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In a Search for Contemporary Growth Drivers: Does Public Healthcare Entrepreneurship Affect Economic Growth?

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ABSTRACT

Entrepreneurship has been long recognized as an essential driver of economic growth. It is widely accepted that entrepreneurship increases innovation, firm formation, employment, and overall GDP. Despite the increasing research on both public entrepreneurship and entrepreneurship in healthcare, these different research areas have not been combined that much. To fill this research gap, this paper analyses whether public healthcare entrepreneurship influences economic growth. This study exploits the WHO Global Health Observatory database approximating various dimensions of entrepreneurship by specific aspects of compliance with international healthcare regulation. The study uses data for 170 countries from 2010 to 2019. Using the fixed effect panel setting, it tests whether improvements in public healthcare entrepreneurship (PHE) affect a country's economic growth. The results suggest that higher entrepreneurial orientation in public healthcare is associated with larger effects on output per capita, which is channelled through productivity. However, after reaching certain level of PHE development, the contributions to growth start diminishing. The findings from this paper produce several implications. First, by exploring the nexus between public entrepreneurship and healthcare entrepreneurship it introduces the concept of public healthcare entrepreneurship explaining its theoretical and empirical importance. It further provides empirical and quantitative support to the view that developing public healthcare entrepreneurship plays a role in achieving a higher output per effective worker. Thereby, this study provides evidence of a non-linear relationship between public healthcare entrepreneurship and growth. Finally, given the statistical and economic significance of the results, these findings motivate policymakers to consider developing policies that guide developing entrepreneurial orientation within public healthcare. We believe this is possibly the first study that considers entrepreneurial orientation withing a public sector into the economic growth discussion.

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1. Introduction

Since the outbreak of Covid-19 in 2020, the world has entered a period of economic slowdown, or even downturn. The last three years were mainly characterized by lower growth across all the countries worldwide, and given the current geopolitical situation, the growth forecasts are unsurprisingly utterly pessimistic. This calls for revisiting growth models in a search for new drivers. In this light, this paper seeks to answer *whether entrepreneurial orientation in the public healthcare sector affects economic growth.*

The baseline specification of this paper assumes the Cobb-Douglas production function, with the output being a function of capital, effective labour, and labour-augmenting total factor productivity (TFP). Furthermore, it assumes that public healthcare entrepreneurship (PHE) is productivity augmenting. The intuition behind this is that PHE possibly increases the efficiency and effectiveness of workers. To answer the research question, we estimate the main model using the core specification, which we further extend by analysing different dimensions of PHE. The empirical analysis relies on several datasets combined. We use WHO International Health Regulation (IHR) data for constructing proxies for entrepreneurial dimensions within a public healthcare sector. Furthermore, we use Penn World Tables 10.01 for the main economic variables. Merging various datasets comes at the price of sample shrinking, leaving us with data for 170 countries over ten years (from 2010 to 2019).

While there is lacking literature on public healthcare entrepreneurship and its impact on economic growth, there is a plethora of evidence on the effects of external entrepreneurship on the macro level and plentiful evidence of the micro effects of intrapreneurship. However, the studies of the macro effects of intrapreneurship are still deficient. In its attempt to fill this gap in the existing literature, this study bridges the several research streams by introducing the notion of healthcare entrepreneurship within a public healthcare sector into the economic growth context.

The main objective of this paper is to test whether there exists a relationship between public healthcare entrepreneurship as the independent variable, and economic growth as dependent variable. Further objective of this paper is to provide theoretical explanations of the role of the public healthcare entrepreneurship in achieving higher economic growth. Finally, the paper offers policy recommendations for ministries of health and public healthcare institutions regarding how to guide development of entrepreneurial orientation in public healthcare to contribute to economic growth on a national level. With these aims, the main research question of this paper asks whether developing public healthcare entrepreneurship contributes a country's economic growth measured by output per effective worker. The empirical method used for hypotheses testing is the panel difference-in-difference analysis. The results of this paper feed the existing studies on the importance of developing public healthcare in increasing human capital (Bassanini & Scarpetta, 2002). Furthermore, it produces several theoretical and practical contributions. First, the study opens a new chapter in studying entrepreneurship in a growth context, focusing on PHE. So far, studies found that healthcare entrepreneurship positively affects the performance of institution apply it, though focusing on private sector. Moreover, studies showed that public entrepreneurship produces positive effects in terms of better provision of public goods and services. Lastly, there is plentiful evidence that entrepreneurship more broadly affects growth. Yet, we are not aware of papers that studied entrepreneurial orientation within a public healthcare sector, particularly from an economic growth perspective. With this approach, we offer one possible answer to the long-standing question of 'what explains the growth differences' across countries. Moreover, this study offers an empirical quantitative analysis of PHE. As other scholars point out, empirical studies on public entrepreneurship and healthcare entrepreneurship are both lacking. This paper complements the Rastoka et al. (2022) study, which is possibly the first empirical study of the use of international health regulation in studying the macro-outcomes of a country. However, this study connects IHR to a broader context of economic growth, offering a plausible explanation of why countries should care about complying with the IHR. Finally, this paper finds evidence for relationship between PHE and economic growth being at least quadratic, but more likely cubic or of a higher order. This builds on the existing studies that find evidence for the inverted U-shaped relationship between entrepreneurship and

economic growth and development. However, those studies were primarily concerned with entrepreneurship in terms of job creation and firm formation. Given the complexity of PHE, we believe our findings are likely resembling the actual relationship between the PHE and economic growth.

The first part of this study gives a literature review along with hypothesis development. It proceeds with describing the data used, the main sample, and the empirical strategy. The next part shows the main results, followed by discussion of the main results. The paper concludes with wrapping up main findings and outlining the theoretical and practical implications.

2. Literature Review and Hypothesis Development

2.1. Entrepreneurship and Growth

Entrepreneurial abilities are cited as an equal factor of production, along with land, labour, and capital (Slavin, 1996). The importance of entrepreneurship for a country's economic growth is reflected in the fact that the level of the population's entrepreneurial abilities could directly affect and shift the aggregate supply curve (McConnell & Brue, 1996). The significance of entrepreneurship from a growth perspective is widely accepted (Carree & Thurik, 2010; Van Stel, 2006; Ács &Audretsch, 2003). Entrepreneurs innovate, create, employ (Cheng et al., 2009; Ács & Armington, 2006; Baumol, 2002), and help reduce poverty (Ahmad & Hoffman, 2008). Entrepreneurship is seen as a scarce and invaluable resource (Kirzner, 2009), determining economic outcomes along with capital and labour in physical form (Dhliwayo, 2017; Douhan & Henrekson, 2007). Moreover, entrepreneurship is deemed a key factor (Ghani et al., 2014) and an engine of growth (Lafontaine et al., 1998). It determines national competitive advantage (Carree & Thurik, 2010), whereas differences in entrepreneurial capital explain significant growth differences across the countries (Audretsch & Keilbach, 2004; Ács & Audretsch, 2003). The literature recognizes entrepreneurship as a solution to stagnation and recession (Kropp & Zolin, 2008; Hansen &Sebora, 2003). Yet, countries facing these macroeconomic issues are not the only ones that benefit from entrepreneurship. Namely, developed economies that have transitioned from managerial to entrepreneurial economies reap the most benefits from entrepreneurship (Audretsch & Thurik, 2001; Carree &Thurik, 1999). Despite the abundance of research on the significance of entrepreneurship for growth, most papers only qualitatively describe channels through which entrepreneurship bolsters growth without offering empirical and quantitative evidence (Lee, 2016). There is increasing evidence that relationship between entrepreneurship (in terms of self-employment) and economic outcomes in non-linear, that is likely U-shaped (Wennekers et el., 2010; Ács &Sanders, 2012; Ács, 2006). Some recent quantitative studies of entrepreneurship (in terms of new firms' formation) actually showed no statistically significant relationship between total entrepreneurship and aggregate economic growth, though they find statistically significant and positive relationship between certain types of entrepreneurship and the industry level growth (Kim et al., 2022).

