Namely, the government/compulsory spending on LTC accounts for a significant percentage of GDP in OECD countries, and due to the aforementioned factors, a substantial further increase in LTC spending is expected in the coming years.[1] Therefore, further insight into the characteristics of LTC institutional care among countries might help model LTC systems that will consider countries' characteristics to provide LTC care efficiently. In other words, this paper adds to the field by providing new knowledge on country-level LTC systems since a majority of research on the productivity and efficiency of LTC has been done at an institutional level observed in a respective country. As expected, this perspective prevails since the productivity and efficiency of elderly care homes as LTC institutions are important for all stakeholders, irrespective of the ownership of these homes. However, providing country-level data is beneficial, whether observed from the microeconomic or macroeconomic perspective. Therefore, we formed the following research questions:

1) Are there differences in total productivity change in institutional LTC systems among observed OECD countries?
2) What are the effects of technical efficiency and technological change, as components of total productivity change, for each of these countries?
3) How did the total productivity and its elements change over the observed period for all countries observed as a whole?

The remainder of the paper is organised as follows. Chapter 2 provides a literature review, while the third chapter describes data and methodology accompanied by presented results and discussion. The last chapter is the conclusion.

[1] Total government/compulsory spending on LTC (including both the health and social care components) accounted for 1.7% of GDP on average across OECD countries in 2017. (OECD iLibrary, a))

2. LITERATURE OVERVIEW

When it comes to developed countries, the demand for LTC services has increased over the years because of demographic and social factors. Demographic factors such as a growing portion of the population older than 65, low fertility rates, and longer life expectancy (all resulting in high old-age dependency ratios) increase the need for both formal and informal LTC service, irrespectively whether it is institutional or non-institutional care (Figure 1). On the other side, social factors such as changes in family structures, higher divorce rates, later retirement, increased spatial distance between parents and adult children, and increased female participation in the labour market result in the fact that more and more elderly need formal (and institutional) long-term care since the pool of possible informal LTC carers decreases.[2]

LTC service generates significant direct and indirect costs; hence many countries develop and enhance non-institutional LTC trying to rationalise (public) LTC expenditures. However, due to the strength of the aforementioned LTC drivers, it is reasonable to expect that institutional LTC will continue to be needed and will be provided by for-profit and non-profit institutions. Regardless of whether private or public resources have been invested in LTC institutions, the issue of their productivity has multiple economic and social repercussions. However, the forthcoming literature review focuses solely on productivity i.e. efficiency of LTC institutions acknowledging a variety of other scientific approaches to analysing LTC systems.

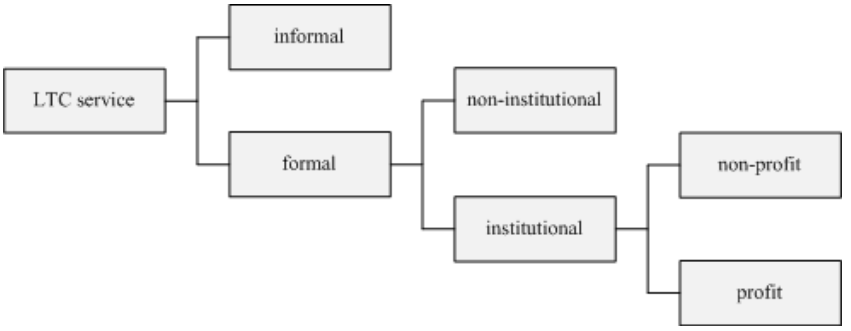

Figure 1 LTC service system classification

LTC refers to providing services required to meet a person's health or personal care needs, and non-profit and for-profit institutions can provide these

[2] The pool of informal carers is under influence of other complex factors as well such as personal (their willingness to do it) and normative beliefs (pressure of the society whether it is expected of them) and factual barriers to do it (in terms of spatial distance between the person in need and the care giver, available time and money) (Broese van Groenou & De Boer, 2016).

