Advances in Management & Applied Economics, Vol. 11, No. 1, 2021, 101-127
ISSN: 1792-7544 (print version), 1792-7552(online)
https://doi.org/10.47260/amae/1116
Scientific Press International Limited

The Impact of GDP on Cross-Country Efficiency in Wealth Maximization: a Joint Analysis Through the Stochastic Frontier and Generalized Method of Moments

Md Harun Or Rosid[1], Zhao Xuefeng[2], Sk Alamgir Hossain[3], Mohammad Raihanul Hasan[4] and Md Reza Sultanuzzaman[5]

Abstract

Wealth maximization is still the principal objective of a corporation and income plays a pivotal role in this regard. Taking this to the country context, wealth maximization can be a more refined objective alongside GDP growth. Considering GDP as the key wealth maximizer for a nation, the present work was undertaken to determine cross-country wealth efficiency and its determinants based on GDP covariates. The relationship between aggregate net wealth and GDP of 106 different countries for a period of 2009 to 2018 were analyzed to estimate annual incremental wealth efficiency based on their GDP covariates using input-output stochastic frontier analysis (SFA). Further, the determinants of incremental wealth efficiency were identified using multiple regression models. The SFA analysis shows significant negative impact of GDP on wealth maximization efficiency, like the law of diminishing marginal return to scales advocates. With the increase of GDP of a country, its marginal efficiency in wealth maximization decreases though aggregate wealth increases. The robust regression models show that imports, broad money and exchange rate undermine the wealth efficiency of a country and country's past efficiency positively influences the subsequent year's efficiency. These findings are expected to open new horizons for policymakers in policy analyses.

[1] School of Management, Huazhong University of Science and Technology (HUST), Wuhan, PR China.
[2] School of Management, Huazhong University of Science and Technology (HUST), Wuhan, PR China.
[3] School of Management, Huazhong University of Science and Technology (HUST), Wuhan, PR China.
[4] School of Management, Huazhong University of Science and Technology (HUST), Wuhan, PR China.
[5] School of Economics and Management, Nanchang University, Nanchang, Jiangxi, China.

Article Info: *Received:* January 28, 2021. *Revised*: February 26, 2021.
Published online: March 1, 2021.

JEL classification numbers: E1, E2, F4
Keywords: Wealth Maximization, GDP, SFA, Technical Efficiency, GMM, Driscoll Kraay.

1. Introduction

GDP may not be a sufficient indicator of national success. Countries should now take action to embrace new metrics [1]. Evaluation of net worth or net wealth maximization can be a better alternative to evaluate the performance of an economy. Net wealth is defined as the value of all owned properties of an organization or business or a nation, less the value of all its remaining commitments [2]. But, the importance of GDP can't be overlooked as it also largely impacts the wealth maximization like the way profit influences wealth for corporations. In the corporate arena, beyond ethical dilemma, the main objective for a corporation is still the wealth maximization [3]. Alike, the economic assessment criterion for a country should be focused on the large status of an economy's national wealth, not GDP nor the index of human development [4].

The wealth of a nation is measured not by its precious metal stock, but by the efficiency of its labor force. In founding these points, common concepts of gross domestic product as a measure of national wealth, specialization and labor division, collective benefit from trade, and market efficiency has to be incorporated [5]. The Global Wealth Report of the Credit Suisse AG has been the leading global household wealth guide since 2000. According to them, global aggregate wealth rose to a total of USD 317 trillion, outperforming population growth, by USD 14.0 trillion (4.6 percent) [6]. But this report has not addressed the issue why the wealth of the nations is changing and how the nations are maximizing their wealth. After observing the wealth status of the nations for past decades it is evident that some countries are doing very good while others are not so (see figure 1). Figure 1 shows the wealth of nations for 10 years i.e. 2009-2018. During these years, two countries of the world, China and USA, have managed to increase their wealth tremendously. USA leaped to 100000 billion USD from 60000 billion USD while China rose to 50000 billion USD from 20,000 billion USD. Japan, UK, India and Australia have also been able to manage a good wealth boost. But, countries like Zambia, Tonga and Bangladesh couldn't do well like them.

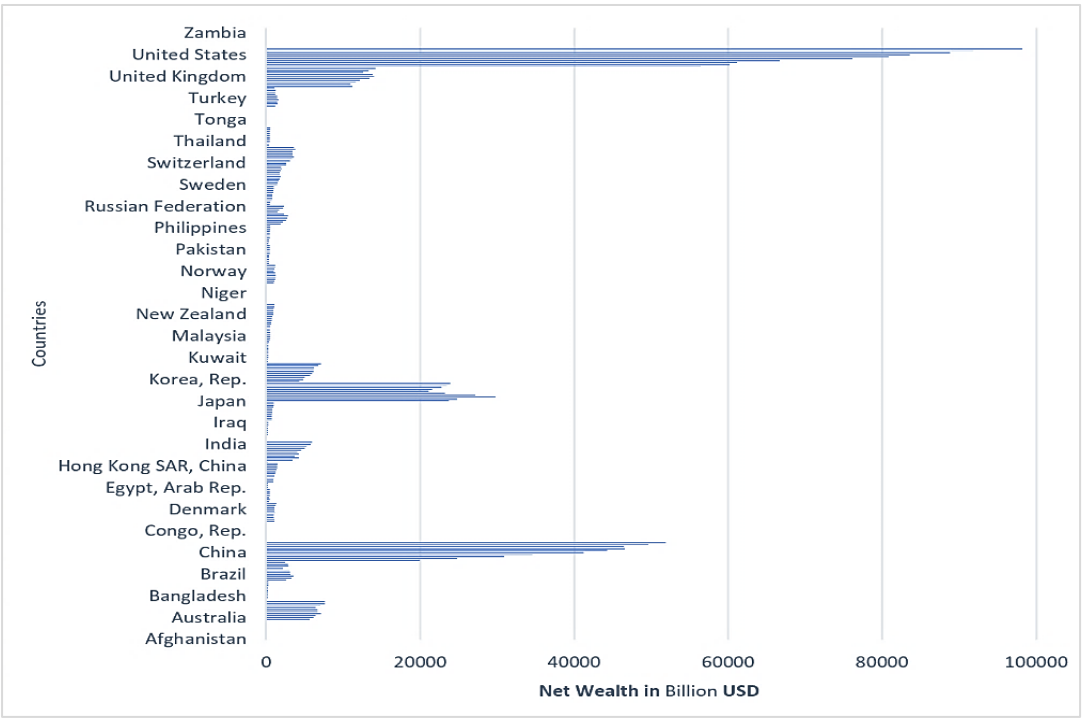

Figure 1: Net wealth of major countries for the year 2009-2018

Source: Authors' Calculation

Relevant literature shows that the determinants of economic development were presented and a ranking of efficiency was obtained for all OECD economies throughout the period of analysis [7]. A higher level of market dynamics increases productivity, while firm size and market concentration seem to decrease industry productivity [8]. But, wealth as a stochastic frontier output has not been used in any found literature. Also, the determinants of this efficiency had also been unaddressed in existing works. So, the lack of empirical evidence in this domain had motivated the researchers to search the answers of the following questions:

RQ1: How efficient are the countries in wealth maximization?
RQ2: What are the cross-country determinants of wealth efficiency?
RQ3: What are the impacts of these determinants in maximizing wealth efficiency of a nation?

To answers these questions, the current study aims at deploying joint analysis of stochastic frontier and robust regression models to explore the cross-country efficiencies and its determinants along with policy implications. In this intended analysis, macroeconomic data of net wealth and world development indicators would be collected and used from Credit Suisse AG and World Bank.
In attaining those aims, the remainder of the paper is organized in the following

manner: section 2 represents literature review, Section 3 articulates materials and methods, followed by results and discussions in section 4 and conclusions in section 5. Finally, discussions of the implications and limitations of the research and possible directions for future study were provided at the end.

