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NGHIÊN CỨU TÁC ĐỘNG CỦA THUẾ THU NHẬP DOANH NGHIỆP VÀ CHI TIÊU CHO NGHIÊN CỨU VÀ PHÁT TRIỂN ĐẾN HIỆU SUẤT ĐỔI MỚI: BẰNG CHỨNG THỰC NGHIỆM TỪ CÁC QUỐC GIA THU NHẬP TRUNG BÌNH CAO

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Tóm tắt

Thuế thu nhập doanh nghiệp và chi tiêu cho nghiên cứu và phát triển (R&D) đóng vai trò quan trọng trong việc thúc đẩy năng lực đổi mới sáng tạo của một quốc gia. Trong khi phần lớn các nghiên cứu trước đây chủ yếu tập trung vào các nền kinh tế phát triển, nghiên cứu này nhằm làm sáng tỏ tác động của thuế thu nhập doanh nghiệp và chi tiêu R&D đối với hiệu suất đổi mới tại 21 quốc gia thu nhập trung bình cao trong giai đoạn 2011-2022. Bằng cách sử dụng các phương pháp hồi quy Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), Random Effects Model (REM) và Generalized Least Squares (GLS), nghiên cứu cung cấp bằng chứng thực nghiệm về mối quan hệ giữa chính sách thuế, đầu tư R&D và năng lực đổi mới quốc gia. Kết quả chỉ ra rằng thuế suất thu nhập doanh nghiệp cao có tác động tiêu cực đến đổi mới, trong khi các yếu tố như chi tiêu R&D và chất lượng thể chế, được đo lường thông qua chỉ số pháp quyền, có ảnh hưởng tích cực đến hiệu suất đổi mới. Dựa trên các phát hiện này, nghiên cứu đề xuất một số khuyến nghị chính sách nhằm tối ưu hóa cơ chế thuế và khuyến khích đầu tư vào R&D, qua đó thúc đẩy hệ thống đổi mới tại các quốc gia thu nhập trung bình cao.

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Từ khóa: thuế thu nhập doanh nghiệp, chi tiêu R&D, đổi mới sáng tạo, quốc gia thu nhập trung bình cao

THE IMPACTS OF CORPORATE TAX AND R&D EXPENDITURE ON INNOVATION PERFORMANCE: EMPIRICAL EVIDENCE FROM UPPER-MIDDLE-INCOME COUNTRIES

Abstract

Corporate tax and research and development (R&D) expenditure are widely recognized as key drivers of a nation's innovation capacity. While much of the existing literature focuses on high-income economies, this research shifts attention to the distinctive fiscal and innovation dynamics of upper-middle-income nations. The paper conducts an empirical study on the impact of corporate tax rates and R&D spending on innovation performance in 21 upper-middle-income countries over the period from 2011 to 2022, utilizing Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), Random Effects Model (REM) and Generalized Least Squares (GLS). The results indicate that higher corporate income tax rates tend to have a restrictive effect on innovation, whereas factors such as the rule of law index and R&D investment contribute positively to innovative performance. Following the investigation, this study provides several practical recommendations for policymakers for better management of the innovation system in upper-middle-income countries.

Keywords: corporate tax, R&D expenditure, innovation, upper-middle-income countries

1. Introduction

In the past few years, innovation has played a central role in economic development, particularly in emerging economies. As the world becomes globalized and technology advances quickly, a nation's capacity to create and maintain innovation has emerged as a pivotal indicator of sustainable economic achievement. The World Intellectual Property Organization (2024) defines innovation as a combination of inputs (such as research institutions and human resources) and outputs (such as knowledge, technology, and creativity). In other words, innovation refers to the creation, development and implementation of new ideas, processes, and technologies for productivity improvement and economic efficiency (Scott & Bruce, 1994; Janssen, 2000). Solow (1957) and Romer (1990) have opined that technological progress, facilitated by continuous innovation, is the main force behind long-term economic growth. Given this, governments across the world implement policies aimed at promoting innovation, with taxation and research and development (R&D) incentives being among the most widely used policy instruments (WIPO, 2024).