services, it is reasonable why there are various types of variables that can be analysed while studying the efficiency of LTC institutions. As expected, according to the nature of LTC service, many studies use solely indicators that are common in health-sector-oriented research, such as the number of beds, the number of LTC employees, the number of LTC residents etc. (cf. Chattopadhyay & Ray, 1996; Lin, Chen & Peng, 2017; Luasa, Dineen & Zieba, 2018; Wu, Hu & Chiou, 2021 etc.). Further, this service is provided to a person in need, in a majority of cases an elderly, consequently, quality measures form the second group of variables additionally used in research (e.g. Kooreman, 1994; Garavaglia, Lettieri, Agasisti & Lopez, 2010; Chang & Yang, 2010; Barsanti, Bunea & Colombini, 2021). Finally, a growing number of LTC institutions are being established as any other for-profit business project and in that sense, financial indicators form the third group of variables that are the less often (solely) used in efficiency studies of the LTC sector (e.g. Kleinsorge & Karney, 1992; Garavaglia et al., 2010; Olivares-Tirado & Tamiya, 2014; Veloso, Vaz & Alves, 2017; Stals, Tsaurkubule, Konstante & Alksnis, 2020; Vrabková & Vaňková, 2021; Višić & Kordić, 2021). As stated, some of the aforementioned studies use just one type of variable, some combine two types, while for example, Zhang, Zeng and Fang (2019) and Barsanti et al. (2021) use all three groups of variables – those common in health-sector focused studies, qualitative and financial variables.

Studies on productivity and efficiency of the LTC sector also differ in terms of a used sample. The majority of them[3] focus on LTC institutions in just one country, while there are fewer studies that compare LTC sectors observed on a country level among several countries. In that sense, Ozbugday, Tirgil and Kose (2020) provide an excellent overview of efficiency changes in LTC in 17 OECD countries. Wichmann, Adang, Vissers, Szczerbińska, Kylänen, Payne, et al. (2018), on the other hand, analyze the technical efficiency in 6 EU countries but focus on end-of-life care in long-term care facilities. Gavurova, Kocisova and Sopko (2021) provide valuable insight into health system efficiency in 36 OECD countries but do not distinguish LTC among total health systems. Further, Ariaans, Lindenb and Wendtet (2021) present a typology analysis of LTC in 25 OECD countries, offering a perspective valuable to policymakers.

Even though the referred papers, and especially a detailed literature review presented by Tran, Nguyen, Gray and Comans (2019), provide an overview of previous research on the efficiency and productivity of the formal LTC sector, the analysis of this sector should be done in a way that acknowledges the complexity of this sector. One aspect is the difference between institutional and non-institutional care LTC services. Non-institutional care allows elderly individuals to continue living in their homes but at the same time to have the needed help. This system has benefits for individuals (it keeps their integrity preserved), society as a whole (members of the society are more independent) and

[3] E.g. all studies mentioned in the previous paragraph.

the state budget (non-institutional care costs less than nursing homes) (Mihić, Todorovic & Obradovic, 2014). In other words, the fact that many countries[4] are developing non-institutional care is not just a decision driven by the aim to decrease government expenses for LTC care, yet non-institutional care produces nontangible personal and society-level benefits. Further, expenses for LTC care[5], also produce tangible, measurable benefits, and they might be treated as an investment since might they have positive economic implications in terms of various direct, indirect, and induced effects, such as lowering the unemployment rate due to the high labour intensity of the LTC sector, increased demand for goods and services from the other sector by companies in LTC sector and consequently increased tax revenues through personal income/corporate income/VAT tax revenues, etc. (c.f. Díaz Díaz, 2011).

Another important aspect of LTC is its formal or informal nature. In that sense, Hlebec, Srakar and Majcen (2016) provide an overview of relation,s i.e. combinations between these two types of care for the elderly, presenting five different theoretical models of care for the elderly, and they also analyse the determinants of care type using individual data on elderly citizens. In other words, designing an efficient LTC system in the country should involve taking into account that personal characteristics, along with multiple social and country-specific factors, will determine which model is the most suitable, i.e. how to combine both institutional and non-institutional care and how to make it complementary to diminishing number of cases available informal care.

Since non-profit and for-profit entities can provide institutional long-term care, another dimension opens up when analysing this sector. Namely, the two types of entities mentioned earlier have different steering mechanisms since the for-profit sector seeks efficiency to increase market power while the non-profit sector follows civil society logic (Trætteberg, 2015). Regardless of whether institutional LTC care is provided by non-profit or for-profit entities, operating in this sector should be characterised by introducing innovations even though, at first, it might seem that this sector does not require constant improvements like those more market-oriented sectors. However, there are many possibilities for improvement of the service, and Mali (2019) provides an overview of various detected[6] social innovations, innovations in social welfare, and elderly care homes innovations.