2.2. Intrapreneurship and Public Sector Entrepreneurship

Many scholars argue the state being responsible for encouraging entrepreneurship. In that light, Stiglitz (2012) discusses the state's role through fiscal expenditures, regulatory, and tax policy. Though not particularly emphasized, most of these studies (Faggian et al., 2017; Urbano & Aparicio, 2016; Ács, 2006) consider external, that is, small business entrepreneurship. Entrepreneurship is commonly associated with creating new firms that generate profits (Zerbinati & Souitaris, 2005). Notwithstanding, it manifests in different ways. There are three widely recognized types of entrepreneurship: (i) individual or external, (ii) organizational or internal (so-called intrapreneurship), and (iii) macro entrepreneurship (Lages et al., 2017, Solesvik, 2013; Kuratko, 2010). Traditionally, intrapreneurship was considered paradoxical, arguing that entrepreneurship and corporate bureaucracy are mutually exclusive (Duncan et al., 1988). However, studies testing entrepreneurial values within large organizations proved the opposite (Cullen et al., 2018; Covin &Miller, 2014; Kuratko et al., 2014). However, a main caveat of this early re-

search on intrapreneurship is they primarily studied various organizational characteristics, leaving it rather vague whether the variables observed were entrepreneurship or business performance characteristics (Cullen et al., 2018).

Generally, intrapreneurship represents activities taken to create new or transform the existing institutions, supporting creation of innovative products and processes (Vargas-Halabí et al., 2017). The aim of intrapreneurship is usually adding value to citizens and increasing the quality of life (Klein et al., 2010; Kearney et al., 2008; Bernier & Hafsi, 2007), supporting and empowering individuals and firms in seizing opportunities (Smallbone, 2008; Legge & Hindle, 2004), or transforming the role of the state by making it more agile and entrepreneurially oriented (Leyden & Link, 2015). Three different streams of studying intrapreneurship emerged (Antončič and Hisrich, 2003). The first focuses on individual intrapreneurs, emphasizing their individual characteristics (Kuratko et al., 1990; Pinchott, 1985). The second field studies new business venture creation and their fitting into the existing organizational structure (Krueger & Brazeal, 1994; Burgelman, 1985). Finally, the third field focuses on entrepreneurial orientations, stressing the characteristics of organizations in which they are represented (Kuratko et al., 1990; Rule and Irwin, 1988).

A series of research on public entrepreneurship emerged in the late twentieth century (Bernier & Hafsi, 2007; Morris & Jones, 1999), with interest in this topic continuing to grow until today (Lindholst, 2019; Leyden & Link, 2015). Recent studies argue that public sector entrepreneurship improves provision of public services (Andrews et al., 2020). The growing interest in this topic possibly came as a response to governments worldwide complaining about the lack of entrepreneurial orientation in the public sector (Özcan & Reichstein, 2009; Zerbinati &Souitaris, 2005). One of the most prominent scholars researching this topic was Elinor Ostrom (Ostrom: 2005; 1990; 1965), who produced a series of research emphasizing the importance of entrepreneurship in the public sector in the context of creating economically more efficient outcomes. In general, the existing literature finds that public sector entrepreneurship contributes to developing public goods infrastructure, including the healthcare infrastructure (Mazzucato, 2018). Public sector entrepreneur is focused on providing alternatives to the *status quo* (Dhliwayo, 2017) by initiating and supporting the establishment of new public enterprises (Iyengar et al., 2016; Klein et al., 2010; Morris & Jones, 1999) or changing the existing or creating new policies (Schnellenbach, 2007). Despite prolific research on intrapreneurship and public sector entrepreneurship (Lages et al., 2017; Kearney et al., 2008; Teng, 2007), the existing studies are mainly theoretical and lacking empirical support of their core arguments.

2.3. Healthcare Entrepreneurship

A healthy population and sound labour are vital for economic growth and social order (Garrett, 2005; Osterholm, 2005), as they contribute to a higher national income and increase in the standard of living (Bloom et al., 2004). Numerous studies emphasize the importance of the health sector for economic growth (Alsahahrani & Alsadiq, 2014; Smith et al., 2009), with some of them particularly emphasizing public healthcare (Reeves et al., 2014; De Costa and Diwan, 2007). International organizations emphasize the connectedness of public healthcare and economic growth, arguing that the public sector is critical in increasing human capital (Bassanini & Scarpetta, 2002). Furthermore, a rich body of literature (Gupta & Barman, 2010; Agénor, 2008) recognizes the importance of government spending on healthcare services and public infrastructure to increase labour productivity and economic growth. The importance of public healthcare comes from the nature of healthcare services that share characteristics of public goods. The danger of the spread of diseases goes beyond the immediate health issues of a person affected, as after becoming prevalent, diseases become a national security problem and a potential source of political instability (Garrett, 2005; Osterholm, 2005).

Research on healthcare entrepreneurship (Amini et al., 2018; Hinz & Ingerfurth, 2013) is aimed at finding solutions to increase the healthcare performance. Healthcare entrepreneurship is an orientation to improving the health and decreasing the population's dis-

ease susceptibility (Torri, 2014). It is argued that healthcare entrepreneurship produces largest effects on economic growth through innovation. The significance of innovation is nowhere more critical than in healthcare (Piña et al., 2015), given that revolutionary discoveries can not only cure diseases but also significantly improve and extend human lives (Trigo, 2016). Entrepreneurially driven innovation in healthcare assumes creating innovative interventions, products, and services to help solve health issues (Hatef et al., 2018; Jacobson et al., 2015). Some more recent studies show that entrepreneurship in general, is a key in solving healthcare emergencies such as the recent Covid-19 pandemic (Liu et al., 2020).

2.4. Hypothesis development

This paper studies the nexus between a couple of widely discussed yet not combined research areas. These are the role of external entrepreneurship in economic growth, the effects of public entrepreneurship in economic growth, and the role of PHE. In its endeavours to test the role of PHE in economic growth, this study builds upon extensions of some of the earliest and most widely used neoclassical growth models, such as Solow-Swan (Swan, 1956; Solow, 1956). Some pioneering extensions to these models considered various endogenous variables corresponding to what we regard as entrepreneurship today. Thus, Lucas (1988) distinguishes between physical and human capital without using the term entrepreneurship. Romer (1990; 1986) endogenizes technological change (ideas creation) entrepreneurship. These seminal papers were followed by a series of papers (Valdés, 1999; Aghion & Howitt, 1992; Grossman & Helpman, 1991) studying the growth model with endogenous R&D, thereby making a sort of introduction to entrepreneurship in growth models. A stream of research that followed (Friis et al., 2004) suggested causation between entrepreneurship and growth.

