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The nonlinear effect of body mass index on economic growth, human capital, productivity, and savings: A cross-country study* **

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Abstract

We examine the association between wealth and health using economic growth and development indicators and body mass index as the proxy variable for health. Empirically, the economic indicators utilized are gross domestic product per capita, human capital, overall and manufacturing productivities, and savings. We estimate our models using the fixed effect and the generalized method of moments estimators and long difference ordinary least squares and instrumental variable estimations using five-yearly balanced panel data, including 47 countries for 1980–2009. We conclude that body mass index has a nonlinear and nonmonotonic effect on all employed economic growth and development indicators.

Key words: Health, economic development, growth, years of schooling, productivity, savings.

JEL codes: I1, J24, O1.

1. Introduction

Our study's core question, "What are the effects of body mass index (BMI) on the determined economic growth and development indicators?" has a link to Azomahou *et al.* (2009) study via BMI. According to the assumptions of Azomahou *et al.* (2009), people of different ages will have alternative active planning and use different saving options. These saving preferences determine the direction of the association between GDP per capita growth and life expectancy. Saving preferences are also linked to time preference rates (Azomahou *et al.*, 2009). As Husain *et al.* (2014) stated, the association between wealth and health should be tested using different health proxy variables to understand the various dimensions of this relationship. Therefore, people in the same age groups are assumed to have remarkably similar BMIs (Jarrett *et al.*, 2010: 430). Thus, these close BMI measurements in the same age groups allow the BMI to be utilized in place of life expectancy in health-related studies.

In this study, we demonstrate the effects of health, as represented by BMI, on economic growth and selected development indicators. The economic indicators we employ are gross domestic product (GDP) per capita, years of schooling (human capital), overall productivity and manufacturing productivity, and gross domestic savings. Several of these indicators' effects have yet to be addressed in the literature.

We used BMI as the health proxy variable because of its association with the time preference rate (Barlow *et al.*, 2016). It has been shown that time preference results from cognitive ability (Ackert *et al.*, 2020; Bayer and Osher, 2018; Dohmen *et al.*, 2010). Therefore, using BMI as a health variable can enable us to exchange information from other wealth-health-related studies that use life expectancy as a health representative variable. In our estimated reduced-form equations, we prefer BMI as a health proxy variable because it is age-dependent, embedded in life expectancy, and strongly related to cognitive ability.

Then, we estimate the effects of BMI on these economic growth and development indicators by using the ordinary least squares (OLS) and the instrumental variable (IV) long difference estimations, and the fixed effect (FE) and the generalized method of moments (GMM) estimations (Arellano and Bond, 1991; Baum *et al.*, 2007; Roodman, 2009; Staiger and Stock, 1997; Wooldridge, 2002, 2012). We found certain thresholds for the association between BMI and economic growth and development indicators. We use the macro-based five-year interval balanced panel data for the 47 countries[1] covering the 1980-2009. Acemoglu and Johnson (2007), Cervellati and Sunde (2009, 2011), and Desbordes (2011) also use these 47 countries in their studies.

This paper's structure and findings might establish an individual cognitive ability-based connection between the macro- and microeconomic aspects via a strong BMI-nutritional status-cognitive ability-time preference (impatience) linkage (Ackert *et al.*, 2020; Barlow *et al.*, 2016; Bayer and Osher, 2018; Brown and Biosca, 2016; Cavaliere *et al.*, 2014; Dahl *et al.*, 2010; Dahl and Hassing, 2013; Dohmen *et al.*, 2010; Gómez-Pinilla, 2008; Kang and Ikeda, 2016). Therefore, we utilize the reduced-form equation in the cubic specification of the time preference rate, another contribution to the literature.

Briefly, we developed our theoretical model using the study of Azomahou *et al.* (2009) as the cubic specification of the time preference rate. With this cubic specification, we release the effect of the independent variable (strongly the time preference rate related BMI) on the dependent variable (economic indicator) to change. As the value of the BMI decreases (or increases), the effect of the economic indicator may decrease or increase. Moreover, this relationship changes at a particular value of the BMI. In short, at a specific point, the increasing effect becomes decreasing, or the decreasing effect becomes increasing. The point where this effect change occurs is defined as an inflexion point.