Along with the aforementioned different issues related to LTC analysis (used variables and samples; institutional/non-institutional care; formal/informal care; non-profit/for-profit entities), there are other aspects and perspectives of LTC that can be used while analysing this type of care (e.g. user perspective

[4] E.g. Croatian government requested technical assistance from the European Commission and the OECD to support the reform process and develop non-institutional forms of elderly care, while Lithuanian government requested them to support the reform process on care for older people, particularly home-based and community-based care (OECD, Ageing and Long-term Care).

[5] For more insights into LTC expenses c.f. Ozbugday et al. (2020).

[6] Empirical part of her research has been performed on Slovenian old people's homes and she presents various examples in all the three mentioned groups of innovations.

oriented on the quality of the provided care). However, the presented brief literature overview hopefully provides a suitable theoretical background to perform the here presented empirical analysis.

3. METHODS, RESULTS, AND DISCUSSION

The total factor productivity change of the institutional long-term care system for the population over the age of 65 in selected OECD countries for 2014-2019, is analysed using the Malmquist DEA performance measure.[7]

In order to set the efficiency frontier, different statistical and mathematical approaches can be used. Contrary to statistical approaches, whose aim is to define absolute efficiency, the aim of mathematical programming is to analyze relative efficiency of the analyzed units (Gardian & Koić, 2012).

Of the observed unit in relation to an idealized comparison with the standards, mathematical programming analyzes relative efficiency in relation to other units within the same network (Gardian & Koić, 2012). Focusing on relative technical efficiency (which presents the use of input variables for the provision of services, in which it implies the maximum possible amount of output variables achieved on the basis of available input variables, or reduction of input for the same amount of output variables), input and output variables are defined in non-monetary terms. Finally the number of formal long-term workers in institutions (other than hospitals) and the number of beds in residential long-term care facilities present input variables, while the number of long-term care recipients in an institution (other than hospitals) presents an output variable. The selection of variables is driven by previous empirical analysis, in detail analysed in the previous section, and confirmed by Tran et al. (2019) as one of the most used when measuring efficiency in nursing homes. OECD provides information on long-term care resources and utilisation in OECD countries, so we used this source to set the data for purpose of this analysis (OECD.stat, 2022). Descriptive statistics for selected input and output variables are shown in table 1.

In order to meet the criteria of the chosen methodology, where the countries with missing data were excluded from the sample, the sample is reduced to twelve OECD countries (Austria, Canada, Estonia, Hungary, Ireland, Israel, Japan, Korea, Luxembourg, Slovak Republic, Switzerland, and Turkey). Justification for this was found in Gavurova et al. (2021), who presented different studies which solved the problem of changing missing data in the same way.

[7] Computer software Frontier Analyst Banxia Software has been used for the analysis.

Table 1

Definition and descriptive statistics of the selected input and output variables, 2014-2019

Variable	Definition (Source: OECD)	Year	Min	Max	Average
Number of beds in residential long-term care facilities	Beds in long-term nursing care facilities and other residential long-term care facilities. Residential long-term care facilities comprise establishments primarily engaged in providing residential long-term care that combines nursing, supervisory or other types of care as required by the residents.	2014	6,580	794,392	134,608.5
		2015	6,894	823,495	139,090.9
		2016	6,858	828,647	145,542.3
		2017	6,965	846,316	148,568.1
		2018	7,058	933,345	157,125.5
		2019	7,139	945,485	160,107.2
Formal LTC workers in institutions (Head counts) - total (nurses and personal carers)	Nurses and personal carers providing LTC services in nursing and residential care facilities dedicated to long-term nursing care. Long-term care institutions herein refer to nursing and residential care facilities which provide accommodation and long-term care as a package.	2014	2,189	469,150	75,153.05
		2015	2,360	478,602	76,931.37
		2016	2,584	480,182	77,946.33
		2017	2,662	488,573	79,468.72
		2018	2,713	533,826	83,400.23
		2019	2,960	544,769	84,871.26
Number of LTC recipients in institutions (other than hospitals) - total, all ages	People receiving formal (paid) long-term care in institutions (other than hospitals). Note: The services received by long-term care recipients can be publicly or privately financed. Inclusion: persons who receive long-term care by paid long-term care providers, including nonprofessionals receiving cash payments under a social programme and recipients of cash benefits such as consumer-choice programmes, care allowances or other social benefits which are granted with the primary goal of supporting individuals with long-term care needs based on an assessment of needs.	2014	4,388	908,400	142,025.3
		2015	4,499	919,100	144,790.2
		2016	4,561	931,900	151,723.7
		2017	4,602	939,900	154,089.8
		2018	5,396	946,900	156,622.8
		2019	5,499	957,200	158,788.4