Nevertheless, there is still a lack of studies of entrepreneurship within the public sector as a possible growth driver. Recent studies particularly emphasize the lack of measurement for public entrepreneurship (Demircioglu & Chowdhury, 2021), which could possibly explain the lack of empirical studies on this topic. The idea of public entrepreneurship seems rather vague given the inconsistency in determining entrepreneurship in the public sector. From a methodological aspect, most recent studies of public entrepreneurship (Głoìd, 2015; Jacobson et al., 2015) do not clearly distinguish managerial and organizational from entrepreneurial variables. Moreover, these studies mainly rely on qualitative discussion, thereby translating managerial and organizational variables to entrepreneurial ones. Predominantly, these studies use qualitative arguing to explain the positive correlation and causality between entrepreneurial practices in public healthcare and overall public healthcare performance. Another caveat is they mainly focus on the micro rather than macro effects of PHE. Finally, the existing studies do not discern entrepreneurial behaviour in the public healthcare sector from entrepreneurial behaviour in private healthcare institutions. Overall, there is a lack of research on applying entrepreneurship in the complex environment of the healthcare sector (Guo, 2003).

To answer the research question, the main hypothesis of this paper postulates that *developing entrepreneurial orientation in the public healthcare sector contributes to a country's economic growth.*

When defining entrepreneurial orientation in public healthcare, we rely upon well-established practices in studying entrepreneurial orientation. The most widely used entrepreneurial concept (Lages et al., 2017; Slevin &Terjesen, 2011; Covin & Slevin, 1989) is the so-called Miller approach (Miller, 1987; 1983). This approach considers innovativeness (predisposition to develop new and unique products, services, and processes), risk-taking (willingness to take advantage of risky opportunities), and proactiveness (persistence and creativity to overcome difficulties until the innovation is fully implemented) as core dimensions of entrepreneurial orientation. Other streams of research consider various additional orientations. Some of the commonly used are autonomy and competitive aggressiveness (Hughes & Morgan, 2007; Lumpkin & Dess, 1996). Notwithstanding, this paper adopts the Miller approach and proceeds with observing PHE through the prism of innovativeness, proactivity, and risk-taking.

Innovation is usually considered the primary driver of healthcare transformation to respond to the constantly growing demand for improved patient care (Piron, 2017). Healthcare innovation bridges social and economic aspects through increasing health and social interaction (Beaulieu et al., 2018; Silva et al., 2018), laying the ground for higher economic growth (Sakellarides, 2008). *Proactivity* is often crucial to realizing innovation (Antončič & Hisrich, 2003). Proactivity is particularly important in healthcare because health demand requires urgent and swift action. It is worthwhile mentioning that the opposite of proactivity is passiveness (Lumpkin & Dess, 1996). Hence, proactivity in healthcare is paramount, given that delays and passiveness might result in excessive deepening and broadening of the issues. *Risk-taking* in entrepreneurship refers to taking bold actions and setting resources to prevent losses (Lumpkin & Dess, 1997; Covin & Slevin, 1989). Healthcare is inseparable from risk. Every action inevitably carries the risk of possible loss. However, failing to take any action might trigger even more significant losses. This is undoubtedly one of the impediments to entrepreneurial orientation in healthcare when the actors are faced with choosing the lesser of two evils.

3. Empirical Analysis

3.1. Sample

Regardless of rich metrics developed for measuring entrepreneurship (see discussion in Rastoka et al., 2022), there is no data available for intrapreneurship on a country level, particularly entrepreneurship within public healthcare. More precisely, the only data available regarding the performance of public healthcare is the data provided by the WHO. Thus, this study exploits WHO's Global Health Observatory database, particularly various indices of International Healthcare Regulation as proxies for multiple dimensions of PHE. We merged this data with the Penn World Database to create the main dataset for this study. The WHO's International Health Regulation (IHR) database is only available from 2010 while reporting for 2020 was affected by Covid-19. We decide to restrict the sample to years absent of shocks focusing on years 2010 to 2019. Matching various datasets comes at the price of missing data. We drop missing data to achieve a balanced panel. This leaves us with 170 countries over ten years (from 2010 to 2019), which we refer to as the full sample.

3.2. Model Specification and Variable Definition

This paper uses the standard neoclassical growth model with Cobb-Douglas production function as a baseline economic model. It follows the main growth decomposition used in seminal studies that tried to explain the difference in growth across countries such as the widely cited Jones (2016) and Hall and Jones (1999). Recent relevant studies on total factor productivity follow the same neoclassical growth model. Thus, in this paper we take productivity as labour augmenting, whereas the labour is a product of physical labour and human capital (in line with the Hall and Jones 1999 approach). This suggests the following growth equation:

$$Y_{it} = K_{it}^{\alpha}(A_{it}H_{it})^{1-\alpha} \quad [1]$$

Where *Y* represents the aggregate output, *K* total capital, *A* productivity, and *H* total human capital (which is a product of total labour and human capital per unit of labour). Subscript *it* indicates country *i,* in time period t. After performing basic mathematical operations[2], our baseline economic model becomes:

$$\ln\_y_{it} = \frac{\alpha}{1-\alpha}\ln\_k_{it} + \ln\_hc_{it} + \ln\_A_{it} \quad [2]$$

Where *y* stands for the gross domestic product (GDP) per effective worker, the index *it* indicates the country *i* (taking values from 1 to 170, depending on the country observed) in period *t* (taking values from 2010 to 2019), *k* represents effective capital stock (i.e. capital stock per unit of output), is the standardly used capital share in the Cobb-Douglas production function taking the value 1/3, *hc* stands for average human capital, while *A* reflects the growth residual, i.e. total factor productivity (TFP) defined as difference in productiv-

[2] $Y_{it} = K_{it}^{\alpha}(A_{it}H_{it})^{1-\alpha} = K_{it}^{\alpha}(A_{it}N_{it}h_{it})^{1-\alpha}$
$Y_{it}^{\frac{1}{1-\alpha}} = K_{it}^{\frac{\alpha}{1-\alpha}}A_{it}N_{it}h_{it}$
$Y_{it} = (\frac{K_{it}}{Y_{it}})^{\frac{\alpha}{1-\alpha}}A_{it}N_{it}h_{it}$
$\frac{Y_{it}}{N_{it}} = (\frac{K_{it}}{Y_{it}})^{\frac{\alpha}{1-\alpha}}A_t h_{it}$

ity from a country observed relative to the US[3] For a detailed explanation of human capital and total factor productivity variables please refer to Penn World Tables.

This rearrangement allows us to solve the multicollinearity. We furthermore include both country and year fixed effect when running the regressions. The main contribution from this paper is applying this widely used growth equation to a different subsample of countries, depending on their level of PHE development. Hence, our main specification is as follows:

$$\ln\_gdp_{it} = \beta_0 + \beta_1 \ln\_capital_{it} + \beta_2 \ln\_hc_{it} + \beta_3 \ln\_tfp_{it} + \epsilon_{it} \quad [3]$$

Where *gdp* stands for the gross domestic product (GDP) per effective worker, the index *it* indicates the country i in period t (taking values from 2010 to 2019), k represents effective capital stock (i.e. capital stock per unite of output adjusted by relative share of capital to share to labour), *hc* is human capital, and *tfp* is the total factor productivity (TFP). Finally, ϵ is the error term.