Similarly, our estimated inflexion points could reflect the effects of different health risk levels between certain thresholds demonstrated in Dasgupta (1997: 13–15) and WHO (2010) for the BMI on economic indicators. Thus, the effect of the health proxy variable BMI, having a solid connection with the time preference rate, on the economic indicators could be observed better. With this setting, we found that the relationship between all economic indicators and BMI is nonmonotonous.

Therefore, in this study, we showed that BMI, as a representative of a solid BMI-nutritional status-cognitive ability-time preference (impatience) linkage, may positively affect economic growth and development indicators only at healthy BMI thresholds through the channels of schooling, overall productivity, manufacturing productivity, and savings.

[1] See Tansel *et al.* (2021: 69) for the country list.

The paper is structured as follows: Section 2 provides the theoretical background. The data and empirical specifications are described in Section 3. Section 4 presents the estimation results. Discussion is detailed in Section 5, and Section 6 offers conclusions.

2. Theoretical background

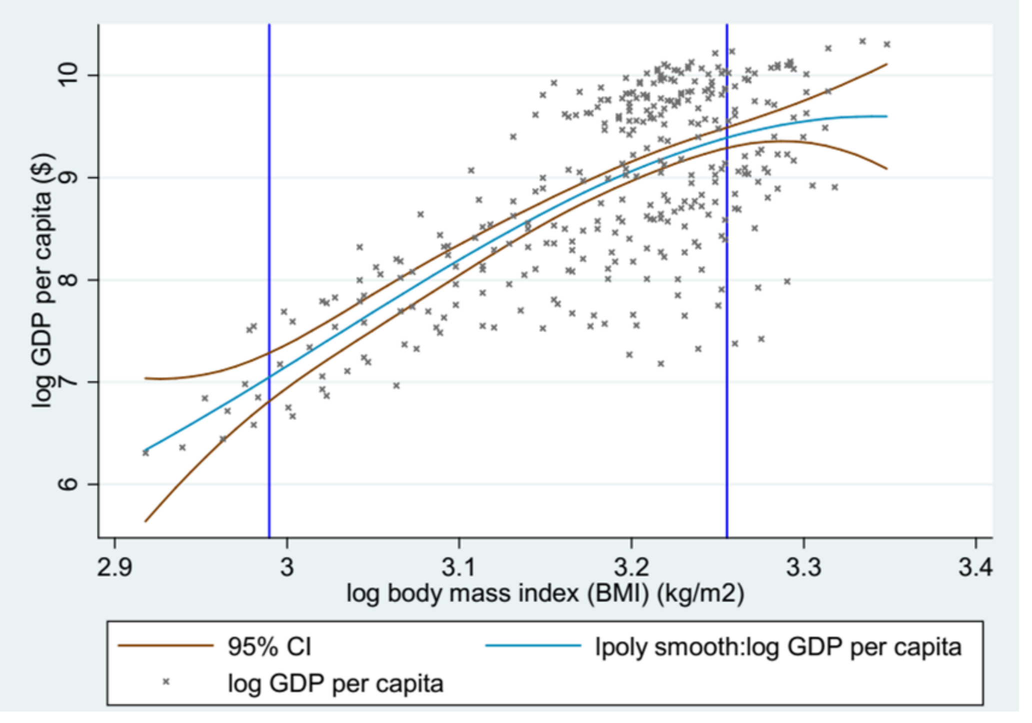
2.1. Nonlinearity issue in the graphical consideration

The purpose of this section is to graphically show the nonlinear relation between GDP per capita and BMI. Figure 1 shows the local cubic polynomial smooth plots with confidence intervals of GDP per capita and BMI for 47 countries in the 1980-2009. The estimation is performed with GMM (Arellano and Bond, 1991). There is a convex-concave-shaped association between GDP per capita and BMI. The turning points (TPs) are estimated to be 19.88-25.93 kg/m^2 (kilogram/square meter) and are shown with blue vertical lines in Figure 1. According to the Table for Nutritional Status in WHO (2010), the BMI range for individuals with a normal weight is 18.5-24.9 kg/m^2.

Figure 1 suggests that the convex-concave-shaped association between GDP per capita and BMI is similar to the graphs for the association between GDP per capita growth and life expectancy in Azomahou *et al.* (2009: 208–209) study. We subsequently observed that BMI closely relates to age-dependent survival probabilities based on the weak identification test results of our empirical estimations.