To examine relative technical efficiency, justification for using Data Envelopment Analysis (DEA), was found in Tran et al. (2019), who mention DEA as one of the most used tools for linear programming. DEA is a comparative approach for identifying performance by considering multiple resources that are used to achieve multiple outputs. According to Gardian and Koić (2012), it identifies the optimal ways of performance compared to other units within the same system, rather than the average. Furthermore, it does not require the specification of the production functional form and it accommodates multiple input and output variables with different units, both presenting its advantages in opposition to the statistical approaches: the deterministic frontier approach (DFA) and stochastic frontier approach (SFA).

However, DEA analysis has a stationary character. Therefore, with the aim to evaluate efficiency over a period of time, a DEA window analysis (WDEA) and the Malmquist productivity index (MI) can be used. (Sun, 2011) Contrary to WDEA, which evaluates the performance of a decision-making unit (DMU) over time by treating it as a different entity in each period, MI allows a comparison of the performance of DMUs from one period to another. Finally, the

MI productivity change measure can be decomposed into two mutually exclusive parts: one measuring the technical efficiency change and the other measuring technological change (Prior, 2006). In order to estimate different parts of efficiency, i.e. with the aim to estimate technological change with the technical efficiency changes, the study uses a Malmquist productivity index.

To examine the total factor productivity change during the time, using MI, specification of the DEA model needs to be done. Namely, types of DEA models can be identified based on the scale and orientation of the model. Based on the scale, the CCR model assumes a constant rate (CRS) of substitution between input and output variables, while the BBC model assumes existing of the economy of scale (Ozcan, 2008). In choosing the appropriate orientation of the model, it needs to be stressed that owners of LTC institutions have influence only on the resources which they use, where their objective is to minimise the existing resources, for the number of provided services (Višić & Kordić, 2021). Hence, the input-oriented model was chosen for this analysis. Furthermore, as the CRS assumption is valid only if the score of scale efficiency (SE, calculated as the ratio of overall technical efficiency (OTE) and pure technical efficiency (PTE)) is equal to one (Ozcan, 2008), OTE and PTE were calculated for 2014. The average overall, technical and scale efficiency for selected OECD countries in 2014 were 68.77%, 86.21%, and 80.8%, respectively. Due to the last stated, the input-oriented BCC model has been selected for this analysis.

As mentioned before, to avoid calculating cross-sectional efficiency values, we evaluate total factor productivity change across years. Specifically, the Malmquist- index is observed using an input-oriented BCC model. Moreover, the total factor productivity measure is decomposed into two components measuring a change in technical efficiency (EFFCH) and a change in technology (TECHCH). In more detail, EFFCH measures change in technical efficiency from one period to another, analysing how the institutional LTC system in different OECD countries has managed to catch up to the best production frontier. On the other hand, TECHCH measures the degree of progress resulted from the changes in the production frontier between two periods. According to those two measures, it is possible to conclude the drivers of changes – whether they are a result of a pure efficiency improvement, technological changes in service delivery due to innovation in the production process, which caused a shift in the efficiency frontier, or they are the mix of both these changes (S´anchez–Ortiz, García-Valderrama, Rodríguez-Cornejo & Monroy, 2021).

Hence, Table 2 shows the Malmquist index efficiency averages for twelve OECD institutional LTC systems for the analysed period 2014-2019. Moreover, Table 2 presents total factor productivity change (TFPCH), with its components: technical efficiency change (EFFCH) and technological change (TECHCH). In doing so, values of the MI and its component greater than 1, equal to 1, or less than 1, indicate progress, no change, or regress during the observed period, respectively.

Table 2

Total factor productivity changes of twelve OECD institutional LTC systems, 2014-2019

Countries	EFFCH	TECHCH	TFPCH
Austria	1.02966	0.9949	1.02454
Canada	1.00784	0.98838	0.99592
Estonia	1	0.9619	0.9619
Hungary	1.00788	1.02782	1.0329
Ireland	1.01	0.98716	0.99692
Israel	1.00386	0.98454	0.98796
Japan	1	0.98746	0.98746
Korea	1	1.0137	1.0137
Luxembourg	1	0.99254	0.99254
Slovak Republic	1	1.05238	1.05238
Switzerland	0.99988	0.99612	0.99552
Turkey	1.063	1.02986	1.08102
Mean	1.010177	1.001397	1.01023

Over the studied period, the total factor productivity change of institutional LTC systems in observed OECD countries is found to be at 1.01023, which indicates an increasing pattern in productivity. The above-mentioned increase in productivity comes from both a technical efficiency increase and an increase in technological change but mainly reflects the catch-up effect. Namely, EFFCH was 1.010177, while TECHCH was recognised at 1.001397. The highest productivity increase occurred in Turkey, where both, an increase in technical efficiency and an increase in technological change have been detected.