2. Literature review and hypotheses

The household supplies capital and labor for increasing its wealth [9], a country as a whole can also be considered like a household which supply labor and capital for increasing its wealth. Alongside, GDP, as the aggregate income indicator for an economy largely influence every aspect of development of a nation, has to be considered together with labor and capital in frontier analysis. So, how GDP can help in maximizing wealth? Very few studies have looked into the impact of GDP on wealth. Most macroeconomic impact on stability, risks and wealth refer to the empirical base of the Gross Domestic Product [10].

There are several techniques and models for measuring technical efficiency, such as Total Factor Productivity (TFP), aggregate output ratio to aggregate inputs [11], Data Envelopment Analysis (DEA), measure productive efficiency of decision making units (DMUs) [12] and Stochastic Frontier Analysis (SFA), using Cobb Douglas basic production function, a stochastic portion that describes random shocks affecting the production process is added [13]. Productivity varies depending on the institution's specific setting [14]. True random effects model that handles unattended heterogeneity in the national dataset generates more reasonable estimates of efficiency [15]. Differences across countries are due to strong unexplained effects on the region [16].

Literature on the variable of stochastic frontier reveals the nature of relationships with wealth. In the case of China, women are more attached to family and substitute market work by home production when experiencing a wealth increase [17]. While, relevant study on wealth and labor supply heterogeneity has found that employment does not fall with wealth rather it creates more wealth [18]. Therefore, we propose the following hypotheses:

Hypothesis 1 (H_1): Net wealth has a positive relationship with Labor

Successful human capital per worker varies significantly across various countries. The empirical model implies the high response of production per worker to changes in TFP and demographic variables [19]. Another study found that capital is particularly vital for wealth perception in post-communist capitalist era [20] . Hence, the following hypothesis is proposed:

Hypothesis 2 (H_2): Net wealth has a positive relationship with capital

Many renowned researchers addressed and emphasized that wealth increases as GDP increases [21-23]. Nevertheless, another study had found that countries where inherited wealth is large there GDP grows slowly but GDP grows fast where entrepreneur driven wealth is large [24]. For this, the following hypothesis is delineated.

Hypothesis 3 (H_3): Net wealth efficiency has a negative relationship with GDP increment

Based on the relevant literature, following hypotheses have been developed for the regression models for both the covariates-based models.
The insights from the study on the impact of five-year plan's on consecutive years' productivity investigated first year's productivity on second year's productivity and so on. Their empirical results show that wealth through the technological performance has dramatically improved in the iron and steel industry of China [25]. Thus, the following hypothesis has been proposed:

Hypothesis 4 (H_4): Wealth maximizing technical efficiency has positive relationship with L.te (lagged) technical efficiency

The impacts of price level fluctuations on a nation had also been portrayed in the study on Chinese Iron and Steel Industry. Impact of price level had been studied on regional technical efficiency of Chinese iron and steel industry based on bootstrap network data envelopment analysis. They found that consumer Price Index slowly but positively impacts the managed competition and efficiency settings in US group insurance [26]. So, the following hypothesis could be put forward:

Hypothesis 5 (H_5): Wealth maximizing technical efficiency has positive relationship with Consumer Price Index

The study on economic growth i.e. GDP growth reveals a positive relationship of export with economic growth grounded on the study on emerging Asian countries [27]. So, following hypothesis is developed as GDP act as the wealth maximizer of a nation:

Hypothesis 6 (H_6): Wealth maximizing technical efficiency has a positive relationship with Export

Unlike CPI, exchange rate impacts negatively on the productivity of a nation. In finding this very truth, two-stage model to research the impacts of exchange rate fluctuations had been applied. Results show that volatility in the exchange rate reduced output in agricultural production sector in Vietnam [28]. Hence, the

subsequent hypothesis is delineated:

Hypothesis 7 (H_7): Wealth maximizing technical efficiency has negative relationship with Exchange Rate

Money received by skilled labour is significant to technical efficiency but has a lowering effect on technical efficiency. Overall, exchange rate has negative impact on technical efficiency [29]. Therefore, the next hypothesis is proposed:

Hypothesis 8 (H_8): Wealth maximizing technical efficiency has a negative relationship with Broad Money

Whether more and more imports increase the productivity of a nation? The answer to this question is adverse. Study indicates that increased import competition affects the production of technological efficiencies of the firm-products in Belgium's small open economy. Companies seem to be less technologically efficient at producing goods for more imported goods [30]. So, the following hypothesis is developed:

Hypothesis 9 (H_9): Wealth maximizing technical efficiency has negative relationship with Import

The above hypotheses talk about the relationship of wealth with other macroeconomic variables. No study has addressed the wealth maximization efficiency based cross-country analysis. In doing so, measurement of wealth efficiency is essential for identifying the countries with highest efficiency level as well as the determinants of this efficiency require consideration. All these things are aimed at the current study.

3. Research Materials and Methods

The envisioned study is going to be carried out with the following data and methods.

3.1 Data

With the aim to attain the study objectives, our macroeconomic data were collected from two sources. Data had been accumulated for 106 countries of the world for the years 2009-2018 firstly from Credit Suisse AG for main dependent cross-country wealth data [6], secondly from World Development Indicators of World Bank for the other independent variables' data. As these data are presented in different units of currency and figures, data correction has been done to harmonize the data for cross-country analysis. It has first been log normalized for analyzing through the stochastic frontier. Also, the net wealth dependent variable has been first order differentiated to fit as the output variable for the stochastic model. Then, the data have been first degree differentiated for neutralizing the autocorrelation problem. Also, all data had been converted into billion dollars and absolute figures.

3.2 Estimation Techniques and Methods

Unlike other studies, this paper has used separate but joint methodology for SFA and regression models. Earlier, this method has been used for studying the impact of block-chain effects [31]. Stochastic frontier is recommended for technical efficiency analysis [32]. Besides, determinants of efficiency has also been advocated [33]. That is why, current study has combined the following two model-based study in a sequential manner.

a) **Stochastic Frontier Analysis (SFA):** In the first analysis, SFA method have been used to identify the cross-country wealth efficiency for both GDPcu and GDPcon covariates along with labor and capital inputs.

b) **Generalized method of moments (GMM):** In the second analysis, multivariate robust regression models have been used to identify the significant explanatory variables which can explain the reasons for cross-country efficiencies in wealth maximization. In this part, SFA model derived technical efficiency (te) variable has been used as the dependent variable. For robustness of the study, multiple models like OLS (Ordinary Least Square), FE (Fixed Effect), DK (Driscoll-Kraay), 2SLS (Two Stage Least Square) and finally GMM (Generalized Method of Moments) have been used. Multivariate regressions on (te) have been done for both the GDPcu and GDPcon covariates separately.

3.3 Variables and its sources

The variables supported and discovered from the relevant literature have been listed below which have been used in the empirical models proposed in the study. Variables have been classified for two different models. Firstly, for stochastic frontier model and then for regression models.