Moreover, we observe roughly similar nonparametric estimation graphs/findings to our results in Strauss and Thomas (1998), Gregory and Ruhm (2009), Kedir (2009), Kropfhäußer and Sunder (2015), and Dou *et al.* (2020), which depict a nonlinear association between wages and BMI. To conclude, we graphically show the nonlinear association between GDP per capita and BMI. The following section presents an econometric methodology of this study.

Figure 1
Local Cubic Polynomial Smooth Plots of GDP per Capita and BMI



Note. The graph is the authors' work.

2.2. Econometric methodology

Following Desbordes (2011), we use long difference OLS and IV estimations (Baum *et al.*, 2007; Wooldridge, 2002, 2012) with crude survival and age 75-79 crude survival probabilities as instrumental variables. There is a disconnect between these instrumental variables and economic growth. The feasible causes for the disconnect of the crude survival probability as a transformed form of crude death rate in this study can be found in Vandenbroucke's (2022a, 2022b) and Mokyr's (1993, 2000) studies primarily related to household behaviour and knowledge. Then, we naturally assumed that these instrumental variable survival probabilities should affect economic activities, which are cognitive science practices (Davis, 2003) through strong BMI-nutritional status-cognitive ability-time preference linkage. Next, following Hansen (2012), we use the FE estimation (Wooldridge, 2002, 2012) and the Arellano–Bond estimation of the GMM (Arellano and Bond, 1991; Roodman, 2009).

We use long-difference estimation to reveal the full effects of BMI on economic indicators and to make a straightforward evaluation of these effects measured between only two-time points (1980 and 2009) for BMI and economic indicators. Long-difference estimation is used in Acemoglu and Johnson's (2007: 933–934) study for similar reasons. Therefore, we directly observe the full effect of the change in BMI on the change in proxy variables of economic growth and development in the long-difference estimation in a panel containing only the same two-time points of economic growth and development proxy variables and BMI.

3. Data and empirical specifications

3.1. Data

We assemble the five-yearly balanced panel data for 47 countries, spanning 29 years (1980–2009), from the publicly available sources for each variable, as seen in Table 1. We prefer to use 47 countries, which were also used in the studies by Acemoglu and Johnson (2007), Cervellati and Sunde (2009, 2011), and Desbordes (2011), considering the data availability for all 47 countries for 1980–2009 period. Descriptive statistics for the variables are given in Table 1. Information regarding each variable is also provided in this table. Age-specific death rates represent the mean age-based death rates for males and females.

Table 1
Variables, Data and Descriptive Statistics for 1980-2009 Period

Variable	Description/Formula	Data Source	N	Mean	Std. Dev.	Minimum	Maximum
log mean body mass index (BMI) 18+ years	= ln ((male mean body mass index + female mean body mass index)/ 2) * (The unit is kg/m^2 and age-standardized estimate)	Data from 1980 to 2009 are utilized from Non-Communicable Disease (NCD) Risk Factor Collaboration (2016).	329	3.188368	0.0825268	2.917771	3.348148
log years of schooling	= ln (years of schooling) The average years of total schooling, aged 15-64, is exactly utilized from Lee and Lee (2016).	Data from 1980 to 2010 are utilized from Lee and Lee (2016).	329	2.042956	0.382604	0.7419373	2.583242
log gross domestic product (GDP) per capita	=ln (gross domestic product (GDP) per capita) This variable is exactly used from Maddison Project Database, Version 2013.	Data from 1980 to 2009 are used from Maddison Project Database, Version 2013 by Bolt and van Zanden (2014).	329	8.87584	0.9548445	6.307299	10.33662
log GDP per person engaged	= ln (real GDP at constant national prices (in millions 2011 US $)) / (number of persons engaged (in millions))	Data from 1980 to 2009 are utilized from Feenstra *et al.* (2015).	329	10.33784	0.9133531	7.320517	11.98606
log manufacturing productivity	= ln ((manufacturing, value added (percent of GDP) × real GDP at constant national prices (in millions 2011 US $)) / (number of persons engaged (in millions))	Data from 1980 to 2009 are used from Feenstra *et al.* (2015), World Bank (1982, 1983, 1987, 1996, 1997, 1999, 2001, n.d.a), and United Nations (UN) (n.d.).	329	8.655354	0.9570671	4.794788	10.155
gross domestic savings (percent of GDP)	= ln (gross domestic (percent of GDP)) Gross domestic savings are estimated as GDP minus total consumption by World Bank (n.d.b).	Data from 1980 to 2009 are utilized from World Bank (1987, 1992, 1996, n.d.b), and Asian Development Bank (1987, 1992, 1997, 2017).	329	22.44033	8.743491	–2.439481	50.65072
log crude survival probability	= ln (1 – (crude death rate / 1000))	Data for 1980 and 2009 are used from World Bank (n.d.c). Data are used in long-difference estimation only.	94	–0.0082234	0.0022935	–0.0143282	–0.0045332
log age 75-79 survival probability	= ln (1 – (age 75-79 death rate / 1000))	Data for 1980 are utilized from UN (1977, 1987, 1999). Data for 2009 are utilized from WHO (n.d.). Data are used in long-difference estimation only.	94	–0.0625243	0.0248765	–0.1687146	–0.0314907

