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Entrepreneurship and Sustainable Development: Unlocking Genuine Savings through Innovation, Green Energy and Finance

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Abstract

This research investigates the role of entrepreneurship in sustainable development through innovation, renewable energy, and financial inclusion in 30 developing countries over the period of 2010-2023. The application of panel fixed effects and system GMM estimations in this study pointed out trade liberalization and the development of infrastructure, especially electricity access, as the main factors of the genuine savings, which is a proxy for sustainable wealth creation. The study revealed that entrepreneurship has an uplifting yet statistically insignificant influence, meaning that its role is very much depended on the presence of a good institutional and financial environment. The results advance the idea that the coupling of entrepreneurship with technology and green finance policies will be capable of boosting sustainability in the long run. Authorities must bolster the integration of trade, infrastructure and finance that breed entrepreneurial activities in line with sustainable development goals.

Keywords: Entrepreneurship; Sustainable Development; Innovation; Renewable Energy; Genuine Savings.

Introduction

Sustainable development continues to be a major challenge for the twenty-first century. Emerging economies are still faced with the task of developing their economies, but in a way that the natural and social resources would be available for the future generations. Genuine savings, or adjusted net savings, have been recognized as a significant factor of sustainability due to the fact that they incorporate all human capital investments, resource depletion and environmental degradation. A positive and stable level of genuine savings signals that an economy is not only producing wealth but also preserving its capacity to sustain that wealth over time (World Bank, 2024).

The potential of entrepreneurship to promote sustainability is becoming more and more important alongside its widely recognized role as a driver of innovation and productivity. Liu et al. (2022) state that among the different ways to support sustainable development, the application of new products and processes by the entrepreneurs such as reducing the environmental impacts, better resource management, and making the clean technologies widely available are the key ones. Green growth is the ultimate adoption of the idea that a sustainable world is a good business. At the same time, solar power and wind power are two areas where the renewables energy played its role by reducing the environmental impact and giving the companies a chance to be more cost-efficient (Sovacool et al., 2021). A financial system is also a very important factor that moderates these issues. When entrepreneurs have the necessary funds, they are more likely to invest in new, less energy-consuming technologies, and this leads to the emergence of a new entrepreneurship-innovation-sustainability nexus (Endeavor Insights, 2022). These conditions create a vibrant system of entrepreneurship leading to innovation, adoption of renewable energy promoting sustainability, and finance determining the strength of these relationships, all contributing to genuine savings which is an indicator of long-term economic resilience.

The conceptual framework of this research places entrepreneurship at the heart of sustainability. Sustainability is the outcome of a chain reaction that starts with entrepreneurship and its related effects of innovation and higher acceptance of renewable energy and resource efficiency. Through these channels, the sustainability of wealth creation is revealed via genuine savings. In addition, this correlation is affected by the financial development which serves as a mediator by either facilitating or restricting the movement of money into innovation and green projects.

Entrepreneurship → Innovation → Renewable Energy → Genuine Savings
↑
Finance (moderating effect)

This study focuses on 30 emerging economies observed between 2010 and 2024. This period includes major global challenges, financial crises, energy transitions, and the rise of sustainability discussions. The central aim is to evaluate whether entrepreneurship contributes to genuine savings and whether this effect is moderated by access to finance and supported by innovation. In doing so, this study connects two important debates: the role of entrepreneurship in economic growth and the role of institutions and finance in sustainability.

The rest of the paper will be organized in the following manner. The second section gives a review of the previous literature on entrepreneurship, sustainability, and finance. The third section outlines the data, variables, and econometric methods. The fourth section shows and talks about the empirical findings. The fifth section ends the paper with main implications and future research directions.

Literature Review

The entrepreneurs, as the main players in economic change, have been repeatedly pointed out in the literature on entrepreneurship and development for their substantial role in the economy. In his famous book "The theory of economic development," Joseph Schumpeter (1934) characterized entrepreneurship as the source of innovation and creative destruction that would henceforth dramatically reshape the whole economy with new products and processes. Current studies such as that by Kuckertz and Brändle, (2020) have also acknowledged the same idea by declaring entrepreneurship a crucial factor for both economic growth and sustainability in their evaluation of the present day. As a consequence, the practices of the entrepreneurs lead to an increase in productivity, the adoption of cleaner technologies, and the more effective utilization of resources, all of which result in wealth accumulation and the subsequent long-term development of the economy. The present study draws from these conclusions and thus, posits that, by investing in the right and sustainable way, the activity of entrepreneurship will direct positively to the genuine savings of the country.