Table 1: Variables and constructs

Model	Sl.no.	Variable	Proxy for construct	Unit	Definition and references
Variables used in Stochastic Frontier Model	1	INW	Incremental Net Wealth	Billion USD	Aggregate household net wealth added for a nation in a year [6]
	2	Labor	Total Labor	Numeric	Total number of labors employed in a year (Dmitriev & Roberts, 2012)
	3	GCF	Gross Capital Formation	Billion USD	Total Gross Capital formed in a fiscal year [34]
	4	GDPcu	Gross Domestic Product in current USD	Billion USD	Total monetary value of goods and services produced in a year in current USD [35]
	5	GDPcon	Gross Domestic Product in constant USD	Billion USD Base Year 2010=100 USD	Total monetary value of goods and services produced in a year in constant USD [35]
Variables used in Generalized Method of Moments	6	te.INW	Technical Efficiency of INW	Range from 0 to 1	Calculated through Stochastic Frontier Model [36]
	7	L.te.INW	Lagged Technical Efficiency	Range from 0 to 1	Calculated on year lag of Technical Efficiency as regressor [37]
	8	Ex	Export	Billion USD	Total export in a fiscal year [37]
	9	CPI	Consumer Price Index	Base Year 2010 = 100USD	The aggregate price level of goods and services in a fiscal year (Rosenthal, 2018
	10	Im	Import	Billion USD	Total import volume in a fiscal year [37]
	11	ER	Exchange Rate	Numeric Local Currency	Average exchange rate of local currency against USD [38]
	12	BM	Broad Money	Billion USD	Total broad money M2 circulated in a fiscal year [39]

3.4 Empirical models

At the very first, stochastic frontier approach had been used based on the Cobb-Douglas production function [40] to come up with the efficiency variable of wealth. Later, this efficiency variable has been used as the dependent variable in multi-

variate regression models. In the next part, functional relationships of the significant variables have been shown along with their regression coefficients. Firstly, for stochastic model and then for multi-variate regression models.

3.4.1 Stochastic Frontier Analysis with GDPcu and GDPcon Covariances

The use of production function in stochastic frontier model had been refined to estimate the efficiency and disturbance term with maximum likelihood method [13]. Based on their paper, the typical functional relationships among the variables under SFA model is:

$$Y_{it} = f(L_{it};\ K_{it}\ ) + (v_{it} - u_{it}) = f(L_{it};\ K_{it}) + \varepsilon_{it} \quad (1)$$

Here, Output (Y_{it}) is the GDP in country i and at time t indicating stochastic output in country i and at time t, L_{it} is total labor in country i and at time t, K_{it} is the gross capital formation in country i and at time t, v_{it}-u_{it} is the error vector where v_{it} is the normal disturbance and u_{it} is the technical inefficiency. This very model had been used in a study of economic growth in OECD countries. [7].

In equation (1) the inefficiency component (u_{it}) of the error term is the log difference between the maximum and the actual output, therefore u_{it} is the percentage by which actual output can be increased using the same input if production is fully efficient (Kumbhakar and Wang, 2015). In other words, due to technological inefficiency it's the amount of production wasted. The approximate value of u_{it} is called output-oriented (technical) inefficiency, with a value near 0 meaning full efficiency [41]. Rearranging (1), we can derive the following technical efficiency equation:

$$te_{it} = \exp(-u_{it}) = \frac{Y_i}{Y_i^*} = \frac{Y_i}{f(L_{it};K_{it})\ \ exp\{v_{it}\}} \quad (2)$$

Equation (2) defines the country-specific technical efficiency as the observed output ratio (Yi) to frontier output $f(L_{it}\ ;\ K_{it})\ exp\{v_{it}\}$ using existing technology it is the maximum feasible in an environment characterized by the stochastic elements specified by (v_{it}). Because $u_{it} \geq 0$, the ratio is bounded between 0 and 1, therefore a country achieves maximum efficiency if, and only if, $te_{it} = 1$. Otherwise $te_{it} \leq 1$ is a shortfall of observed output from the maximum feasible output that is stochastic and varies across countries [32]. The translog form of the equation (1) is as follows:

$$lnOutput = \ f(lnLabor, lnCapital) + (v_{it} - u_{it}) \quad (3)$$

In equation (3), lnOutput is the log normalized GDP in country i and at time t indicating stochastic output in country i and at time t, $lnLabor_{it}$ is log normalized total labor in country i and at time t, $lnCapital_{it}$ is the log normalized gross capital formation in country i and at time t, v_{it}-u_{it} is the error vector where v_{it} is the normal disturbance and u_{it} is the technical inefficiency.

Typically, households supply labor and capital for the production which eventually ensure income for that household. Finally, this income is used for consumption and savings. These savings and consumption create more wealth for the household. So, in a cyclical way labor and capital are being used as the main input for household to increase its wealth. Like this, GDP as a measure of production for a year can be the output variable in equation (3). Alike, incremental net wealth (INW) for a year for a nation can also act as an output of labor and capital. As the incremental net wealth is the end product of production and income. So, replacing output in equation (3) with incremental net wealth, as the paper on Shareholders' wealth and corporate sustainability has recommended [42], we get the following revised model:

$$lnINW_{it} = f(lnLabor_{it}, lnGCF_{it}) + (v_{it} - u_{it}) \quad (4)$$

In equation (4), lnINW is the log normalized first order differenced incremental net wealth (INW) dependent variable which has been replaced into lnOutput according to the presented arguments.

GDP also as an indicator for aggregate national income necessarily act as a wealth maximizer for a country. To better understand and evaluate the policies, we propose a new stochastic frontier model with a treatment status and a mediator i.e GDP [43]. When adding the effect of GDPcu into the stochastic frontier (4) revised model would adjust for average efficiency level taking the effect of GDPcu covariate into account.

$$lnINW_{it} = f(lnLabor_{it}, lnGCF_{it}) + (lnGDPcu + v_{it} - u_{it}) \quad (5)$$

In equation (5), lnGDPcu is the other exogenous vector used as covariate in moderating the technical efficiency variable of wealth.

To test the impact of real GDP on cross country wealth efficiency, GDPcon covariance had been used alongside GDPcu. When adding the effect of GDPcon into the stochastic frontier revised model would also adjust for average efficiency level.

$$lnINW_{it} = f(lnLabor_{it}, lnGCF_{it}) + (lnGDPcon + v_{it} - u_{it}) \quad (6)$$

In equation (6)**,** lnGDPcon is the other exogenous vector used as covariate in moderating the technical efficiency variable of wealth for calculating the impact of real GDP on wealth maximizing efficiency.

Testing for stationarity in heterogeneous panel data had been carefully experimented to avoid any unexpected attributes in the dataset [44]. Besides, normality of the data set has been ensured through log normalization and first degree difference of the data [45]. The stochastic frontier production function is the most appropriate, though not the most convenient, analytical tool for analyzing production and technical efficiency, in cases where it is thought to be widespread inefficiency across firms [46]. This notion can be tested in the country context

which is the main objective of the current study. The empirical results show that low technical efficiency is the main reason for lower pure technical efficiency, since the efficiency of the scale is higher than pure technical efficiency also return to scale decreases along with technical efficiency [47]. Labor and capital had been related in setting technical efficiency [48].

3.4.2 Generalized methods of moments analysis for both covariance-based technical efficiency

Based on Variance Inflation Factor (VIF) analysis, the hypothesized variables associated with the fluctuations in efficiency level of a country have been used in the following regression model to identify the determinants of the technical efficiency (generated from SFA) of the countries of the world in wealth maximization. The indicative model for the intended regression analysis is as follows:

$$te_{it}.INW = \alpha 1_{it} + \beta_1 L.te_{it}.INW + \beta_2 dlmEx + \beta_3 dlnIm + \beta_4 dlnER + \beta_5 dlnCPI + \beta_6 dlnBM + U_{it} \quad (7)$$

In equation (7)**,** te.INW is the technical efficiency of incremental net wealth dependent variable, L.te.INW is the lagged dependent variable of technical efficiency of net wealth, and dlnEx, dlnIm, dlnER, dlnCPI, dlnBM are the log normalized first order differenced independent variables. $\mathbf{U}_{it}$ is the error term.
Built on Variance Inflation Factor (VIF) analysis, technical efficiency based on GDPcu covariate the following regression model has been analyzed:

$$te_{it}.INW = a2_{it} + \beta_7 L.te_{it}.INW + \beta_8 dlmEx + \beta_{10} dlnIm + U_{it} \quad (8)$$

In equation (8), te.INW is the technical efficiency of incremental net wealth dependent variable, L.te.INW is the lagged dependent variable of technical efficiency of net wealth, and dlnEx, dlnIm, dlnER, dlnCPI, dlnBM are the log normalized first order differenced independent variables. $\mathbf{U}_{it}$ is the error term.
We assume that inefficiency follows an autoregressive process, e.g. the current year's inefficiency for a country depends on its past inefficiency plus a transient inefficiency incurred in the current year. Intercountry variations in the transient inefficiency are explained by some country-specific covariates [49].