To test our hypothesis, we run the regression [3] on five different subsamples, depending on their level of PHE development. This allows us to compare the parameters from [3] while fixing the level of PHE development. Effectively, we will pairwise test three parameters obtained from each of the five regressions (according to five levels of PHE development we distinguish). The alternative technically feasible approach could be creating joint variables for each of the factors and level of PHE development. However, this could rise certain concerns on economics side. In trying to be more pedantic and to comply with general conventions with performing growth regressions, we decide to run the regression on multiple subsamples in the first step, and then in second step we perform pairwise test of difference in parameters. With this approach, we provide more extensive analysis of how the changes in PHE level are reflected on TFP parameters and hence the output per effective worker. In further steps, we expand our analysis by focusing on each of the individual dimensions of PHE, namely innovativeness, proactivity and risk-taking. In each of our specifications, we divide the countries depending on their total level of PHE development, or alternatively, the level of development of individual dimensions.

The raw data we use for creating PHE variables are ordered indices ranging from 0 to 100. We follow Rastoka et al. (2022) approach in identifying approximations for innovativeness, proactivity, and risk-taking. We also follow their approach in aggregating and averaging over the individual PHE dimensions to create a composite index of PHE development ranging from 0 to 100. We account for distribution of our available data and define the following relative levels of PHE development:

- Low (composite or individual index less or equal to 60)
- Low-Moderate (composite or individual index larger than 60 and less or equal to 70)
- Moderate (composite or individual index larger than 70 and less or equal to 80)
- High-Moderate (composite or individual index larger than 80 and less or equal to 90)
- High (composite or individual index larger than 90)

Here, we appreciate for the first possible caveat, that is setting the upper bound for our lowest-order category rather high. However, we are limited to the available data where there are not many observations distributed in lower bound of the index ladder. This way, as we want to interpret relative level of PHE development (relative to other countries), our boundaries had to be defined in such way. Notwithstanding, we keep in mind that having observations with larger dispersion of PHE development could provide much more information on what is going on as a country is 'climbing' from the bottom of PHE development ladder. Yet, until the new datasets become available, that is unfortunately unfeasible. Table 1 below shows the summary statistics for variables used in our main specification [3].

[3] For a detailed discussion on selection of indices for approximations of various entrepreneurial dimensions, please see Rastoka et al., 2022.

Table 1

Variable description and summary statistics for full sample

Variables	Variable description	Mean (Std. Dev.)	Source
ln_gdp	Natural logarithm of real GDP at constant 2017 national prices (in mil. 2017US$) per effective worker	10.211 (1.084)	PWT 10.01 (multiple variables combined)
ln_capital	Natural logarithm of capital stock at constant 2017 national prices (in mil. 2017US$) per output unit scaled by 1-α	0.641 (0.244)	PWT 10.01 (multiple variables combined)
ln_hc	Natural logarithm of human capital index	0.915 (0.293)	PWT 10.0
ln_tfp	Natural logarithm of total factor productivity (TFP) level at constant national prices (2017=1)	-0.0004 (0.085)	PWT 10.01

Notes. Author calculation.

When observing entrepreneurial dimensions, we follow literature studying entrepreneurship (Yoo, 2015; George & Marino, 2011; Wiklund & Shepherd, 2005; Lumpkin & Dess, 2001). We furthermore follow Rastoka et al. (2022) and use various indices of public healthcare performance as approximations for entrepreneurial dimensions. Hence, we approximate innovativeness, proactivity, and risk-taking with different IHR scores (laboratory, surveillance, risk communication, respectively)[4] For a detailed discussion on selection of indices for approximations of various entrepreneurial dimensions, please see Rastoka et al., 2022.

. Most empirical studies on entrepreneurship rely on questionnaires and interviews based on self-evaluation (Dempster & Kluver, 2019; Jacobson et al., 2015). One of the main downsides of collecting data on entrepreneurship in this manner is that people need not be educated about entrepreneurship to be entrepreneurially oriented. Hence, the misreporting is likely to happen due to ignorance (Lages et al., 2017). Finally, some authors mention that the drawback of interviews and questionnaires in studying healthcare is they focus on what is easily measurable regardless of fully reflecting the subject of measurement (Barzilay et al., 2018). Thus, aware of the caveat of using approximations such as IHR scores, we think the challenges outweigh the possibility of measurement errors imminent to alternative approaches to data collection in this field. In quantifying the PHE, we follow Rastoka et al. (2022) with the difference of using dummy variables for different levels of PHE development instead of scores. Table 2 below gives summary statistics for categorical variables we used for breaking down the sample into the subsamples to test difference in effects of PHE.

Table 2

Variable description and summary statistics for categorical variables used for breaking down the sample into the subsamples

Variables/ Subsample categories	Variable description	Mean (Std. Dev.)	Source
PHE-Low	DV=1 if a country has a low level of PHE development (0 otherwise); it takes value 1 when the composite index of PHE is less than or equal to 60	0.214 (0.410)	IHR (multiple variables combined and dummy encoded)
PHE-Low-Mod	DV=1 if a country has a lower moderate level of PHE development (0 otherwise); it takes value 1 when the composite index of PHE is higher than 60 and less than or equal to 70	0.133 (0.339)	IHR (multiple variables combined and dummy ecoded)

[4] For a detailed discussion on selection of indices for approximations of various entrepreneurial dimensions, please see Rastoka et al., 2022.