Table 3 presents the classification of countries based on the values of the Malmquist index and its components.

Table 3

Profile for OECD countries based on the values of the Malmquist index and its components

	EFFCH and TECHCH regress	EFFCH regress and TECHC progress	EFFCH progress and TECHC regress	EFFCH and TECHCH progress
Productivity progress (TFPCH > 1)	/	/	Austria	Hungary, Korea, Slovak Republic, Turkey
Productivity regress (TFPCH < 1)	Switzerland	/	Canada, Estonia, Ireland, Israel, Japan, Luxembourg	/

The previous table shows that half of the analysed countries experienced productivity regress, mostly because of a decline in technological changes, stressing the lack of innovations.

In continuation, table 4 evidences aggregate mean productivity change of institutional LTC system in OECD countries for each pair of years.

Table 4

Total factor productivity changes over the period 2014-2019

Year	EFFCH		TECHCH		TFPCH	
	Mean	% change	Mean	% change	Mean	% change
2015	1.0055	0.55%	0.9952	-0.48%	1.0002	0.02%
2016	0.9948	-0.52%	1.0189	1.89%	1.0133	1.33%
2017	0.9842	-1.58%	1.0247	2.47%	1.0083	0.83%
2018	1.0538	5.38%	0.9732	-2.68%	1.0219	2.19%
2019	1.0126	1.26%	0.9951	-0.49%	1.0074	0.74%
Mean	1.0102	1.02%	1.0014	0.14%	1.0102	1.02%

The productivity of analysed systems increased by 1.02% on average over the analysed period. This results from an increase in technical and technological changes (1.02% and 0.14%, respectively). The most significant increase was indicated in 2018, driven by an increase in technical efficiency, which presents an improvement in managerial efficiency. Interestingly, the most significant decline in technological change occurred in the same period, but an aforementioned increase in pure technical efficiency positively contributed to the total factor productivity change.

4. CONCLUSION

Even though the LTC system is the focus of many studies, this study, to the authors' best knowledge, belongs to the few that analyse the efficiency of this sector on a country level, especially using the latest available data. In particular, the selection of variables acknowledges the existing issues of increasing demand for LTC accommodation accompanied by the shortage of LTC employees. Namely, LTC sector issues are relevant for both developed and transition countries, especially in the context of the lack of health care/LTC workforce in transition countries and their migrations to rich countries. Additionally, even though this study is directed to one aspect of the LTC sector, the theoretical segment of this paper addresses multiple issues that could be taken into consideration while analysing the efficiency of the respective sector, and in that sense, this paper provides a wider perspective for all LTC sector stakeholders.

Here presented results show an increase in productivity (1.02% on average) and those results are in line with the results of Ozbugday, Tirgil and Kose (2020). However, in contrast to previous research, our results show that the aforementioned increase is accompanied by a modest increase in technological change (0.14% on average), which indicates that innovations (e.g. in the form of implementation of assistive technology etc.) should be used to increase productivity. In other words, while designing a country-specific long-term care strategy, policymakers should consider the population's ageing and increased demand for LTC services. At the same time, the LTC sector is labour-intensive and will continue to deal with shortages in the supply of both formal LTC workers and informal carers. Therefore, policies regarding the LTC sector should include efforts to decrease the demand for formal institutional LTC by providing various possibilities to the elderly to obtain the care they need in their homes via non-institutional formal care. Complimentary activities that decrease costs in this sector should include implementing various technological solutions that help LTC workers save time and enable the elderly to live independently for as long as possible. Along with the suggested activities, additional policymakers' efforts should be directed to design a model of financing the LTC sector, e.g. introducing insurance that both fits the needs of the elderly and is in line with the structure of the LTC system in their country. In short, here presented findings might serve as a valuable additional tool to design and adopt policy recommendations and to form models that will result in a more efficient LTC system.