Grounded on Variance Inflation Factor (VIF) analysis, technical efficiency based on GDPcon covariate the following regression model has been analyzed:

$$te_{it}.INW = \alpha 3_{it} + \beta_{11} L.te_{it}.INW + \beta_{12} dlnIm + \beta_{13} dlnER + \beta_{14} dlnCPI + \beta_{15} dlnBM + U_{it} \quad (9)$$

In equation (9)**,** te.INW is the technical efficiency of incremental net wealth dependent variable. L.te.INW is the lagged dependent variable of technical efficiency of net wealth, And dlnEx, dlnIm, dlnER, dlnCPI, dlnBM are the log normalized first order differenced independent variables. $\mathbf{U}_{it}$ is the error term.

As, true fixed or random effects model handles unattended heterogeneity in the national dataset generates more reasonable estimates of efficiency [15], study have purified this heterogeneity in the dataset using true fixed effect model. The imputed net value attribute of Panel Study of Income Dynamics (PSID) comprises all components of calculated properties and identified the potential source of measurement error that contributes to large wealth fluctuation [50]. This very matter has also been carefully handled to observe the actual fluctuation in the wealth efficiency. Another study suggested that findings should be robust on the main variables and alternative methodologies to alternative proxies [51]. It has been ensured through using multiple regression models in the study. Besides, no serial autocorrelation remains in the data has been warranted [52]. Also, multicollinearity problem has been addressed and mitigated for coming up with acceptable multi-variate model [53].

Based on the results of the above equations and their coefficients further analysis and interpretation have been done. In the next section, all the descriptive results based on the above equations have been reported in the first hand and then detail discussions along with their relevance in proving relevant hypotheses have also been annexed. Besides, robustness of the models has been checked through advanced regression models from OLS to other robust models i.e. FE, DC, 2SLS and GMM. These models are cross verified for finding the uniformity in results across the models. Besides, Hausman test recommended most appropriate Fixed Effect or Random Effect model is used and recommended for fixed effect [54]. Biggest share of cross-country differences is not attributable to the distribution of household demographic and economic characteristics but rather reflect strong unexplained country effects [16]. Following are the results of the above-mentioned equations and their coefficients.

4. Results and discussions

In the result section, firstly descriptive statistics of the variables would be presented, then pairwise correlation matrix for the determining variables of wealth efficiency would be reported, after that stochastic frontier model results for both the covariates would be presented. Then the impact and nature of relationship of these variables with wealth efficiency would be elaborated in detail.

4.1 Descriptive statistics

Summary of the descriptive statistics of all the variables used in the models of this study is in table 2. It includes the number of observations, mean score, standard deviations, minimum and maximum score for each and every variable.

Table 2: Descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
NW	1060	95.2768	687.5274	-3997	9406
BM	1060	631.253	2668.532	.005	27100.06
CPI	1060	119.02	27.71	86.609	382.501
Ex	1060	124.757	330.356	.044	2651.01
GDPcon	1060	500.571	1859.555	.357	17844.28
GDPcu	1060	520.498	2005.045	.318	20494.1
GCF	1060	138.888	564.161	.022	6022.374
Im	1060	125.372	350.382	.219	3128.992
Inf	1060	4.343	4.529	-7.732	48.7
Labor	1060	2.54e+07	9.00e+07	38210	7.87e+08
ER	1060	573.181	1568.268	.276	14236.94
te.INW	848	.807	.268	.1	.999

Source: Authors' calculation

Net wealth (NW) is showing an average of 95 billion USD for the countries studied along with a very high standard deviation of 687 billion USD. Which indicates there is considerable disparity in wealth among the countries of the world. Besides, mean GDP is 520 billion USD with standard deviation of 2005 billion USD. This is again indicating a high inequality among the countries. The result is also similar with real GDP. On an average 500 billion USD for GDP at constant price while standard deviation is 1859 billion USD. Table also shows import average is 125 billion USD while export of 125 billion USD as well. Both of these variables have high standard deviations. On the other hand, gross capital formation is 138 billion USD for each country on an average. Labor units of 25400000 for each and every country.

4.2 Comparison of pairwise correlations matrices

With the aim to identify the factors affecting the technical efficiency in wealth maximization, a combined correlation matrix along with VIF value is given below to report the variables survived under both the models with two different covariates.

Table 3: Pairwise correlations among the variables with VIF

Variables	VIF	te.INW	L.te.INW	dlnEx	dlnIm	dlnER	dlnCPI	dlnBm
(1) te.INW	-	1.000						
(2) L.te.INW	1.84	0.768***	1.000					
(3) dlnEx	1.72	-0.016	-0.090***	1.000				
(4) dlnIm	1.60	-0.013	-0.034	0.863***	1.000			
(5) dlnER	1.21	-0.158***	-0.018	-0.102***	-0.126***	1.000		
(6) dlnCPI	1.17	-0.354***	-0.279***	0.052*	0.040	0.204***	1.000	
(7) dlnBM	0.91	0.063*	-0.044	0.148***	0.172***	-0.898***	-0.060*	1.000
*** $p<0.01$, ** <0.05, * $p<0.1$								

Source: Authors' calculation

Table 3 shows little association among the variables indicating very low chance of endogeneity. Limited by the layout, only the correlation coefficient matrices and collinearity test results are provided here. However, the results meet the requirements of the correlation coefficient test and VIFs test for both covariances i.e. GDPcu and GDPcon. Also, the results show significance at least at .10 level for all the variables. No variable is showing association over .90 level.

4.3 Results of Stochastic Frontier Analysis and interpretation

Stochastic frontier analysis results for both the covariances are given below:

Table 4: Stochastic Frontier results for two different models with GDPcu and GDPcon covariances

	lnGDPcu	lnGDPcon
lnGCF	0.542***	0.530***
	(0.120)	(0.031)
lnLabor	0.232***	0.231***
	(0.017)	(0.021)
Year	-0.004***	-0.004***
	(0.000)	(0.000)
Mu:lnGDPcu	0.425***	
	(0.097)	
Mu:lnGDPcon		0.410***
		(0.026)
Mu:_cons	-1.656***	-1.719***
	(0.237)	(0.301)
Usigma:_cons	-5.786	-5.740***
	(0.000)	(0.388)
Vsigma:_cons	-3.556***	-3.547***
	(0.160)	(0.064)
Standard errors are in parenthesis		

Test of SFA model fit

General test

= Usigma/(Usigma+Vsigma)

= 33.47/(33.47+12.64)=.73 which is close to 1 which sufficiently justifies the SFA use.

Kumbhakar test: [39]

= -2[L(H_0)-L(H_1)

= -2[567.4455-321.88]

= -492

Which is much higher than the critical value. Which significantly recommends the use of Stochastic frontier.

Source: Authors' Contribution

After testing the SFA according to [32], the stochastic analysis in table 3 shows that there is significant positive relationship of Capital and Labor with wealth maximization. Indicating more and more capital and labor engagement bring about more and more wealth. On the other hand, year effect has very low but negative impact on wealth maximizing efficiency. Besides, the covariates lnGDPcu and lnGDPcon show significant negative relationship with the wealth maximizing efficiency. Which has been referred as the technical inefficiency of GDP with respect to net wealth.