3.2. Empirical specifications

By developing Equation (7)[2] and following the quadratic and cubic empirical specifications of Desbordes (2011), Hansen (2012), and Husain *et al.* (2014), we specify the following association between GDP and BMI in reduced form:

$$\log Y_{it} = \alpha_0 + \alpha_1 \log BMI_{it} + \alpha_2 (\log BMI_{it})^2 + \alpha_3 (\log BMI_{it})^3 + \lambda_i + \eta_t + \omega_{it} \qquad (1)$$

where "log" indicates "the natural logarithm", Y is replaced in turn by GDP per capita, years of schooling (human capital), overall productivity, manufacturing productivity, and gross domestic savings. Overall productivity is measured by GDP per person engaged. Manufacturing productivity is measured by the manufacturing value added per person engaged. The BMI is expressed in kg/m^2; λ and η are the country- and time-specific effects, respectively, and ω is the disturbance term.

Following Hansen (2012), Model (1) is estimated by including the lagged values of "log GDP" for one (five years) or two (ten years) periods on the right-hand side as an additional regressor. This formulation allows for dynamic effects as well as endogeneity. We estimate this association using GMM, as proposed by Arellano and Bond (1991) and as performed by Hansen (2012). Time and country dummies are included to account for the relevant fixed effects. Wooldridge (2012: 313–314) noted that including a lagged dependent variable, such as a five-year earlier, in an estimation of a cross-sectional equation is a general approach to attribute historical factors by its coefficient, such as more than 1, produce present-day differences in a dependent variable.[3] Due to the five-year interval balanced panel data, these notes are also valid for the lagged dependent variables' effects and coefficients, such as more than 1, estimated in this cross-sectional study without concerning the stationarity issue.

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[2] See Tansel *et al.* (2021: 18‒20) for developing reduced-form equations.

[3] Wooldridge (2012: 334) explained that the case study found a strong relationship between the log of current and past dependent variables. According to the estimate, a "1"% increase in the past dependent variable in five years before would predict a "1.19"% increase in the current dependent variable in the current time.

4. Estimation results

In detail, all the long difference OLS and IV estimation, FE and GMM difference estimation results, their diagnostic tests, and tables produced in this study can be seen in Tansel et al. (2021: 23–47).

4.1. Estimation results for the linear specification

The results from the long difference OLS and IV estimation and FE and GMM difference estimation are outlined as follows: For GDP per capita, in the linear specification, the coefficient of BMI is positive at a 5% or better significance level. For overall productivity, the coefficient of BMI for the linear specification was positive at a 5% or better significance level. Considering manufacturing productivity, the linear specification's BMI coefficient was positive at a 10% or better significance level. According to the results of human capital, in linear specification, the coefficient of BMI is positive at a 5% significance level. The coefficient of BMI in the linear specification is insignificant for gross domestic savings.