H1: Entrepreneurship has a positive effect on genuine savings in emerging economies.

Innovation plays a major role in a direct channel through which the activity of entrepreneurs can lead to the new green economy. Through innovation, the new green economy, and the new technologies that come along with it, the new economy would be efficient in resource use so that the emissions will be lower and the industrial transformation will be green (Liu et al., 2022; Callegari et al., 2022). On the other hand, a non-polluting energy base—the access to electricity—allows all the possible sectors of the economy to be productive and at the same time, the innovation is done in those sectors. The innovation is well supported by the electricity access. Moreover, the developed electricity access opens the door to the whole economy for the use of renewable sources; thus, the economy is getting stronger and more capable of creating wealth that would last for a long time (Agyekum et al., 2023; Sovacool et al., 2021). As a matter of fact, this research paper evaluates novelty and green energy supply separately to determine their individual roles in the economy in terms of genuine savings and sustainable development.

H2: Innovation and sustainable energy infrastructure each positively influence genuine savings in emerging economies.

The ability to secure funding is among the major factors that will eventually decide the fate of a business in terms of its impact on the environment and society. Together with financial systems, the investment in clean technologies and green infrastructure is now possible through the availability of cash. Various researchers show that the use of green finance and easier access to credit compel companies to switch to renewable-energy and energy-efficient processes (Zhang et al., 2023; Endeavor Insights, 2022). Thus, financial inclusion and the provision of environment-

friendly funding sources can be seen as the driving forces that would help entrepreneurship to generate sustainable wealth.

H3: Financial development positively moderates the relationship between entrepreneurship and genuine savings.

The literature reveals two important gaps. To begin with, the majority of past research has treated entrepreneurship, green finance, innovation, or genuine savings separately rather than evaluating their joint impacts through a unified empirical framework. Moreover, even though some reviews sum up sustainable entrepreneurship, there are still fewer empirical studies that measure the impact of entrepreneurship on national-level wealth accounting indicators like genuine savings. This research fills these gaps by not only estimating the impact of entrepreneurship on genuine savings but also by analyzing whether the process is influenced by innovation, sustainable energy infrastructure, and financial development in a panel of emerging markets.

Materials and Methods

This study employs a quantitative panel data approach to examine the roles of entrepreneurship, innovation, green energy, and finance in shaping genuine savings in emerging economies. The dataset covers 30 emerging economies, including Pakistan, from 2010 to 2023. All variables were obtained from the World Development Indicators (WDI) of the World Bank, ensuring consistency and comparability across countries and years of the study. The dependent variable is Gross Savings as a percentage of gross national income, which serves as a proxy for genuine savings. Entrepreneurship is proxied by the share of self-employed in total employment, and access to electricity (% of population) captures progress in sustainable energy infrastructure. ICT service exports as a share of service exports serve as the innovation proxy, while GDP per capita (constant US$) and trade as a percentage of GDP are included as the control variables. Domestic credit to the private sector acts as a moderator, with an interaction term between self-employment and domestic credit constructed to test whether finance strengthens or weakens the relationship between entrepreneurship and sustainability.

Two econometric methods were played in succession: the Fixed Effects (FE) model and System Generalized Method of Moments (System GMM) estimation. The Fixed Effects technique comes first in the queue, serving to remove the unobserved factors that differ between countries and would distort the results if left unchecked. Literally, the FE model captures these country-specific influences that are constant during the studied period, be they due to differences in institutions, cultural practices, or geographical locations. Besides, it takes into account the common shocks (for instance, financial crises or energy crunches) experienced by all nations and that are specific to the corresponding year. Thus, the estimated coefficients represent variations that occur within the countries over time. Nevertheless, the Fixed Effects estimator presumes that the variables are strictly exogenous and at the same time does not satisfactorily deal with the possible endogeneity

in the situation due to reverse causality and the savings behavior being dynamic. For example, higher savings in previous years may influence current entrepreneurship or trade openness, violating exogeneity assumptions. To address this limitation, the study applies System GMM as the second estimation method. The System GMM estimator, which is credited to Arellano and Bond (1991) and later on Blundell and Bond (1999), is the preferred choice for panel models that are dynamic and whose dependent variable relies on its past values while regressors may be endogenous. This method adopts past levels and differences of the variables as instruments, thereby allowing for consistent estimation even under milder assumptions. Additionally, System GMM is the right approach in cases where the panel consists of a large number of cross-sectional units (in this case, countries) and a relatively small time dimension, just like in this particular research (30 countries in 14 years).