As, the stochastic analysis shows significant positive relationship of Capital and Labor with wealth maximization and negative relationship with the lnGDPcu and lnGDPcon covariances, the primary analysis of the result is that GDP has an undesirable impact on wealth maximizing efficiency of the countries of the world. The more the GDP increases, the less the wealth maximizing efficiency. According to the result of SFA equation, capital positively increases the wealth maximizing output by .542 points and .532 points for GDPcu and GDPcon respectively. Alongside, labor positively increases the wealth output by .232 points and .231 points for GDPcu and GDPcon respectively. Year effect has an overall negative impact on wealth output by a negligible .004 points. Besides, GDPcu and GDPcon variable is negatively but significantly influencing the wealth output for a nation. That is why all the relevant hypotheses (H_1, H_2 and H3) regarding the stochastic

frontier model are proved to be true for all the covariances (GDPcu and GDPcon). So, irrespective of the established theory regarding profit enhances wealth for corporation is not being true in the country context. Added GDP is not sufficiently adding wealth for a nation. So, we should find ways to maximize wealth for a nation and factors affecting the efficiency offsetting the negative impact of GDP. The vary problem have been solved through the analysis of multi variate regression models based on the stochastic frontier model derived technical efficiency dependent variable.

Under both the covariates GDPcu and GDPcon technical efficiency variable has been derived. Then, this efficiency has been summarized with top efficient and inefficient countries. In the upcoming section a summary of cross-country wealth efficiency and inefficiency among the nations of the world has been provided for comprehending the real status of technical efficiency across the countries of the world.

4.4 Cross Country Wealth Efficiency/Inefficiency Summary

As the stochastic frontier model had found technical inefficiency of wealth with GDPcu and GDPcon, efficiency levels of the countries have been reported with reverse interpretations. Efficiency/inefficiency level by country and year have been reported below. The efficiency tables have been designed with two vertical axis one for amount of GDP, GCF and Labor and another one for efficiency level. The average efficiency level has been severely affected by the GDP covariates. The level and dimension of the efficiency was much different before adding GDP covariates. So, the efficiency levels of the relevant countries were mainly the covariate's impact at large. Though, the common input variables like labor and capital were in traditional direction along with incremental net wealth as the earlier literature suggested. First, let us take a look at the most wealth efficient countries of the world. See figure 2.

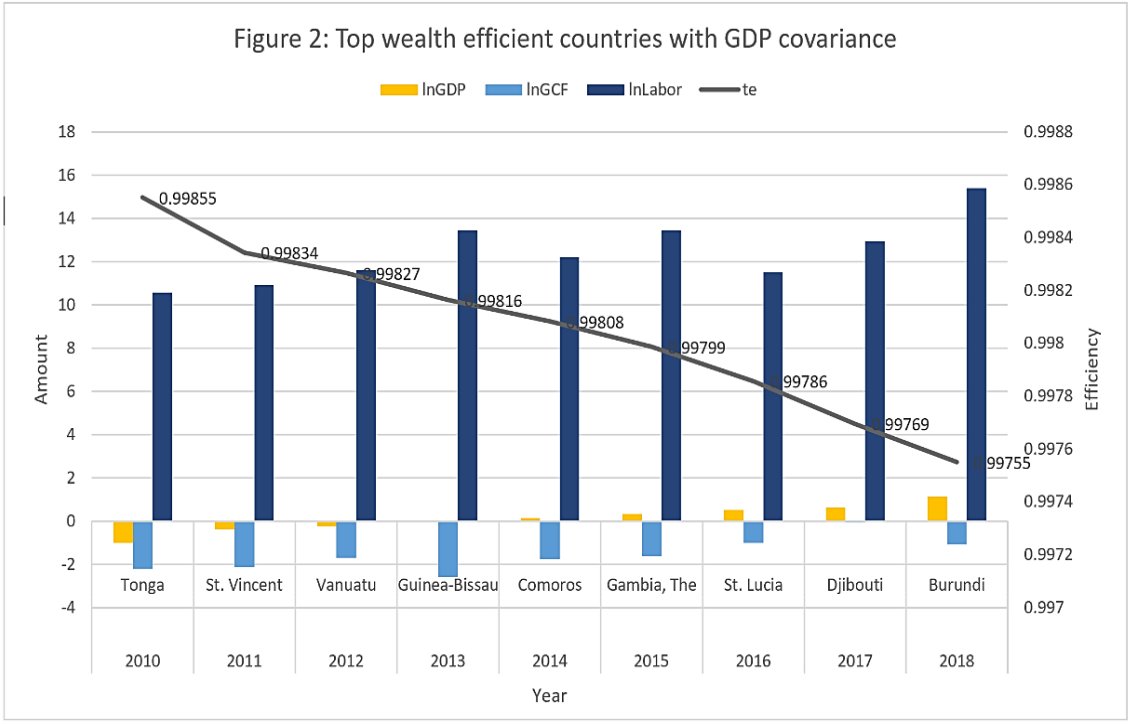

Figure 2: Top wealth efficient countries with GDP covariance

Source: Authors' calculation

Figure 2 shows that Tonga, St. Vincent, Vanuatu, Guinea-Bissau, Comoros, Gambia, St. Lucia, Djibouti and Burundi were most efficient in the year 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 respectively. It is also noticeable that the efficiency curve is downward sloping with respect to GDP, GCF and Labor. It also indicates that efficiency level is decreasing along with GDP increment. Indicating and validating the law of diminishing marginal return to scale.

Now, let us take a look at the most wealth inefficient countries of the world. Though our primary insights from Figure 1 indicated that probably the most wealth efficient country of the world would be USA and China. But the result of the current study indicates otherwise.

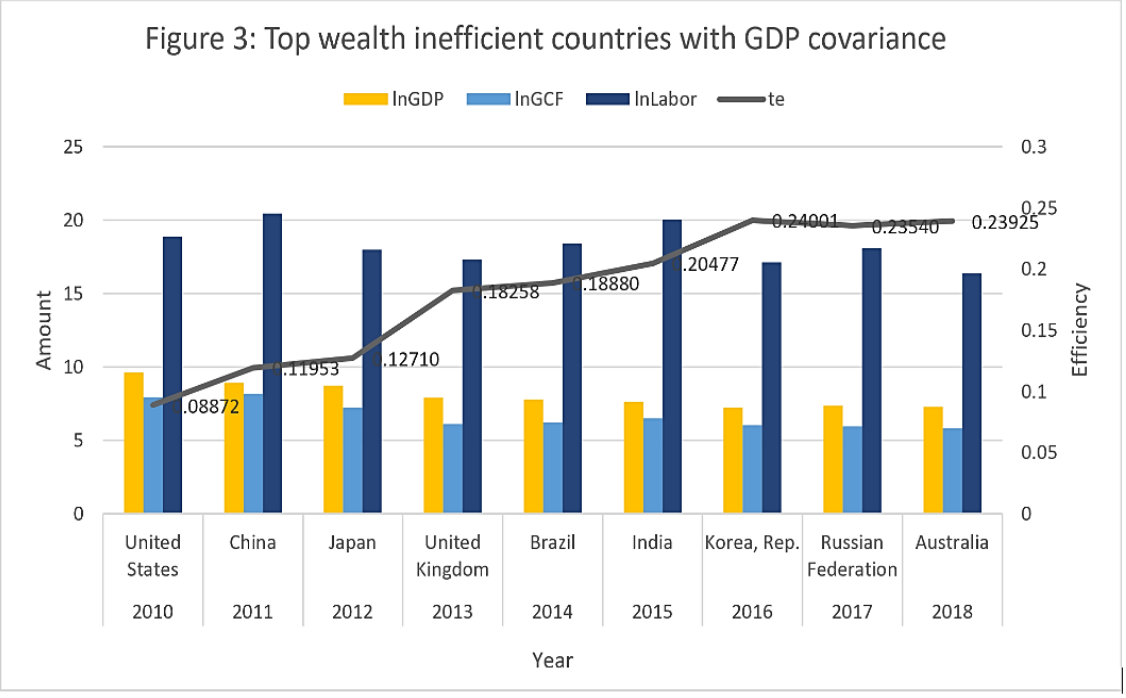

Figure 3: Top wealth inefficient countries with GDP covariance

Source: Authors' calculation

Figure 3 shows that United States, China, Japan, United Kingdom, Brazil, India, Korea, Rep., Russian Federation and Australia were most inefficient in the year 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 respectively. It is also noticeable that the efficiency curve is upward sloping with respect to GDP, GCF and Labor. It also indicates that efficiency level is increasing along with GDP decrement. Again, validating the law of diminishing marginal return to scale.