4.2. Estimation results for the quadratic specification

The outlines of the results obtained from the long difference OLS and IV estimation and the FE and GMM difference estimation are the following: For GDP per capita, in the quadratic specification, the coefficients of the linear and quadratic terms are both significantly different from zero at a 5% or better significance level. The estimated turning points[4] in the quadratic specification are within the range of 24.51-28.61 kg/m^2. For overall productivity, in the quadratic specification, the coefficients of both the linear and quadratic terms are significantly different from zero at a 5% or better significance level. For the quadratic specification, the estimated turning points are within the range of 24.62-27.69 kg/m^2. For manufacturing productivity, in the quadratic specification, the coefficients of both the linear and quadratic terms are significantly different from zero at a 5% or better significance level. For the quadratic specification, the estimated turning points are within the range of 25.19-28.90 kg/m^2. According to human capital results, in the quadratic specification, on the other hand, the coefficients of the linear and quadratic terms are both significantly different from zero at a 10% or better significance level. The estimated turning points in the quadratic specification are within the range of 23.13-29.77 kg/m^2. For gross domestic savings, in the quadratic specification, the coefficients of both the linear and quadratic terms are significantly different from zero at a 10% or better significance level. For the quadratic

[4] Quadratic specification turning point (TP) is estimated using the following formula: $TP = \exp(|\hat{\beta}_1/2\hat{\beta}_2|)$.

specification, the estimated turning points are within the range of 24.39-26.16 kg/m^2. In all these prominent growth and development indicators, the coefficients of both the linear and quadratic terms are positive and negative, respectively.

4.3. Estimation results for the cubic specification

According to GDP per capita, overall productivity, and manufacturing productivity results acquired from long-difference OLS and IV estimation and FE estimation, the cubic specification produced insignificant linear, quadratic, and cubic coefficients for the association between these economic indicators and BMI. However, Table 2 shows the GMM difference estimation results for GDP per capita, overall productivity, and manufacturing productivity in the cubic specification.

Table 2

The Cubic Associations between GDP per capita, GDP per person engaged, and manufacturing productivity and BMI, 1980-2009

	log GDP per capita	log GDP per person engaged	log manufacturing productivity
	(1)	(2)	(3)
	GMM (Arellano–Bond)	GMM (Arellano–Bond)	GMM (Arellano–Bond)
first lagged log GDP per person engaged, or lagged log manufacturing productivity	–	0.84***	−0.45
		(0.25)	(0.39)
second lagged log GDP per capita	0.19	–	–
	(0.13)		
log mean body mass index 18+ years	−4175.95**	−2256.71*	−13772.01**
	(1595.02)	(1138.20)	(6629.30)
(log mean body mass index 18+ years)^2	1339.79**	727.98*	4463.42**
	(507.66)	(365.25)	(2124.92)
(log mean body mass index 18+ years)^3	−143.02**	−78.19*	−482.04**
	(53.93)	(39.11)	(226.91)
Number of observations	188	235	235
Number of countries	47	47	47
R-squared	–	–	–
F test *p* value	0.00	0.00	0.00
Arellano–Bond test for AR (1) *p* value	0.02	0.06	0.04
Arellano–Bond test for AR (2) *p* value	0.27	0.13	0.10
Hansen test *p* value	0.16	0.30	0.49
Country dummies	–	–	–
Time dummies	yes	yes	yes
Turning points (1)	19.88	20.03	20.75
(2)	25.93	24.78	23.11

Notes. Robust standard errors (SE)s are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All panels are balanced panels with one observation per five years and per country. The dependent variables are the log GDP per capita, log GDP per person engaged, and log manufacturing productivity. Column (1), (2), and (3) are difference GMM estimations. Turning points are estimated for coefficients at 10% or better significance level in these Columns.

In these GMM estimations, we reject the null hypothesis of Arellano–Bond AR (1) at a 10% or better significance level. In contrast, we do not reject the null hypothesis of AR (2), providing consistent estimates. In addition, Hansen tests of these estimations indicate that overidentification fails to be rejected at a 10% or better significance level. These Hansen test results hint that the instrument sets are valid in all these estimates. For GDP per capita, in the cubic specification, the coefficients of the linear, quadratic, and cubic terms are significantly different from zero at a 5% significance level. The estimated turning point-1[5] is 19.88 kg/m^2, and the turning point-2 is 25.93 kg/m^2. For overall productivity, in the cubic specification, the coefficients of the linear, quadratic, and cubic terms are significantly different from zero at a 10% significance level. The estimated turning point-1 is 20.03 kg/m^2, and turning point-2 is 24.78 kg/m^2. For manufacturing productivity, in the cubic specification, the coefficients of the linear, the quadratic, and the cubic terms are significantly different from zero at a 5% significance level. The estimated turning point-1 is 20.75 kg/m^2, and turning point-2 is 23.11 kg/m^2. For GDP per capita, overall productivity, and manufacturing productivity, the linear, quadratic, and cubic terms coefficients are negative, positive, and negative, respectively. Regarding the GMM cubic specification estimation results, the associations between GDP per capita, overall productivity or manufacturing productivity and BMI could be cubic and convex-concave-shaped.