However, the presented analysis has certain shortcomings, and the main limitations of this study are related to the size of the sample. Namely, due to the missing data problem, the sample includes twelve countries, and it would be beneficial if more countries had been included in the analysis so they could be compared from the macroeconomic perspective as well. Further, data availability on a country level had a significant impact on the selection of used variables in a way that they refer to the most commonly used variables in similar studies. However, if there existed variables reflecting the quality of the LTC service on a country level, it would surely increase the value of the research. Therefore, further research on this subject will be focused on widening the sample and increasing the number of the used variables to provide more detailed information on LTC systems in various countries. Finally, and the most important recommendation for future research, is to examine the two-stage panel DEA to investigate the influence of different factors in their environment or, for example, different types of ownership of LTC institutions, which influence the efficiency scores.

REFERENCES

Ariaans, M., Lindenb, P., Wendtet, C. (2021). "Worlds of long-term care: A typology of OECD countries". Health Policy, Vol. 125, No. 5, pp. 609-617. https://doi.org/10.1016/j.healthpol.2021.02.009

Barsanti S., Bunea, A. M., Colombini, G. (2021). "What Counts in Nursing Homes' Quality and Efficiency? Results From Data Envelopment Analysis in Italy". The Journal of Health Care Organization, Provision, and Financing, Vol. 58, pp. 1-9. https://doi.org/10.1177/00469580211059730

Broese van Groenou, M. I., De Boer, A. (2016). "Providing informal care in a changing society". European Journal of Ageing, Vol. 13, pp. 271-279. https://doi.org/10.1007/s10433-016-0370-7

Chang, D.-S., Yang, F.-C. (2010). "A New Benchmarking Method to Advance the Two-Model DEA Approach: Evidence from a Nursing Home Application". Information Systems and Operational Research, Vol. 48, No. 2, pp. 83-94. https://doi.org/10.3138/infor.48.2.083

Chattopadhyay, S., Ray, S. C. (1996). "Technical, scale, and size efficiency in nursing home care: a nonparametric analysis of Connecticut homes". Health Economics, Vol. 5, No. 4, pp. 363-373. https://doi.org/10.1002/(SICI)1099-1050(199607)5:4<363::AID-HEC217>3.0.CO;2-1

Costa-Font, J. Courbage, C., Swartzet, K. (2015). "Financing long-term care: Ex ante, ex post or both?". Health Economics, Vol. 24, pp. 45-57. https://doi.org/10.1002/hec.3152

Díaz Díaz, B. (2012). "Economic Impact of Ageing and Disabled Population Care Centres in Spain: Valuation for the Region of Cantabria". Revija za socijalnu politiku, Vol. 19, No. 2, pp. 155-174. https://doi.org/10.3935/rsp.v19i2.1052

Garavaglia, G., Lettieri, E., Agasisti, T., Lopez, S. (2010). "Efficiency and quality of care in nursing homes: an Italian case study". Health Care Management Science, Vol. 14, No. 1, pp. 22-35. https://doi.org/10.1007/s10729-010-9139-2

Gardijan, M., Kojić, V. (2012). "DEA-based investment strategy and its application in the Croatian stock market". Croatian Operational Research Review, Vol. 3, No. 1, pp. 203-212.

Gavurova, B., Kocisova, K., Sopko, J. (2021). "Health system efficiency in OECD countries: dynamic network DEA approach". Health Economics Review, Vol. 11, pp. 1-25. https://doi.org/10.1186/s13561-021-00337-9

Hlebec, V., Srakar, A., Majcen, B. (2016). "Care for the Elderly in Slovenia: A Combination of Informal and Formal Care". Revija za socijalnu politiku, Vol. 23, No. 2, pp. 159-179. https://doi.org/10.3935/rsp.v23i2.1317

Kleinsorge, I. K., Karney, D. F. (1992). "Management of nursing homes using data envelopment analysis". Socio-Economic Planning Sciences, Vol. 26, No. 1, pp. 57-71. https://doi.org/10.1016/0038-0121(92)90026-2

Kooreman, P. (1994). "Nursing home care in The Netherlands: a nonparametric efficiency analysis". Journal of Health Economics, Vol. 13, No. 3, pp. 301-316. https://doi.org/10.1016/0167-6296(94)90029-9

Lin, J.-R., Chen, C.-Y., Peng, T.-K. (2017). "Study of the Relevance of the Quality of Care, Operating Efficiency and Inefficient Quality Competition of Senior Care Facilities". International Journal of Environmental Research and Public Health, Vol. 14, pp. 1-18. https://doi.org/10.3390/ijerph14091047