4.5 GMM and other Robust Analysis and Discussions

In this section, two stochastic frontier models generated technical efficiency variables have been regressed through robust models to identify the determinants of this efficiency. Table 5 reports the determinants of efficiency in wealth maximization for GDPcu covariate based SFA model, which shows that wealth efficiency has significant positive relationship with Lagged.te while significant negative relationship with exports and imports. All results are identical in multiple regression models like OLS, FE, DK, 2SLS, Two step system GMM. Because of the possible existence of endogeneity, OLS may not be a sufficient estimator. For this reason, robust regression models had been used on the basis of the same data and variables.

Table 5: Determinants of wealth maximizing technical efficiency for SFA model 1

	Ordinary Least Square (OLS)	**Fixed Effect (FE)**	**Driscoll-Kraay (DK)**	**Two Stage Least Square (2SLS)**	**Generalized methods of Moments (GMM)**
L.te.INW	1.005***	0.702***	1.005***	1.005***	1.076***
	(0.002)	(0.025)	(0.004)	(0.002)	(0.030)
dlnEx	-0.030***	-0.020***	-0.029**	-0.029***	-0.030**
	(0.005)	(0.004)	(0.008)	(0.005)	(0.011)
dlnIm	-0.030***	-0.024***	-0.030***	-0.030***	-0.027***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.009)
_cons	-0.005***	0.228***	-0.006	-0.006***	-0.061***
	(0.002)	(0.019)	(0.004)	(0.002)	(0.023)
Obs.	848	848	848	848	848
GMM model post-test results F-Value 268.13*** , Wald Chi-square 1698.36*** , AR(2) = 0.621 Sargan Statistics 0.373, Hansen Statistics 0.101					
Standard errors are in parenthesis					

Source: Authors' calculation

The findings show that the lagged dependent variable (L.te.INW) is important ($p<0.01$), suggesting the positive impact of the efficiency level of the past year. Two control variables, export and import, remain negative and significant ($p < 0.01$) across the five models. It suggests that countries with larger export and higher import benefit less regarding wealth efficiency. The negligible Sargan test statistics ($p<0.05$) indicate the residuals are not associated with the instrumental variable (IV). In addition, the Hansen test supports the null hypothesis of instrument validity ($p<0.05$), suggesting that the instruments are exogenous and appropriate. Moreover, the model is free from second-order correlation indicating no serial correlation. So, the overall model is valid and relevant hypotheses are valid.

In the next model with GDPcon covariates different explanatory variables have come into being. These variables are similar with the variables of first model but not same and also endogeneity had been neutralized through analysis of correlation matrix and robust regression models. The variables endured with the second model are shown in the next table.

Table 6: Determinants of wealth maximizing technical efficiency for SFA model 2

	Ordinary Least Square (OLS)	Fixed Effect (FE)	Driscoll-Kraay (DK)	Two Stage Least Square (2SLS)	Generalized methods of Moments (GMM)
L.te.INW	1.006***	0.817***	1.007***	1.007***	1.017***
	(0.002)	(0.016)	(0.002)	(0.001)	(0.008)
dlnER	-0.014***	-0.006	-0.017***	-0.017***	-0.017***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
dlnCPI	0.050***	0.068***	0.031**	0.031***	0.030**
	(0.008)	(0.008)	(0.012)	(0.007)	(0.015)
dlnBM	-0.017***	-0.009**	-0.018***	-0.018***	-0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
dlnIm	-0.009***	-0.005***	-0.009***	-0.009***	-0.009***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)
_cons	-0.008***	0.143***	-0.009***	-0.009***	-0.016**
	(0.002)	(0.013)	(0.002)	(0.001)	(0.006)
GMM model post-test results F-Value 541.28***, Wald Chi-square 32040.00***, AR(2) = 0.135 Sargan Statistics 0.307, Hansen Statistics 0.117					
Standard errors are in parenthesis					

Source: Authors' calculation

Table 6 reports the determinants of efficiency in wealth maximization for second SFA model, which shows that L.te.INW, and consumer price index (dlnCPI) have significant positive relationship with wealth efficiency while significant negative relationship only with broad money (dlnBM), exchange rate (dlnER) and imports (dlnIm). Three control variables, exchange rate, broad money and import remain negative and significant ($p < 0.01$) across the five models. It suggests that countries with high exchange rate, money supply and larger import benefit less regarding wealth efficiency. But for fourth control variable consumer price index shows positive relationship with wealth efficiency across the five models. Like the previous model, the negligible Sargan test statistics ($p<0.05$) validates instrumental variable (IV). Also, the Hansen test supports the null hypothesis of instrument validity ($p<0.05$), suggesting that the instruments are exogenous and appropriate. Furthermore, the model is free from second-order correlation indicating no serial correlation. So, the overall model is valid and relevant hypotheses are valid. In the upcoming section a comparative figure on top efficient and inefficient countries of the world would be depicted for better visual understanding of the efficiency reality across the countries.

4.6 Hypotheses results and interpretations

Based on the findings of the study, the following hypotheses proved to be right and supported by stochastic model as well as robust regression models. In this study, labor and capital showed significant positive relationship with wealth. Though, there is significant negative relationship of wealth efficiency with GDP. Countries with more and more GDP capability make them inefficient in maximizing their wealth. As for the determinants of wealth efficiency, study found significant positive relationship with past year's efficiency level and consumer price index. On the contrary, significant negative relationship of wealth efficiency had been found with Exchange Rate, Broad Money and Imports.

Table 7: Hypotheses results and interpretations

No.	**Hypotheses**	**Result and interpretations**
H_1	Net wealth has a positive relationship with labor	Result is significant (p>000) and supported by stochastic frontier model for both covariates
H_2	Net wealth has a positive relationship with capital	Result is significant (p>000) and supported by stochastic frontier model for both covariates
H_3	Technical wealth efficiency has negative relationship with GDPcu as well as GDPcon	Result is significant (p>000) and supported by stochastic frontier model for both covariates
H_4	Wealth maximizing technical efficiency has positive relationship with L.te (lagged)	Result is significant (p>000) and supported by OLS, FE, DC, 2SLS and GMM models.
H_5	Wealth maximizing technical efficiency has positive relationship with Consumer Price Index	Result is significant (p>000) and supported by OLS, FE, DC, 2SLS and GMM models.
H_6	Wealth maximizing technical efficiency has negative relationship with Export	Except for export which is negative in GMM may be due to the outflow of resources from a country. Subsequent study may reveal more insight.
H_7	Wealth maximizing technical efficiency has negative relationship with Exchange Rate, Broad money and Import	Result is significant (p>000) and supported by OLS, FE, DC, 2SLS and GMM models
H_8	Wealth maximizing technical efficiency has negative relationship with Broad money	Result is significant (p>000) and supported by OLS, FE, DC, 2SLS and GMM models
H_9	Wealth maximizing technical efficiency has negative relationship with Import	Result is significant (p>000) and supported by OLS, FE, DC, 2SLS and GMM models