PHE-Mod	DV=1 if a country has a moderate level of PHE development (0 otherwise); it takes value 1 when the composite index of PHE is higher than 70 and less than or equal to 80	0.170 (0.376)	IHR (multiple variables combined and dummy encoded)
PHE-High-Mod	DV=1 if a country has a higher moderate level of PHE development (0 otherwise); it takes value 1 when the composite index of PHE is higher than 80 and less than or equal to 90	0.195 (0.396)	IHR (multiple variables combined and dummy encoded)
PHE-High	DV=1 if a country has a high level of PHE development (0 otherwise); it takes value 1 when the composite index of PHE is higher than 90	0.288 (0.453)	IHR (multiple variables combined and dummy encoded)
Inno-Low	DV=1 if a country has a low level of innovativeness within their public healthcare (0 otherwise); it takes value 1 when the innovativeness index is less than or equal to 60	0.242 (0.428)	IHR (laboratory index as in Rastoka et al., 2022 and dummy encoded)
Inno-Low-Mod	DV=1 if a country has a lower moderate level of innovativeness within their public healthcare (0 otherwise); it takes value 1 when the innovativeness index is higher than 60 and less than or equal to 70	0.093 (0.291)	IHR (laboratory index as in Rastoka et al., 2022 and dummy encoded)
Inno-Mod	DV=1 if a country has a moderate level of innovativeness within their public healthcare (0 otherwise); it takes value 1 when the innovativeness index is higher than 70 and less than or equal to 80	0.145 (0.353)	IHR (laboratory index as in Rastoka et al., 2022 and dummy encoded)
Inno-High-Mod	DV=1 if a country has a higher moderate level of innovativeness within their public healthcare (0 otherwise); it takes value 1 when the innovativeness index is higher than 80 and less than or equal to 90	0.151 (0.358)	IHR (laboratory index as in Rastoka et al., 2022 and dummy encoded)
Inno-High	DV=1 if a country has a high level of innovativeness within their public healthcare (0 otherwise); it takes value 1 when the innovativeness index is higher than 90	0.369 (0.483)	IHR (laboratory index as in Rastoka et al., 2022 and dummy encoded)
Proa-Low	DV=1 if a country has a low level of proactivity within their public healthcare (0 otherwise); it takes value 1 when the proactivity index is less than or equal to 60	0.192 (0.394)	IHR (surveillance index as in Rastoka et al., 2022 and dummy encoded)
Proa -Low-Mod	DV=1 if a country has a lower moderate level of proactivity within their public healthcare (0 otherwise); it takes value 1 when the proactivity index is higher than 60 and less than or equal to 70	0.104 (0.305)	IHR (surveillance index as in Rastoka et al., 2022 and dummy encoded)
Proa -Mod	DV=1 if a country has a moderate level of proactivity within their public healthcare (0 otherwise); it takes value 1 when the proactivity index is higher than 70 and less than or equal to 80	0.194 (0.395)	IHR (surveillance index as in Rastoka et al., 2022 and dummy encoded)
Proa -High-Mod	DV=1 if a country has a higher moderate level of proactivity within their public healthcare (0 otherwise); it takes value 1 when the proactivity index is higher than 80 and less than or equal to 90	0.188 (0.391)	IHR (surveillance index as in Rastoka et al., 2022 and dummy encoded)
Proa -High	DV=1 if a country has a high level of proactivity within their public healthcare (0 otherwise); it takes value 1 when the proactivity index is higher than 90	0.322 (0.468)	IHR (surveillance index as in Rastoka et al., 2022 and dummy encoded)
Risk-Low	DV=1 if a country has a low level of risk-taking within their public healthcare (0 otherwise); it takes value 1 when the risk-taking index is less than or equal to 60	0.399 (0.490)	IHR (risk-communication index as in Rastoka et al., 2022 and dummy encoded)

Notes. Author calculation.

In each of the specifications used, we employ the year-fixed effect (along with country-fixed effect). We use Pearson's correlation coefficients to test the main dataset for multicollinearity. As Table 3. shows, the correlation coefficients are low to weak (Akoglu, 2018), suggesting absence of multicollinearity.

Table 3

Matrix of correlations

Variables	(1)	(2)	(3)
(1) *ln_capital*		1.000	
(2) *ln_hc*	0.366	1.000	
(3) *ln_tfp*	-0.17 6	-0.06 1	1.00 0

Notes. Author calculation.

3.3. Methodology

Following relevant studies (Leszczensky & Wolbring, 2018; Vaisey & Miles, 2017), we use panel data setting, more precisely, difference-in-difference specification. We used a fixed effect estimator, given its main advantage of the ability to control for systemic differences across clusters. Fixed effect estimator acts as a quasi-experiment, allowing us to observe the actual effects free from noise (Ghani et al., 2014; Fritsch & Falck, 2007). The advantage of the panel data fixed effect method is dealing with endogeneity issues by extracting the correlatedness between the variable of interest and part of the residual. This way, the fixed effect observes the error term as a composition of the idiosyncratic and time-invariant part (Card, 1999).

We acknowledge the well-known issues from dynamic panels with fixed effects, especially given the relatively short period our data covers. To mitigate the potential problems, we follow other studies that used economic growth as dependent variable (Besley et al., 2005) and use clustered standard errors. As suggested by econometrics literature (Angrist & Pischke, 2009), using standard errors clustering at country level allows us dealing with possible correlation in modelling residuals. This way the standard errors are robust against autocorrelation and heteroskedasticity (they allow for autocorrelated errors and heteroskedasticity within an entity, but not correlation across entities what makes them consistent).

4. Empirical Results

Table 4 shows results for our main specification. Column (0) is a baseline growth regression where we impose no assumptions regarding the level of PHE development. As expected, the effect of all factors of production on output per effective worker is statistically significant and positive. High value of R-squared is implied by the construction of PWT data, which calculates TFP as a growth residual.

Columns (1) through (5) show the results for our main conjecture, i.e. the output growth *inter alia* depends on the PHE level. To test our main hypothesis, we test the statistical significance of differences between TFP coefficients across each of the specifications from column (1) through (5). We appreciate that a country's PHE development does not necessarily follow a continuous path. That is, a country can possibly switch from one to any category, and not just to the immediately next or immediately previous order category. Therefore, we make pairwise comparisons between *ln_tfp* coefficients (i.e. 3 parameters from [3]) for each of the columns (1) through (5). The results of pairwise tests unambiguously show that the for the Low-PHE coefficient is statistically smaller than any of the coefficients from the remaining four categories. The levels of significance are as follows: 1% when compared to Low-Mod, 10% when compared to Mod, 1% when compared to High-Mod, and 10% when compared to High-PHE-level. Altogether, this suggest that increasing PHE-level from low to any other higher-order level, is associated with larger magnitude of effects of productivity on growth. In simple words, increasing productivity is associated with greater increases in economic growth generated through productivity, as a country increases the level of PHE. Apart from statistical significance, as it can be observed from Table 4, the size of differences is also economically significant. For example, increasing TFP by 1%[5] By construction of this variable, this would mean an increase relative to the baseline, which is the US TFP.

while having a low level of PHE development is associated with 1.59% increase in output per effective worker, whereas increasing TFP by the same level (1%) while having a lower moderate level of PHE development is associated with 2.32% increase in output per effective worker. Given the difference of 0.73 percentage points, the economic significance is substantial.

We next test the differences between TFP coefficient for Low-Mod group to that of the higher-order levels of PHE development groups. Compared to Mod, the coefficients statistically do not differ. However, compared to High-Mod and High, the coefficients for Low-Mod turn out to be higher (the difference is established at 5% and 1%, respectively). This suggests that the benefits from increasing TFP are larger with lower moderate PHE development, than they are with higher moderate or high level of PHE development. Furthermore, we test whether Mod coefficient differs from High-Mod and High coefficients. Pairwise test shows no statistical difference between TFP coefficients for moderate and higher moderate level of PHE development. Compared to High, we find marginally significant (at 10%) difference suggesting that the coefficient for Mod is higher. Fi-

[5] By construction of this variable, this would mean an increase relative to the baseline, which is the US TFP.

nally, we compare High-Mod and High coefficient. At 10% significance, we establish that the High-Mod coefficient is larger. In summary, the results from Table 4 suggest that moving away from a low level of PHE development is associated with greater effects from productivity increases on economic growth. However, there seems to be an upper limit of PHE development after which a further increase in PHE development is associated with slightly diminishing effects of productivity on output per effective worker. Clearly, these results suggest a curvilinear relationship between PHE development and economic growth.