Mali, J. (2019). "Inovacije u dugoročnoj skrbi: slučaj domova za starije osobe u Sloveniji". Revija za socijalnu politiku, Vol. 26, No. 2, pp. 225-225. https://doi.org/10.3935/rsp.v26i2.1584

Mihić, M. M., Todorovic, M. LJ., Obradovic, V. LJ. (2014). "Economic analysis of social services for the elderly in Serbia: Two sides of the same coin". Evaluation and Program Planning, Vol. 45, pp. 9-21. https://doi.org/10.1016/j.evalprogplan.2014.03.004

Luasa, S. N., Dineen, D., Zieba, M. (2018). "Technical and scale efficiency in public and private Irish nursing homes - a bootstrap DEA approach". Health Care Management Science, Vol. 21, pp. 326-347. https://doi.org/10.1007/s10729-016-9389-8

OECD, Ageing and Long-term Care, https://www.oecd.org/els/health-systems/long-term-care.htm [accessed: 10/2/2022]

OECD iLibrary, a), Long-term care spending and unit costs, https://www.oecd-ilibrary.org/sites/3e583d73-en/index.html?itemId=/content/component/3e583d73-en [accessed: 12/4/2022]

OECD iLibrary, b), Who Cares? Attracting and Retaining Care Workers for the Elderly - Executive summary, https://www.oecd-ilibrary.org/sites/92c0ef68-en/index.html?itemId=/content/publication/92c0ef68-en [accessed: 12/4/2022]

OECD.stat, https://stats.oecd.org/index.aspx?queryid=85465 [accessed: 10/2/2022]

Olivares-Tirado, P., Tamiya, N. (2014). "Measuring Efficiency in Special Nursing Homes in Japan: An Application of DEA Analysis". In Olivares-Tirado, P., Tamiya, N., Trends and Factors in Japan's Long-Term Care Insurance System, pp. 81-101. New York, USA: Springer. https://doi.org/10.1007/978-94-007-7875-7_5

Ozbugday, F. C., Tirgil, A., Kose, E. G. (2020). "Efficiency changes in long-term care in OECD countries: A non-parametric Malmquist Index approach". Socio-Economic Planning Sciences, Vol. 70, 10733. https://doi.org/10.1016/j.seps.2019.100733

Ozcan, Y. A. (2008). Health care benchmarking and performance evaluation: An assessment using data envelopment analysis (DEA). New York, USA: Springer. https://doi.org/10.1007/978-0-387-75448-2

Prior, D. (2006). "Efficiency and total quality management in health care organizations: A dynamic frontier approach". Annals of Operations Research, Vol. 145, No. 1, pp. 281-299. https://doi.org/10.1007/s10479-006-0035-6

Sánchez-Ortiz, J., García-Valderrama, T., Rodríguez-Cornejo, V., Monroy, F. C. (2021). "DEA window analysis and Malmquist index to assess efficiency and productivity in the Spanish electricity sector". International Journal of Energy Sector Management, Vol. 15, No. 4, pp. 765-788. https://doi.org/10.1108/IJESM-03-2019-0020

Stals, E., Tsaurkubule, Z., Konstante, R., Alksnis, A. (2020). "Evaluation of the technical efficiency of Latvia's municipal long-term care centres for the elderly". Social Sciences Bulletin, Vol. 2, No. 31, pp. 66-95. https://doi.org/10.9770/szv.2020.2(4)

Sun, C.-C. (2011). "Assessing Taiwan financial holding companies' performance using window analysis and Malmquist productivity index". African Journal of Business Management, Vol. 5, No. 26, pp. 10508-10523. https://doi.org/10.5897/AJBM11.438

Tran, A., Nguyen, K.-H., Gray, L., Comans, T. (2019). "A Systematic Literature Review of Efficiency Measurement in Nursing Homes". International Journal of Environmental Research and Public Health, Vol. 16, No. 12, pp. 1-18. https://doi.org/10.3390/ijerph16122186

Trætteberg, H. D. (2015). "Public, For-Profit, and Nonprofit Welfare Institutions in Norway: Distinctive Goals and Steering Mechanisms or Hybridity in a Dominant State". Voluntas, Vol. 26, pp. 1620-1638. https://doi.org/10.1007/s11266-015-9565-3

UNCTAD Handbook of Statistics 2021 - Population, https://unctad.org/system/files/official-document/tdstat46_FS12_en.pdf [accessed: 10/2/2022]