According to human capital and gross domestic savings results obtained from all estimation methodologies used in this study, the cubic specification produced insignificant linear, quadratic, and cubic coefficients for the association between years of schooling or gross domestic savings and BMI. Therefore, we suggest that there are non-monotonic and inverse U-shaped associations between human capital or gross domestic savings and BMI.

5. Discussion

This study examines the effects of BMI on GDP per capita, years of schooling (human capital), overall productivity, manufacturing productivity, and gross domestic savings for the 1980-2009 period. The empirical results generally agree with the GDP per capita growth and life expectancy association in Azomahou *et al.* (2009). There were nonlinear and nonmonotonic associations between all the dependent variables and BMI. According to our estimations, the relationship holds

[5] Cubic specification turning points (*TPs*) are estimated by using the general mathematical formula: $\frac{d}{dx}\left(\hat{\beta}_3 x^3 + \hat{\beta}_2 x^2 + \hat{\beta}_1 x + \text{constant}\right)$, then, $TPs\,(1,2) = \exp\left((-(2\hat{\beta}_2) \pm \sqrt{\left(2\hat{\beta}_2\right)^2 - 4(3\hat{\beta}_3\hat{\beta}_1)})\ /\ (2(3\hat{\beta}_3)) \right)$

true at the country level. The empirical findings of the current study yield significant evidence that a healthy mean population BMI ensures economic growth and development by promoting prominent economic growth and development indicators.

We consider the endogeneity of BMI and the reverse causality between economic growth and development indicators and BMI. Therefore, we use instrumental variable estimation through crude survival and age 75-79 survival probabilities as instrumental variables. We are not concerned with the instrumental variables for long difference estimations, which satisfy the rule of thumb that F statistics of the first stage should be at least ten or more (Staiger and Stock, 1997: 557; Baum *et al.*, 2007: 490). The instrumental variables' valid/invalid test results are explained in detail.[6] We consider that rare invalid test results for instrumental variables stem from data conditions[7] for several countries and years. By introducing reverse causality in their estimations, Husain *et al.* (2014) suggest that the shape of the wealth–health curve could be an inverse U-shaped curve. These findings also generally agree with our findings, as mentioned above. Husain *et al.* (2014) suggest that health affects wealth through several channels, such as savings and education.

We find that the associations between all the drivers of economic growth and development and BMI are nonmonotonic and inverse U-shaped, and the estimated turning points in the quadratic specification are within the range of 23.13-29.77 kg/m^2 based on the results of all estimation methodologies used in the quadratic specification. In addition, regarding the GMM cubic specification estimation results, there is evidence that the associations between GDP per capita or overall productivity and between manufacturing productivity and BMI could be cubic and convex-concave-shaped, that the estimated turning point-1 is within the range of 19.88-20.75 kg/m^2, and that the turning point-2 is within the range of 23.11-25.93 kg/m^2. According to the Hansen test p-value in GMM estimations, these estimates should be considered causal effects with caution (Roodman, 2009). Also, we have acknowledged that the degrees of freedom are relatively low in the case of cubic polynomial specifications, but the coefficient estimates are significant.

As far as we know from the literature, these results make this study unique because they build a direct bridge between individuals' BMI levels and economic growth and development indicators concerning the theoretical background and the empirical cubic specification. We model a cubic specification between health and economic growth and development indicators. The convex and concave-shaped results imply that economic growth and development can be sustainable only if society's health status remains within healthy BMI thresholds. Furthermore, the BMI thresholds in both the quadratic and cubic specification estimations generally

[6] See Tansel *et al.* (2021: 23–47).
[7] Data explanation can be seen in Tansel et al.'s (2021: 21–22) footnotes.

agree with Dasgupta's (1997: 13–15) function, which demonstrates the association between the probability of someone not having a health problem and a BMI that remains steady between 18.5 and 25 kg/m^2.