Table 4

Empirical results for the main specification

	(0)	(1)	(2)	(3)	(4)	(5)
Variables	*ln_gdp*	*ln_gdp*	*ln_gdp*	*ln_gdp*	*ln_gdp*	*ln_gdp*
ln_capital	1.528***	1.461***	2.381***	2.163***	1.705***	1.324***
	(0.152)	(0.051)	(0.579)	(0.294)	(0.252)	(0.047)
ln_hc	0.976***	-1.429	1.243***	0.507	0.629***	1.085***
	(0.104)	(1.249)	(0.243)	(0.439)	(0.150)	(0.049)
ln_tfp	1.887***	1.590***	2.322***	2.064***	1.977***	1.839***
	(0.065)	(0.145)	(0.247)	(0.190)	(0.077)	(0.063)
PHE level	n/a	Low	Low-Mod	Mod	High-Mod	High
Observations	589	33	36	87	109	230
R-squared	0.949	0.999	0.999	0.966	0.984	0.982

Notes. Author calculation. In parentheses are standard errors which are robust against heteroskedasticity and adjusted for clustering at the state level: *** p<0.01, ** p<0.05, * p<0.1.

To further investigate where the non-linearities possibly come from, we next decide to focus on each of the PHE dimensions separately. Hence, we first repeat our main specification studying only the effects of changes in innovativeness within the public healthcare. After performing pairwise tests for *ln_tfp* coefficients from columns (1) through (5) from Table 5, at 5% significance we establish that the coefficient from Low group is greater than that of the High group. Furthermore, at 10% significance we establish that both coefficients from Low-Mod and Mod groups are greater than that of the High group. The other pairwise differences are not statistically significant. As such, these findings suggest that as the level of innovativeness within public healthcare continues to grow beyond a certain extent, the effect of productivity increases on growth start diminishing.

Table 5

Empirical results for focusing only on innovativeness within the public healthcare sector

	(1)	(2)	(3)	(4)	(5)
Variables	*ln_gdp*	*ln_gdp*	*ln_gdp*	*ln_gdp*	*ln_gdp*
ln_capital	1.877***	2.291***	2.170***	1.424***	1.508***
	(0.273)	(0.366)	(0.240)	(0.475)	(0.158)
ln_hc	0.964***	0.627	1.318***	0.742**	0.564***
	(0.263)	(0.466)	(0.295)	(0.296)	(0.129)
ln_tfp	1.907***	1.872***	1.765***	1.718***	1.403***
	(0.148)	(0.154)	(0.125)	(0.276)	(0.113)
Innovativeness level	Low	Low-Mod	Mod	High-Mod	High
Observations	174	73	133	155	385
R-squared	0.945	0.975	0.918	0.890	0.840

Notes. Author calculation. In parentheses are standard errors which are robust against heteroskedasticity and adjusted for clustering at the state level: *** p<0.01, ** p<0.05, * p<0.1.

Next, we repeat the same test with considering only proactivity. At 10% significance, we establish that *ln_tfp* coefficient for low level of proactivity within the public healthcare is larger than the coefficient from Mod group. However, at 5% significance, we establish that Low-Mod coefficient is smaller than each of the Mod, High-Mod and High coefficients. This suggests that as proactivity increases beyond a certain level, the effects of productivity on growth possibly diminish. However, as proactivity continues to grow and passes a certain threshold, the effects of productivity on growth start increasing again.

Table 6

Empirical results for focusing only on proactivity within the public healthcare sector

Variables	(1) *ln_gdp*	(2) *ln_gdp*	(3) *ln_gdp*	(4) *ln_gdp*	(5) *ln_gdp*
ln_capital	1.666***	1.357***	1.676***	1.985***	1.489***
	(0.279)	(0.479)	(0.455)	(0.547)	(0.175)
ln_hc	1.181***	0.430*	0.798***	0.812***	0.827***
	(0.326)	(0.242)	(0.284)	(0.266)	(0.087)
ln_tfp	1.654***	1.191***	1.963***	2.030***	1.713***
	(0.199)	(0.236)	(0.235)	(0.272)	(0.112)
Proactivity level	Low	Low-Mod	Mod	High-Mod	High
Observations	150	89	164	173	344
R-squared	0.878	0.889	0.932	0.947	0.890

Notes. Author calculation. In parentheses are standard errors which are robust against heteroskedasticity and adjusted for clustering at the state level: *** p<0.01, ** p<0.05, * p<0.1.

Finally, we test how are the changes in risk-taking related to the effects of productivity on growth by observing the changes in risk-taking. At 5% significance we establish that *ln_tfp* coefficients for low level of risk-taking is larger than the coefficients for both higher moderate and high level of risk-taking. Interestingly at 10% significance we establish that Mod coefficient is smaller than the High-Mod coefficient, but also larger than the High coefficient. Finally, at 1% significance we establish that High-Mod coefficient is lower than the High coefficient. Altogether, this reconfirms the non-linear relationship between PHE dimensions and output per capita. Namely, as risk-taking increases beyond certain level, the effects of increases in TFP on output per effective worker first decline, but then they recover (and possibly again decline, and finally arise).

Table 7

Empirical results for focusing only on risk-taking within the public healthcare sector

Variables	(1) *ln_gdp*	(3) *ln_gdp*	(4) *ln_gdp*	(5) *ln_gdp*
ln_capital	1.728***	1.768***	2.742***	1.227***
	(0.237)	(0.449)	(0.390)	(0.172)
ln_hc	1.234***	0.683**	1.200**	0.681***
	(0.230)	(0.328)	(0.575)	(0.088)
ln_tfp	1.846***	1.865***	2.379***	1.465***
	(0.141)	(0.244)	(0.206)	(0.134)
Risk-taking level	Low	Mod	High-Mod	High
Observations	310	144	122	330
R-squared	0.890	0.912	0.901	0.896

Notes. Author calculation. Low-Mod subsample is omitted due to insufficient observations. In parentheses are standard errors which are robust against heteroskedasticity and adjusted for clustering at the state level: *** p<0.01, ** p<0.05, * p<0.1.

5. Discussion

Overall, the results support the main hypothesis, stating that developing entrepreneurial orientation in the public healthcare sector is associated with increases in a country's economic growth measured by output per worker. However, the evidence suggests that after reaching a certain level of PHE development, the effects start diminishing. Namely, as a country moves away from a low level of PHE, it seizes higher growth through increases in effects of productivity on growth. That is, 'productivity becomes more growth-enhancing', meaning a same relative increase in TFP while having low level of PHE development is associated with lower effects on growth, compared to the effects that are achieved from increasing productivity as a country moves away from a low level of PHE development. As a country continues to increase PHE level, it possibly reaches an upper bound, after which any further increases lead to a situation where increases in TFP will produce less effects on growth. Altogether, this provides strong evidence for the curvilinear relationship (either an inverted U-shaped or a higher than second order) between PHE and output per effective worker.