Results and Discussion

Table 1 reports the fixed effects estimates of gross savings.

Table 1

Fixed Effects Estimates of Gross Savings

Variable	**Coefficient**	**Std.Error**	**t-value**	**p-value**	**Significance**
Self-employed	0.2274	0.2006	1.134	0.258	
Access Electricity	0.2342	0.0985	2.378	0.018	**
ICT Exports	0.0297	0.0303	0.980	0.328	
GD Ppc	0.0004	0.0004	1.030	0.304	
Trade	0.0852	0.0394	2.163	0.031	**
Domestic Credit	-0.0189	0.0568	-0.332	0.740	
Self-employed* Domestic Credit	-0.0003	0.0010	-0.304	0.761	

*Note. Robust standard errors in parentheses. ***p < 0.01, **p < 0.05, p < 0.10.*

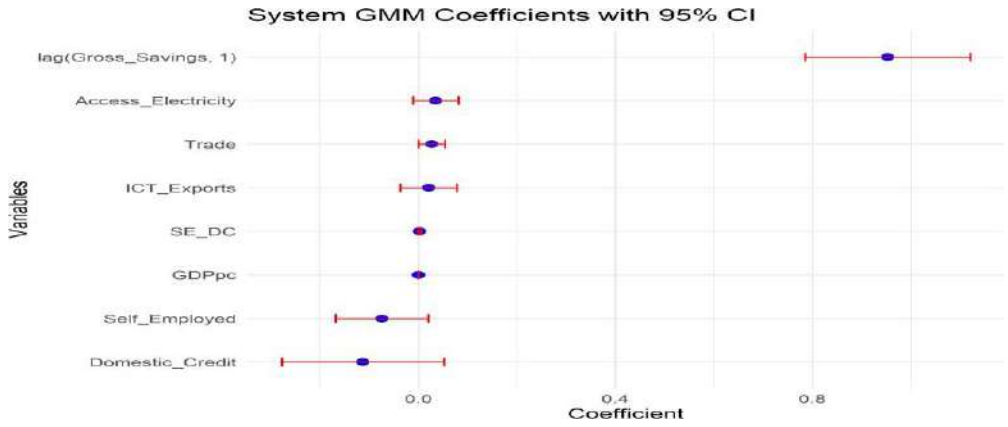
Table 2

System GMM Estimates of Gross Savings

Variable	Coefficient	Std. Error	t-value	p-value	Significance
lag(Gross_Savings,1)	0.9525	0.0853	11.1633	6. 17E-29	***
Self_Employed	-0.0741	0.0481	-1.5394	0.1237	
Access_Electricity	0.0350	0.0235	1.4864	0.1372	
ICT_Exports	0.0206	0.0295	0.7002	0.4838	
GDPpc	0.000007	0.00018	0.0388	0.9690	
Trade	0.0272	0.0137	1.9857	0.0471	**
Domestic_Credit	-0.1124	0.0838	-1.3413	0.1798	
SE_DC	0.0023	0.0017	1.3513	0.1766	

Note. *p < 0.10, **p < 0.05, ***p < 0.01.

Figure 1. GMM Estimates Visualization



This figure displays the dynamic effects of entrepreneurship and finance on genuine savings. It is generated directly from the GMM output in R.

The dataset was subjected to both the Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests for a thorough examination of the stationarity of all variables. ADF test results yield consistent p-values of 0.01 across the board, which leads to the conclusion that

the null hypothesis of a unit root is rejected and consequently, each series is confirmed to be stationary. In addition, the KPSS test results corroborate the ADF tests: the test statistics for all variables are lower than their 5% critical values, hence the null hypothesis of stationarity is retained. As a result, the entire range of series, that is gross savings, self-employment, access to electricity, ICT service exports, GDP per capita, trade, and domestic credit to the private sector, are non-trend. The findings robustly prove that the data meet the stationarity condition prerequisite for legitimate regression and economical analyzing techniques.