5. Conclusion

In the end, it can be recommended that a country should not put it concentration only on increasing GDP as it has a negative relationship with wealth efficiency. It does not mean that GDP is decreasing wealth rather wealth is increasing at a decreasing rate. That is why other contributory variables like the imports, money supply, exchange rate should be reduced to the extent possible to be more efficient in maximizing its wealth. If a country can do so, it will emerge as a strong wealthy nation in near future as the study indicates. Determinants of the wealth efficiency could be the major factors to be considered during policy formulation for a country. Import demotivating strategies and policies will enable a nation to be more wealthy compare to others. Besides, a country should keep it in mind that it should continue its excellence in increasing its efficiency in wealth maximization as the past year's level of efficiency is positively affecting the current year's efficiency. Other relevant variables found significant according to the hypotheses which are impacting the wealth efficiency should also be considered sincerely. These things indicate that policy makers may take a look at these results before revising their policies to increase or decrease the amount of any variable with an aim to maximize their wealth. Also, emphasis may be put on effective use of the productive labor and capital rather increasing more production it may not be suitable to come up with higher wealth in long run.

5.1 Theoretical Implications of the study

This paper contributed in the relevant theories in many ways. Firstly, wealth maximization theory was mainly used at the firm level and has not been used at the country context before [55-59]. This paper has extended the wealth maximization theory at country level [60]. Secondly, it has predicted and shown the technical efficiency like earlier studies on TFP as dependent variable based on GDP covariates [61-64]. Thirdly, it has scrutinized and identified the nature and magnitude of impacts of the factors affecting wealth efficiency of a nation. The joint use of SFA and GMM models in analyzing the efficiency can be widely used in academic arena [65]. Also, the concept of wealth efficiency and its determinants can be used in broad theoretical discussion of the economic world in upcoming future. After establishing the findings of the study about how wealth maximization can be the better economic indicator alongside GDP, the economic arena would be assisted to think about the importance of wealth as an alternative to GDP. More and more concentration would-be put-on wealth maximization besides GDP growth rate as it will ensure sustainable future for the economy. Also, a global sense of wealth based economic evaluation will draw attention at large.

5.2 Practical and Managerial Implications

The study's main finding is that GDP does not inherently increase the effectiveness of wealth maximization for a country. This finding will show pathways for

economists to rethink about the policy formulation of a country. After establishing the findings of the study about how wealth maximization can be the better economic indicator alongside GDP, the economic arena would be assisted to think about the importance of wealth besides GDP. Society as a whole be benefited by the findings as it will create a sense of wealth rather production which will lead to set up a normative view towards the development of a nation. In addition to the GDP growth rate, more and more concentration will be placed on wealth maximization as it would ensure the economy's sustainable future. Also, a global sense of wealth based economic evaluation will draw attention at large.

5.3 Limitations of the Research and Future Research Opportunities

Data were not collected for all the countries of the world because of the unavailability in the database. Also, more than 10 years' data would have been more conclusive combined with more countries in the study would ensure the correctness of the findings. In addition, data had to be converted for making it suitable for analysis which may lead to discrepancies. Many variables have been added besides existing literature in study. Nevertheless, many other variables have been untouched in this research which could be addressed in future researches.

Future study may be conducted on finding out new determinants of wealth efficiency besides the variables identified by the current study. Studies on factors affecting sustainable wealth maximization, ranking of countries with efficiency index on wealth, green wealth index creation through big data analytics and wealth based real time exchange rate fluctuation linkage establishing could be great for future research in this area. As, prediction of wealth based real time exchange rates would help in reduction of exchange rate disparity among the countries of the world. Besides, wealth based gini-coefficient calculation would be a great tool to realize the wealth inequality among the counties of the world also among the people of a country. Study on global wealth to identify the fair share of every man on earth could open the reality of wealth holding by the people of the world. Impact of mutually beneficial trades on wealth maximization could complement the existing literature as well. The effect of good governance on wealth maximization can also be studied in future researches.

References

[1] Costanza, R., et al., Development: Time to leave GDP behind. Nature, 2014. 505(7483): p. 283-285.
[2] Durand, M., The value of lands and its contribution to wealth, in Eurostat-OECD compilation guide on land estimation, M. Durand, Editor. 2008, OECD: Luxembourg. p. 143-145.
[3] Posner, R.A., Wealth Maximization Revisited. 2014. p. 277-297.
[4] Dasgupta, P., National Wealth. Population and Development Review, 2013. 38: p. 243-264.
[5] Smith, A., An inquiry into the nature and causes of the wealth of nations. 1952, Chicago U6: Encyclopædia Britannica.
[6] O'Sullivan, M., Global Wealth Databook 2018, in Credit Suisse Research Institute. 2018, Credit Suisse AG. p. 1-167.
[7] De la Fuente-Mella, H., A.M. Vallina-Hernandez, and R. Fuentes-Solís, Stochastic analysis of the economic growth of OECD countries. Economic Research-Ekonomska Istraživanja, 2019: p. 1-14.
[8] Škuflić, L. and M.J.E.r.-E.i. Družić, Deindustrialisation and productivity in the EU. 2016. 29(1): p. 991-1002.
[9] Marx, K. and F. Engels, Wage-labor and capital. 1902: New York Labor News Company.
[10] Dill, A., 'Wealth beyond GDP–composing a National Commons Product. Basel, 2009. 4: p. 2012.
[11] Van Beveren, I., TOTAL FACTOR PRODUCTIVITY ESTIMATION: A PRACTICAL REVIEW. Journal of Economic Surveys, 2012. 26(1): p. 98-128.
[12] Ray, S.C., Data Envelopment Analysis: Theory and Techniques for Economics and Operations Research. 2004, Cambridge: Cambridge University Press.
[13] Aigner, D., C.K. Lovell, and P.J. Schmidt, Formulation and estimation of stochastic frontier production function models. Journal of econometrics, 1977. 6(1): p. 21-37.
[14] Syverson, C., What Determines Productivity? Journal of Economic Literature, 2011. 49(2): p. 326-365.
[15] Danquah, M. and B. Ouattara, COMPARISON OF STOCHASTIC FRONTIER APPROACHES FOR ESTIMATING NATIONAL EFFICIENCY: AN APPLICATION TO SUB-SAHARAN AFRICAN COUNTRIES. Journal of Economic Development, 2018. 43(3): p. 119-142.
[16] Cowell, F., E. Karagiannaki, and A. McKnight, Accounting for Cross-Country Differences in Wealth Inequality. Review of Income and Wealth, 2018. 64(2): p. 332-356.
[17] Fu, S., Y. Liao, and J. Zhang, The effect of housing wealth on labor force participation: Evidence from China. Journal of Housing Economics, 2016. 33: p. 59-69.
[18] Mustre-del-Río, J., Wealth and labor supply heterogeneity. Review of Economic Dynamics, 2015. 18(3): p. 619-634.