To examine where the nonlinearities come from, we focus on examining the effects of changing each of the individual PHE dimensions. In case of innovativeness, we see that as a country moves to a higher than what we defined as a low level of innovativeness, the effects of productivity on growth start marginally diminishing. This would suggest the existence of an upper bound for productive innovativeness withing the public healthcare. That is, after achieving a certain level of innovativeness, there is no more room left for seizing growth opportunities from this source, as congestions takes place and further increasing innovativeness lowers the total factor productivity effects on growth. This could be the reflection of the right-hand side of the inverted U-shaped function. For productivity, we find that moving upward from a low level of proactivity first shrinks the effects of productivity on growth, but as productivity continues to grow, the effects of productivity on growth start increasing again. Such behaviour reflects a U-shaped (regular not the inverted) relationship along the observed interval. Finally, for risk-taking our findings are similar to proactivity results. Namely, increasing risk-taking beyond low level, first results in lower effects of productivity on growth, but as risk-taking increases, the effects of productivity increase. However, continued risk-taking up until high level, again decrease the productivity effects, but as a country reaches a high level of risk-taking, the effects of productivity increase again. This effectively shows 'double U-shaped' on the interval observed.

In summary, our results show that countries at lowest levels of PHE development benefit most from fostering public healthcare entrepreneurship. However, as they reach certain extent of PHE development, the relationship could go either way – either upward of downward. Unambiguously this suggests a non-linear relationship between PHE and productivity effects on growth. According to our findings, the relationship is at least quadratic, but perhaps more likely a cubic or a higher order. Furthermore, this means there are possibly multiple equilibria where a country could end up seizing highest growth opportunities. This leads to some interesting conclusions. First, a country could be stuck at an inferior equilibrium in the absence of big enough push to the superior equilibrium state. Secondly, the changes are dynamic, given that as soon as a country has reached new level of PHE development, the new equilibrium possibly changes. This means there is no unique path, nor a unique equilibrium as far as the PHE level is concerned.

As for the potential channels through which PHE allows for larger effects of productivity on economic growth, we believe it is through increasing effective labour and enhancing labour productivity. Namely, entrepreneurship in public healthcare could contribute to higher quality of provision of healthcare services, what would result in better health and well-being of workers. This would be aligned with findings from other studies that show positive effects of entrepreneurship on provision of public services (Andrews et al., 2020). Improvements in health and well-being of workers would mean less absenteeism (involving average hours worked) and higher productivity. Some authors (Novakov, 1993) explain that when oppressed by poverty, they do not leave their jobs regardless of their health condition. If an

individual falls ill, they might not be absent, yet show up at work with decreased productivity. Furthermore, from an economic perspective, shorter sick leave, and generally a shorter stay in stationary healthcare institutions reduce costs. Another possible channel through which entrepreneurship in public healthcare sector benefits growth would involve restraining the adverse effects and fighting the detrimental effects of diseases. As recent studies argue (Liu et al., 2020), the importance of entrepreneurship in fighting the outbreaks of diseases was particularly emphasized during the Covid-19. This means that amidst negative shocks to the economy PHE help mitigating the costs.

Generally, the part about positive impact of entrepreneurship on growth aligns with earlier studies on this topic (Stuetzer et al., 2018; Audretsch and Keilbach, 2005). Our findings complement studies (Ehrlich & Liu, 2017) arguing that entrepreneurial capital in terms of entrepreneurial orientation contributes to growth. Our study does not offer a decisive response to what are the exact channels through which PHE affects productivity and thereby growth. However, plentiful studies (Ács et al., 2018; Nightingale & Coad, 2014; Ács &Varga, 2005) suggest that entrepreneurship affects growth directly and indirectly, meaning the relationship between entrepreneurship and growth is not explicit. In this regard, the growing body of literature argues in favour of a non-linear, i.e. the inverted U-shape relationship between entrepreneurship and growth (Wennekers et el., 2010; Ács & Sanders, 2012; Ács, 2006). For example, Ács (2006) postulates the U-shape relationship between entrepreneurship and growth. This standpoint suggests that entrepreneurship largely occurs in countries with deficient economic growth, when it is mainly manifested as necessity-based entrepreneurship. As a country develops, the necessities shrink, and so does entrepreneurship. Furthermore, as the country reaches a high level of economic growth, opportunities sharply jump, which triggers entrepreneurship. However, these studies consider entrepreneurship generally and/or in terms of firms' formation and self-employment. As our study deals with public entrepreneurship, i.e. intrapreneurship, we conjecture that the relationship is likely even more complex, hence at least quadratic, but more likely cubic or of a higher order.

Furthermore, despite finding evidence of a positive relationship between the entrepreneurial orientation of public healthcare and economic growth, this study does not offer an ultimate response regarding the directions of causality. That is, we do not consider the feedback loop that economic growth creates on PHE. Establishing causality accounting for reverse causality is considered the most significant caveat of research in social sciences (Vaisey and Miles, 2017; Kennedy, 2003). Reverse causality is the phenomenon of the dependent variable creating feedback loop on the independent variable. It causes the correlation of the independent variable with errors, which makes drawing reliable conclusions difficult (Leszczensky & Wolbring, 2018; Kennedy, 2003). In the context of this study, reverse causality would imply growth affecting the entrepreneurial orientation of the public healthcare sector. The available literature offers arguments for causality flowing in both directions between economic growth and healthcare sector, despite not discussing the PHE per se. Generally, higher growth allows for a higher development of a country, including the development of public healthcare and, consequentially, its performance (Smith, 2011; Summers & Pritchett, 1996). Furthermore, if we accept the position that PHE positively affects productivity, this will imply that PHE also affects the productivity within the public healthcare. As such, the public healthcare is more likely to contribute to developing the entrepreneurial orientation. Moreover, scholars mention that entrepreneurship is inseparable from a two-way interaction with its environment and the factors that affect entrepreneurship and growth (Audretsch and Keilbach, 2005). Thus, entrepreneurship is seen as a multiplier, as the more a nation fosters entrepreneurship, the more it contributes to developing environmental factors that encourage further entrepreneurship development (Ács, 2006; Friis et al., 2004). However, many studies argue that growth is making a feedback loop to all growth factors, as higher growth allows an increase in aspects of production through their accumulation and advancement (Bassanini and Scarpetta, 2002). Notwithstanding, the methodology used in this paper substantially controls for all the reverse causalities and feedback loops. Yet,

as they cannot be eliminated, we do not attempt to dispute or rule them out. Ignoring these two-way relationships is the reason why some scholars claim that most research on entrepreneurship overemphasizes entrepreneurship and show a somewhat illusionary idea of entrepreneurship being the panacea for the underperformance of both countries and organizations (Ács et al., 2018; Nightingale & Coad, 2014; Ács & Varga, 2005).

6. Conclusions and Implications

We believe this study is the first that assesses the implications of International Healthcare Regulation on the macroeconomic level. In particular, the first study that bridges the IHR to economic growth through the notion of public healthcare entrepreneurship. The intuition of observing the IHR through the PHE lenses is adopted from the Rastoka et al., 2022. However, unlike their study which considers the effects of PHE on the public healthcare variables, we focus on a different outcome, that is the economic growth. Overall, our results show the statistical and economic significance of the effects changing the level of public healthcare entrepreneurship development has on economic growth. What is more, we establish that the relationship is at least quadratic, whereby the countries at lowest levels of PHE seize the most growth opportunities as they develop the PHE. However, after reaching a certain extent of the development, the effects on growth start shrinking. This suggest the relationship between PHE and economic growth being at least quadratic.