In the case of the dynamic GMM estimation, a series of post-diagnostic tests were conducted to evaluate the validity of the instruments, autocorrelation, and model fit. The Sargan test of overidentifying restrictions gave a chi-square statistic of 12.11 ($p = 0.355$), suggesting that the null hypothesis of valid instruments could not be rejected. The first-order autocorrelation test [AR(1)] resulted in a z-value of –2.876 ($p = 0.004$), which is normal because of first-differencing, while the second-order autocorrelation test [AR(2)] gave a z-value of 0.630 ($p = 0.529$), thus confirming the absence of second-order serial correlation. The Wald test for the joint significance of coefficients was extremely significant ($\chi^2 = 13{,}221.22$, $p < 0.001$), which supports the idea that the explanatory variables together account for a large part of the variation in gross savings. All these diagnostics, in a way, validate the reliability of the GMM estimates and at the same time confirm the robustness of the model as a whole.

The Fixed Effects estimation (Table 1) indicates that, out of the investigated variables, electricity access and trade openness are the ones that have the most significant positive influence on the gross savings at the 5% significance level. Increased electricity access means more sustainable energy infrastructure, which in turn, leads to more productive and economically efficient activities thus, more savings capacity. Likewise, the increase in trade openness leads to the global market integration, and it is through this integration that one can get more competitive and accumulate more capital.Although self-employment and ICT exports positively impact the economy, their coefficients are still not statistically significant. Their expected signs turned out to be the same as theoretical predictions, which indicates that their influence on sustainable savings could be through indirect or long-term channels. The negative coefficients associated with domestic credit and the interaction term with self-employment, although statistically insignificant, point to the fact that

financial sector expansion will not automatically result in increased savings unless the funds are directed to productive or sustainable activities.

The System GMM estimation (Table 2) gives more clarity regarding this issue. The lagged dependent variable's coefficient (Gross Savings$_{t-1}$) is positively and highly significant ($\beta = 0.9525$, $p < 0.01$), meaning that there is a very strong persistence in the savings behavior over time—those economies that have saved more in the past are likely to keep that performance. The trade openness variable also turned out to be significant and positively associated with savings ($p < 0.05$), thus emphasizing its strong role in the saving improvement process across both static and dynamic approaches. Other variables like entrepreneurship, innovation, energy access, and domestic credit which are theoretically consistent in their signs still remain statistically insignificant, meaning that their effects may require the support of complementary institutions or policies for them to be reflected in savings outcomes.

In sum, the results imply that the savings behavior in the emerging economies is mainly influenced by trade integration and previous savings performance, while infrastructure (electricity access) also plays a role under static specifications. The limited impact of entrepreneurship, innovation, and finance may be due to structural limitations, different institutions, or the time it takes for these factors to affect real savings. One key point is that the diagnostic checks affirm that the model is correctly specified, the instruments are valid and the estimators are consistent, thus giving confidence in the robustness of these conclusions.

Conclusion

The relationship between entrepreneurship and sustainable wealth accumulation, as measured by gross savings, was explored in this research analysis which considered a panel of thirty emerging economies for the period 2010–2023. The Fixed Effects and System GMM methods were used for the estimation of the model, which included self-employment, ICT service exports, access to electricity, trade openness, and domestic credit as independent variables while controlling for per capita income. The empirical evidence points out that past savings behavior (persistence) and trade openness across countries are the most robust predictors of gross savings. In the Fixed Effects estimation, access to electricity is also positively related to and statistically significant in

association with gross savings, while entrepreneurship measured as self-employment share, innovation, and domestic credit have economically reasonable signs but their lack of statistical significance in both static and dynamic specifications.

These results have provided theory with twofold contributions. One, they show the nuanced role of entrepreneurship in national-level wealth accounting: entrepreneurship does not automatically lead to higher national genuine savings in absence of market integration and infrastructure. Two, the results highlight the primary role of dynamic persistence in savings behavior—a finding that is in line with macroeconomic adjustment models where past wealth accumulation determines future saving capability. These three insights combined imply that the positive impact of entrepreneurship on sustainability is not direct but rather through structural and institutional factors.