Economics is a cognitive science (Davis, 2003). Moreover, cognition requires healthy body energy to operate. BMI thresholds are critical for identifying this healthy source of body energy (Dasgupta, 1997). Therefore, the main finding of this study, as a nonlinear and nonmonotonic relationship between BMI and economic indicators, can be used to comment on recent economic issues society has confronted via cognition. Therefore, these findings propose that cognitive ability and skill development form a cycle. This cycle can be maintained by keeping BMI within healthy threshold values. The results also suggest that this same approach can be applied to the time preference rate (ρ), representing the rate individuals choose between present and future rewards in Ramsey's (1928) Keynes-Ramsey rule. It is essential to stay within the healthy threshold values of the time preference rate, as being outside of them can make the Keynes-Ramsey rule ineffective and unresponsive to the real interest rate. In some societies, a health issue-specific time preference rate may be significantly lower or higher, making it even more important to remain within the healthy threshold values.

Based on our findings and those of other studies, as referenced earlier, we can infer that nutrient intake provides energy to activate an individual's cognitive ability. Then, cognitive ability interacts with knowledge and tacit knowledge via education at school. This interaction becomes a skill necessary to work/create work and can also be acquired through on-the-job training. Skill is, then, transformed into productivity, income, savings, investment, and innovation as a future-oriented behaviour derived from the patience of cognitive ability. We can call this dynamic process "the cognitive ability-skill development cycle of each individual" and suggest this process as a new transmission channel.

Therefore, we assume that each individual in a country should be included in the economic ecosystem and social infrastructure. We believe that the nonlinear association between economic growth and development indicators and BMI, which we observed roughly outside the healthy BMI thresholds in the estimations of our study, is due to the accumulated deformations of the breaks in the cognitive ability-skill-development cycle of each individual, which undermine the sustainability of macroeconomic and microeconomic activities.

6. Conclusions

Empirically, the economic indicators utilized are GDP per capita, schooling, overall productivity and manufacturing productivity, and savings; some still need to be addressed in the literature. There is a solid BMI-nutritional status-cognitive ability-time preference (impatience) linkage. Our theoretical model, developed from the study by Azomahou *et al.* (2009), gives the cubic specification of the time preference rate. Therefore, we used the reduced-form equation in the cubic specification of the time preference rate to estimate this association through BMI.

Using long-difference IV and GMM estimations, we can cautiously show the causal effect of BMI on the economic growth and development indicators we used. Therefore, in this study, we showed that BMI, as a representative of a solid BMI-nutritional status-cognitive ability-time preference (impatience) linkage, may positively affect economic growth and development indicators only at healthy BMI thresholds through the channels of schooling, overall productivity, manufacturing productivity, and savings. We conclude that BMI has a nonlinear and nonmonotonic effect on all the economic growth and development indicators we employed.

Compliance with ethical standards

The authors declare that they have no conflicts of interest relevant to the content of this manuscript.

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Authors’ contributions

The text was prepared by C. Öztürk with contextual contributions by A. Tansel and E. Erdil. All the authors have read and approved the final manuscript.

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Özet

Beden kitle indeksinin ekonomik büyüme, beşeri sermaye, verimlilik ve tasarruf üzerindeki doğrusal olmayan etkisi: Ülkeler arası bir araştırma

Zenginlik ve sağlık arasındaki ilişkiyi, zenginliği ekonomik büyüme ve kalkınma göstergeleri ile ölçerek, sağlığı ise vücut kitle indeksini temsili değişkeni olarak kullanarak inceliyoruz. Ampirik olarak, kullanılan ekonomik göstergeler kişi başına düşen gayri safi yurtiçi hasıla, beşeri sermaye, genel verimlilik ve imalat verimliliği ve tasarruflardır. Modellerimizi, 1980–2009 yılları için 47 ülkeyi kapsayan beş yıllık dengeli panel verilerini kullanarak sabit etki ve genelleştirilmiş moment tahmin edicileri yöntemi ve uzun fark sıradan en küçük kareler ve araçsal değişken yöntemlerini kullanarak tahmin ediyoruz. Vücut kitle indeksinin, kullanılan tüm ekonomik büyüme ve kalkınma göstergeleri üzerinde doğrusal olmayan ve monoton olmayan bir etkiye sahip olduğu ve pozitif etki kanalının indeksin sağlıklı aralığında geçerli olduğu sonucuna varıyoruz.

Anahtar kelimeler: Sağlık, ekonomik kalkınma, büyüme, beşeri sermaye, verimlilik, tasarruf.

JEL kodları: I1, J24, O1.