6.1. Theoretical implications

This main results from this paper contribute several areas of economics theory. First, it explores the nexus between public sector entrepreneurship and healthcare entrepreneurship, showing there is a role for the public healthcare entrepreneurship (PHE). We provide a thorough reasoning for what is the PHE and how it manifests. In particular, we conjecture that the PHE affects economic growth through the total factor productivity. We furthermore contribute the theory on economy growth, as we suggest a plausible explanation for part of differences in growth across otherwise fully comparable countries. Our findings also provide some contributions to public economics. If we think of PHE as something that is a part of, or something that affects the public healthcare infrastructure, we show that the relationship between improving public healthcare infrastructure and economic growth is not linear (as commonly discussed).

Most of all, our results provide contributions to the theory of entrepreneurship, particularly the role of entrepreneurship within the economy. Despite the existing studies on relationship between entrepreneurship and economic growth, they were predominantly focusing on firm formation and job creation. Here, we show that the effects of entrepreneurship on growth go beyond that. Besides, our results feed the existing theory on shape of the relationship between entrepreneurship and economic growth more broadly. Unlike the existing studies that argued either linear or inverted U-shape relationship, we provide evidence that the functional form of this relationship is at least quadratic, but more likely cubic or even of a higher order. Acknowledging such a shape of the relationship resulted in creating valuable empirical implications.

6.2. Policy and managerial implications

The practical contribution of this paper follows from the statistical and economic significance of the obtained results. That is, we find that productivity coefficients are statistically different depending on the level of the PHE development. At the same time, comparing the magnitudes of differences, we find they are substantial in terms of economics effects. This directly translates to several empirical (policy and managerial) implications. First, state governments, especially ministries of health, could use these findings as a guideline when organising public health institutions. This would suggest providing conditions that would enable a higher entrepreneurial orientation within the public healthcare. The insights from this paper may also be useful to international organizations, particularly the WHO. Our findings could help them in revisiting the existing regulation to better account for aspects that have a meaningful impact on economic outcomes.

Namely, so far, the IHR was in a way treated isolated, with the focus being meeting certain requests

(without showing evidence of the effects of meeting those requirements outside beyond the healthcare effects). The WHO could consider linking the IHR to aggregate economic indicators, as we did in this study with linking them to the output per effective worker. Proving evidence of the potential benefits of IHR could incentivise countries to provide a better compliance. This undoubtedly creates positive spillover effects across the borders. Moreover, given the non-linear relationship we established in this paper, the WHO could think of guidelines for countries on their path in developing PHE, and more broadly on their path to IHR compliance. Our results could be useful for informing policy making in part with making better choices when trading off between various IHR requirements. Given the constraints the public healthcare face, they could use our results to help them make most of the efforts made. For example, at the point when all growth opportunities from innovativeness (i.e. laboratory) are seized, they should focus on further developing their weakest point instead of continuing to develop that one. Finally, the WHO could use our results as a foundation for performing different studies on how various IHR indicators correlate with a country's macroeconomic outcomes.

6.3. Limitations and suggestions for future research

The main limitations of this study stem from its research subject. In the absence of universally developed PHE indicators, this study uses approximations. Whether the approximations used ideally reflect entrepreneurial orientations is, of course, subject to debate. However, an advantage of using proxies is avoiding the measurement error. Namely, the data on entrepreneurship based on self-evaluations is normally subject to misreporting with the likeliness of bias towards underreporting or overreporting. Further limitations are imminent to the research questions selected. Namely, the novelty of the research question comes at the price of lacking comparable, especially recent studies. Hence, these findings cannot be compared with other studied that explicitly consider the effects of PHE on economic growth. Still, given the breadth of related studies this paper refers to, we believe the discussion provides a reasonable comparison to relevant studies. Some of these limitations set grounds for further studies. Lastly, the interval we observe is rather limited, meaning we were unable to scrutinize what happens as a country starts developing the PHE 'from the scratch'. Namely, as there are insufficient observations for particularly low levels of PHE development, we were unable to see what is happening on a country's path from bottom to upper bound of the low level of PHE (and PHE dimensions) development.

Possible directions for future research could involve coming up with alternative metrics for PHE. Moreover, we believe studying public entrepreneurship within different industries (where the public sector share in the industry is high) could also be helpful—for example, studying the effects of entrepreneurship in education on economic growth. Some plausible channels for this relationship include human capital index, but also labour and productivity. Finally, this research question could be studied using different econometric specifications.

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Biography

Jelica Rastoka, an MSc in Economics candidate at the London School of Economics and Science. She holds an MSc in Economics for Development from the University of Oxford and a Master of Economics: Business Economics degree from the Faculty of Economics, University of Banja Luka. Jelica is a Senior Bank Analysis and Monitoring Associate at the Deposit Insurance Agency of Bosnia and Herzegovina (Currently on leave). Jelica is genuinely interested in macro-micro economic linkages, covering growth and development, banking and finance, political economy, and relationships between nature and economy. She has published papers in journals such as Sustainability, International Journal of Environmental Research and Public Health.

У потрази за савременим покретачима раста:
Да ли предузетништво у јавном здравству утиче на економски раст?

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Кључне ријечи:
предузетништво у
јавном здравству (ПЈЗ),
унутрашње предузетништво
здравствене заштите,
међународна здравствена
регулатива, савремени раст

САЖЕТАК

Предузетништво је одавно препознато као суштински покретач економског раста. Опште је прихваћено да предузетништво повећава иновације, формирање предузећа, запосленост и укупни БДП. Упркос све већем броју истраживања о јавном предузетништву и предузетништву у здравству, ове различите области истраживања нису толико комбиноване. Да би се попунила ова истраживачка празнина, овај рад анализира да ли предузетништво у јавном здравству утиче на економски раст. Ова студија користи базу података Свјетске здравствене опсерваторије Свјетске здравствене организације (WHO) која приближава различите димензије предузетништва по специфичним аспектима усклађености са међународним здравственим прописима. Студија користи податке из 170 земаља од 2010. године до 2019. године. Користећи поставку панела са фиксним ефектом, студија тестира да ли побољшања предузетништва у јавном здравству (ПЈЗ) утичу на економски раст земље. Резултати сугеришу да је већа предузетничка оријентација у јавном здравству повезана са већим ефектима на производњу по глави становника, која се каналише кроз продуктивност. Међутим, након достизања одређеног нивоа развоја ПЈЗ, доприноси расту почињу да опадају. Налази из овог рада дају неколико импликација. Прво, истражујући везу између јавног предузетништва и предузетништва у здравству, оно уводи концепт предузетништва у јавном здравству објашњавајући његову теоријску и емпиријску важност. Даље пружа емпиријску и квантитативну подршку гледишту да развој предузетништва у јавном здравству игра улогу у постизању већег учинка по ефективном раднику. Стога, ова студија пружа доказе о нелинеарној вези између предузетништва у јавном здравству и економског раста. Коначно, имајући у виду статистички и економски значај резултата, ови налази мотивишу креаторе политике да размотре развој политика које усмјеравају развој предузетничке оријентације у јавном здравству. Вјерујемо да је ово можда прва студија која разматра предузетничку оријентацију у оквиру јавног сектора у дискусију о економском расту.