From both a practical and policy standpoint, the data indicate clear priorities for government to make changes that would benefit the national wealth in the long run. It seems that policies that support trade integration and invest in energy infrastructure (accessible electricity for all) will bring about better and longer-lasting savings effect in the country. Meanwhile, the introduction of innovations in the areas of financial instruments (e.g., green finance and directed credit programs) and policies that transport innovation into fruitful, ecological business models must be done along with efforts to uplift entrepreneurship. To put it differently, the policies for entrepreneurship work most effectively when connected with a wider range of reforms in infrastructure, markets, and finance. The research has a number of limitations that give rise to new areas of study. To start with, the application of large, country-level proxies (self-employment for entrepreneurship, ICT service exports for innovation, and access to electricity for sustainable energy infrastructure) may mask the differences among sectors; research on specific firms or sectors could uncover the most direct ways through which entrepreneurship influences sustainability outcomes. Another point is that measuring the financial development in terms of total domestic credit does not classify the green finance instruments; the next studies should measure the green finance (green bonds, sustainability-linked loans) and credits for environmentally friendly investments directly. The temporal span (2010–2023) includes the effects of different global shocks and transition dynamics; researchers might consider using longer panels and different estimation strategies (panel

cointegration, error-correction models) to separate short-run from long-run effects more effectively. Lastly, the testing of institutional factors and policy implementation capacity in future research could be done more explicitly.

In conclusion, the findings of the current research point out that although entrepreneurship has the potential to be a significant part of a sustainable development strategy, its national effectiveness is heavily reliant on certain additional factors—especially openness to trade, modern energy infrastructure, and financial instruments that direct the activities of entrepreneurs towards both productive and environmentally friendly investments. Thus, it is very important to create a conducive environment that supports these factors in order to turn the energetic and innovative spirit of entrepreneurs into lasting savings and wealth that can be shared by future generations.

References

Agyekum, E. B., Adebayo, T. S., Bekun, F. V., & Agboola, M. O. (2023). Energy transition and environmental sustainability in Africa: The role of renewable energy and innovation. *Renewable Energy, 205*, 218–230. https://doi.org/10.1016/j.renene.2023.01.042

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies, 58*(2), 277–297. https://doi.org/10.2307/2297968

Blundell, R., & Bond, S. (1999). GMM estimation with persistent panel data: An application to production functions. *Econometric Reviews, 19*(3), 321–340. https://doi.org/10.1080/07474939908800400

Callegari, B., Bianchini, A., & Pellegrini, M. (2022). Innovation and the green economy: Exploring the link between technological innovation and sustainable development. *Journal of Cleaner Production, 370*, 133537. https://doi.org/10.1016/j.jclepro.2022.133537

Endeavor Insights. (2022). *Entrepreneurship, innovation, and sustainability: The finance connection*. Endeavor Insight Research Report. https://endeavor.org/insights

Kuckertz, A., & Brändle, L. (2020). Entrepreneurship and the sustainability transformation: An analysis of sustainable entrepreneurial intentions. *Journal of Cleaner Production, 271*, 122529. https://doi.org/10.1016/j.jclepro.2020.122529

Liu, Z., Zhang, H., & Li, J. (2022). Green innovation and sustainable entrepreneurship: Evidence from emerging economies. *Technological Forecasting and Social Change, 175*, 121385. https://doi.org/10.1016/j.techfore.2021.121385

Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Harvard University Press.

Sovacool, B. K., Griffiths, S., Kim, J., & Bazilian, M. (2021). Climate change mitigation through energy transitions: A review and agenda for research. *Energy Research & Social Science, 80*, 102212. https://doi.org/10.1016/j.erss.2021.102212

World Bank. (2024). *World development indicators (WDI)*. World Bank Group. https://databank.worldbank.org/source/world-development-indicators

Zhang, X., Wang, C., & Zhou, D. (2023). Green finance and sustainable entrepreneurship: The moderating role of financial inclusion. *Journal of Environmental Management, 336*, 117669. https://doi.org/10.1016/j.jenvman.2023.117669