Veloso, A. S., Vaz, C. B., Alves, J. (2018). "Determinants of Nursing Homes Performance: The Case of Portuguese Santas Casas da Misericordia". Congress of APDIO, the Portuguese Operational Research Society, pp. 393-409. https://doi.org/10.1007/978-3-319-71583-4_26

Višić, J., Kordić, L. (2021). "Patterns of productivity changes in nursing homes by using Malmquist DEA index". Croatian Operational Research Review, Vol. 2, pp. 151-160. https://doi.org/10.17535/crorr.2021.0013

Vrabková, I., Vaňková, I., (2021). "Allocative efficiency of providing long-term social care: evidence from the practice of public and private nursing homes". In: Vaňková, I. (ed.), Proceedings of the 14th International Scientific Conference Public Economics and Administration 2021. Ostrava: VSB - Technical University of Ostrava.

Wichmann, A. B, Adang, E. M. M., Vissers, K. C. P., Szczerbińska, K., Kylänen M., Payne, S. (2018). "Technical-efficiency analysis of end-of-life care in long-term care facilities within Europe: A cross-sectional study of deceased residents in 6 EU countries". PLOS ONE, Vol. 13, No. 9, pp. 1-12. https://doi.org/10.1371/journal.pone.0204120; https://doi.org/10.1371/journal.pone.0208199

Wu, K.-F., Hu, J.-L., Chiou, H. (2021). "Degrees of Shortage and Uncovered Ratios for Long-Term Care in Taiwan's Regions: Evidence from Dynamic DEA". International Journal of Environmental Research and Public Health, Vol. 18, No. 2, pp. 1-17. https://doi.org/10.1080/09603123.2021.2017862

Zhang, L., Zeng, Y., Fang, Y. (2019). "Evaluating the technical efficiency of care among long-term care facilities in Xiamen, China: based on data envelopment analysis and Tobit model". BMC Public Health, Vol. 19, No. 1230, pp. 1-9. https://doi.org/10.1186/s12889-019-7571-x

Dr. sc. Lana Kordić
Izvanredna profesorica
Sveučilište u Splitu
Ekonomski fakultet
E-mail: lana.kordic@efst.hr
Orcid: https://orcid.org/0000-0001-5398-4152

Dr. sc. Josipa Višić
Izvanredna profesorica
Sveučilište u Splitu
Ekonomski fakultet
E-mail: josipa.visic@efst.hr
Orcid: https://orcid.org/ 0000-0002-2536-8317

PROMJENA RELATIVNE EFIKASNOSTI SUSTAVA DUGOTRAJNE SKRBI U ODABRANIM ZEMLJAMA OECD-A

Sažetak

Starenje stanovništva ima različite društvene i ekonomske posljedice, a sve veća potražnja za dugotrajnom skrbi za starije osobe jedna je od njih. U tom je smislu cilj ovog rada istražiti promjenu relativne efikasnosti sustava dugotrajne skrbi za stanovništvo u dobi od 65 i više godina, u razdoblju 2014. – 2019., kako bi se otkrile potencijalne razlike između dvanaest zemalja OECD-a. Pritom se koristi Malmquist – AOMP indeks produktivnosti, uz pretpostavku varijabilnih prinosa (BCC model) i korištenjem AOMP modela orijentiranog na minimiziranje ulaznih varijabli. Odabrane ulazne varijable uključuju broj radnika i broj kreveta u rezidencijalnim ustanovama za dugotrajnu skrb. Kao izlazna varijabla koristi se broj korisnika dugotrajne skrbi. Dobiveni rezultati pokazuju da su promatrane zemlje OECD-a u analiziranom razdoblju povećale relativnu efikasnost za 1,023%, uglavnom zbog povećanja tehničke efikasnosti (1,018%), uslijed veće menadžerske efikasnosti. Najveće povećanje produktivnosti dogodilo se u Turskoj, gdje je otkriveno i povećanje tehničke efikasnosti i uvođenje tehnoloških promjena. Nadalje, produktivnost je u prosjeku porasla za 1,02% tijekom analiziranog razdoblja zbog povećanja tehničke efikasnosti koja odražava pozitivan pomak neefikasnih sustava bliže relativnoj granici efikasnosti, ali uz skromno uvođenje pozitivnih tehnoloških promjena, što ukazuje na nedostatak inovacija.

Ključne riječi: dugotrajna skrb, zemlje OECD-a, AOMP model, Malmquist indeks, panel podaci.

JEL klasifikacija: I10, J14, D24.