[19] Manuelli, R.E. and A. Seshadri, Human capital and the wealth of nations. American economic review, 2014. 104(9): p. 2736-62.
[20] Mihalyi, P. and I. Szelenyi, Wealth and capital: a critique of Piketty's conceptualisation of return on capital. CAMBRIDGE JOURNAL OF ECONOMICS, 2017. 41(4): p. 1237-1247.
[21] Víctor Raúl López, R., N. José Luis Alfaro, and D.N. Peña, Relationship Between Gross Domestic Product (GDP) and Hidden Wealth Over the Period 2000-2008: An International Study. Electronic Journal of Knowledge Management U6 2011. 9(3): p. 259.
[22] Carroll, C.D. and O. Jeanne, A Tractable Model of Precautionary Reserves, Net Foreign Assets, or Sovereign Wealth Funds. 2009, Peterson Institute for International Economics.
[23] Garip, F., The Impact of Migration and Remittances on Wealth Accumulation and Distribution in Rural Thailand. Demography, 2014. 51(2): p. 673-698.
[24] Morck, R.K., D.A. Stangeland, and B. Yeung, Inherited wealth, corporate control and economic growth: The Canadian disease. 1998, National Bureau of Economic Research.
[25] Yang, W., et al., Regional technical efficiency of Chinese Iron and steel industry based on bootstrap network data envelopment analysis. Socio-Economic Planning Sciences, 2017. 57: p. 14-24.
[26] Schut, F.T. and W.H. Hassink, Managed competition and consumer price sensitivity in social health insurance. Journal of health economics, 2002. 21(6): p. 1009-1029.
[27] Sultanuzzaman, M.R., et al., Effects of export and technology on economic growth: Selected emerging Asian economies. Economic Research-Ekonomska Istraživanja, 2019. 32(1): p. 2515-2531.
[28] Minh, N.K., P. Van Khanh, and N.V. Hung, Impacts of Exchange Rate Volatility and FDI on Technical Efficiency—A Case Study of Vietnamese Agricultural Sector. American Journal of Operations Research, 2015. 5(04): p. 317.
[29] Dzeha, G.O., et al., Technical Efficiency and Technical Change in Africa: The Role of Money from the Diasporas. International Journal of Economics, 2018. 10(7): p. 177-177.
[30] Dhyne, E., et al., Multi product firms, import competition, and the evolution of firm-product technical efficiencies. 2017, National Bureau of Economic Research.
[31] Hasan, M.R., et al., Operational efficiency effects of blockchain technology implementation in firms. Review of International Business Strategy, 2020.
[32] Kumbhakar, S.C., H.-J. Wang, and A.P. Horncastle, A practitioner's guide to stochastic frontier analysis using Stata. 2015: Cambridge University Press.
[33] Monkam, N.F., Local municipality productive efficiency and its determinants in South Africa. Development Southern Africa, 2014. 31(2): p. 275-298.

[34] Kaymak, B., D. Leung, and M. Poschke. Accounting for the determinants of wealth concentration in the US. in 2018 Meeting Papers. 2018. Society for Economic Dynamics.
[35] Parente, S.L. and E.C. Prescott, Changes in the wealth of nations. Federal Reserve Bank of Minneapolis Quarterly Review, 1993. 17(2): p. 3.
[36] Greene, W., A stochastic frontier model with correction for sample selection. Journal of Productivity Analysis, 2010. 34(1): p. 15-24.
[37] Chen, T.-j. and D.-p. Tang, Comparing Technical Efficiency between Import-Substitution-Oriented and Export-Oriented Foreign Firms in a Developing Economy. Journal of Development Economics U6 1987. 26(2): p. 277-289.
[38] Wang, R., B. Morley, and J. Ordóñez, The Taylor Rule, Wealth Effects and the Exchange Rate: TAYLOR RULE, WEALTH AND EXCHANGE RATE. Review of International Economics, 2016. 24(2): p. 282-301.
[39] Baharumshah, A.Z. and S.-V. Soon, Demand for broad money in Singapore: does wealth matter? Journal of Economics and Finance, 2015. 39(3): p. 557-573.
[40] Douglas, P., The Cobb-Douglas production function once again: its history, its testing, and some new empirical values. Journal of Political Economy, 1976. 84(5): p. 903-915.
[41] Ahmadzai, H., Crop diversification and technical efficiency in Afghanistan: Stochastic frontier analysis. 2017, CREDIT Research Paper.
[42] Gómez-Bezares, F., W. Przychodzen, and J. Przychodzen, Corporate Sustainability and Shareholder Wealth—Evidence from British Companies and Lessons from the Crisis. 2016. 8(3): p. 276.
[43] Chen, Y.-T., Y.-C. Hsu, and H.-J. Wang, A Stochastic Frontier Model with Endogenous Treatment Status and Mediator. Journal of business & economic statistics, 2018. 38(2): p. 243-256.
[44] Hadri, K., Testing for stationarity in heterogeneous panel data. The Econometrics Journal, 2000. 3(2): p. 148-161.
[45] Moder, K., L. Střelec, and M. Stehlík. Selected issues on robust testing for normality. in AIP Conference Proceedings. 2013. American Institute of Physics.
[46] Lee, L.-F. and W.G. Tyler, The stochastic frontier production function and average efficiency: An empirical analysis. Journal of econometrics, 1978. 7(3): p. 385-389.
[47] Chang, C.-W., et al., Measuring Technical Efficiency and Returns to Scale in Taiwan's Baking Industry—A Case Study of the 85° C Company. Sustainability, 2019. 11(5): p. 1268.
[48] Chen, F. and Y. Zhao, Determinants and Differences of Grain Production Efficiency Between Main and Non-Main Producing Area in China. Sustainability, 2019. 11(19): p. 5225.
[49] Lai, H.p. and S.C. Kumbhakar, Estimation of a dynamic stochastic frontier model using likelihood-based approaches. Journal of Applied Econometrics, 2020. 35(2): p. 217-247.

[50] Pfeffer, F.T. and J. Griffin, Determinants of Wealth Fluctuation: Changes in Hard-To-Measure Economic Variables in a Panel Study. Methoden, daten, analysen, 2017. 11(1): p. 87-108.
[51] Islam, M.A., et al., Financial Development and Foreign Direct Investment—The Moderating Role of Quality Institutions. 2020. 12(9): p. 3556.
[52] Baltagi, B.H., et al., Testing for serial correlation, spatial autocorrelation and random effects using panel data. Journal of Econometrics, 2007. 140(1): p. 5-51.
[53] Boardman, A.E. and R. Murnane, Using panel data to improve estimates of the determinants of educational achievement. Sociology of education, 1979: p. 113-121.
[54] Zulfikar, R. and M. STp, Estimation model and selection method of panel data regression: an overview of common effect, fixed effect, and random effect model. 2019.
[55] Kronman, A.T., Wealth maximization as a normative principle. The Journal of Legal Studies, 1980. 9(2): p. 227-242.
[56] Coleman, J.L., Efficiency, utility, and wealth maximization. Hofstra L. Rev., 1979. 8: p. 509.
[57] Jones, T.M. and W. Felps, Shareholder wealth maximization and social welfare: A utilitarian critique. Business Ethics Quarterly, 2013. 23(2): p. 207-238.
[58] Posner, R.A. and P. Pol'y, Wealth maximization revisited. Notre Dame JL Ethics, 1985. 2: p. 85.
[59] Dobson, J., Is shareholder wealth maximization immoral? Financial Analysts Journal, 1999. 55(5): p. 69-75.
[60] Wittman, D., The wealth and size of nations. Journal of Conflict Resolution, 2000. 44(6): p. 868-884.
[61] Islam, N., Determinants of productivity across countries: an exploratory analysis. The Journal of Developing Areas, 2008: p. 201-242.
[62] Loko, M.B. and M.A. Diouf, Revisiting the determinants of productivity growth: What's new? 2009: International Monetary Fund.
[63] Kim, Y.E. and N. Loayza, Productivity and its determinants: Innovation, education, efficiency, infrastructure, and institutions. Unpublished Working Paper, 2017.
[64] Kim, D., D. Lee, and K.-Y. Jeong, A New Approach to Measuring a Multidimensional Productivity Index: An Application for 60 Selected Countries. Global Economic Review, 2018. 47(3): p. 270-288.
[65] Hasan, M.R., et al., Operational efficiency effects of blockchain technology implementation in firms. Review of International Business Strategy, 2020.