Corporate tax, one of the key instruments of fiscal policy, has been subject to extensive controversy regarding its effect on business investment, economic growth, and innovation. Although taxes are an important source of government revenue, excessive corporate tax rates may put financial pressure on businesses, limiting their ability to invest in innovative activities (Keuschnigg & Ribi, 2010). Conversely, tax incentives targeted at R&D expenditures are

frequently used to encourage firms to invest in research, technological development, and new product creation (Cummins, Hassett, & Hubbard, 1996; Giroud & Rauh, 2019). However, the net effect of corporate tax policies on innovation remains an area of debate, especially in upper-middle-income countries, where economic conditions and institutional factors differ from those of high-income economies.

While previous studies have thoroughly investigated the relationship between taxation, R&D investment, and innovation in developed economies, there remains a lack of empirical evidence from upper-middle-income nations. Existing research focuses on the effects of corporate tax on firm-level innovation, such as patent development (Mukherjee, Singh, & Zaldokas, 2015; Ufuk et al., 2018) or R&D investments (Shao & Xiao, 2019), and tends to ignore overall indicators of national innovation performance. In addition, the efficacy of fiscal policies in stimulating innovation is largely determined by local economic conditions, the quality of governance, and the prevailing institutional arrangements. As a result, understanding how corporate tax and R&D investment influence innovation in upper-middle-income economies is essential for developing effective policy interventions.

Therefore, this study seeks to address an important gap in the literature by investigating the effects of corporate tax rates and R&D expenditure on innovation performance. To achieve this, an empirical analysis was conducted using data from 21 upper-middle-income countries between 2011 and 2022, including Azerbaijan, Argentina, Armenia, Bosnia and Herzegovina, Brazil, Belarus, China, Colombia, Costa Rica, Georgia, Guatemala, Indonesia, Kazakhstan, Mexico, Malaysia, Mongolia, Paraguay, Peru, South Africa, Thailand, and Turkiye. The research employs the Global Innovation Index (GII) as a measure of national innovation performance and applies various econometric models, namely Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), Random Effects Model (REM) and Generalized Least Squares (GLS) to analyze the relationship between corporate tax, R&D investment, and innovation. Additionally, the research explores how governance quality, particularly the rule of law, influences this relationship. By providing empirical evidence on the interaction between tax policies, R&D spending, and innovation in upper-middle-income countries, this paper contributes to ongoing discussions on fiscal policy and innovation. The findings are expected to guide policymakers in designing tax structures that encourage innovation while maintaining fiscal sustainability.

The remainder of this paper is structured as follows: Section 2 reviews the existing literature on corporate tax, R&D investment, and innovation performance, identifies research gaps, and develops research hypotheses. Section 3 describes the data and methodology, detailing the econometric models used in the analysis. Section 4 presents the empirical findings, discusses their implications, and explores their relevance in the context of innovation. Finally, the paper concludes with policy recommendations and broader insights for fostering innovation in upper-middle-income economies.

2. Literature review

2.1 Theoretical overview and empirical evidence

2.1.1 Innovation performance

Schumpeter (1942) introduced the concept of "creative destruction," emphasizing innovation as a continuous cycle of replacing outdated technologies and business models with more efficient alternatives. Schumpeter (1942) defines innovation performance as the ability of a firm, industry, or economy to develop and implement new technologies, products, or processes that significantly reshape economic landscapes and foster industrial transformation. Drucker (1985) expanded on this perspective, highlighting innovation as a strategic necessity for firms to sustain competitive advantages. Stagnation lurks at the firms who fail to innovate, while those successfully adapting will shape the direction of their markets.

From a technological standpoint, Rosenberg (1982) shifts the focus instead to how innovation spreads. He argues that innovation also revolves around applying and diffusing new technologies across industries. Similarly, Abernathy and Clark (1985) expand on this notion, suggesting that existing technologies, when combined into new products or processes, can lead to substantial efficiency improvements. In other words, not all innovation requires radical change sometimes, the most impactful advancements come from refining and recombining what already exists.

2.1.2 Cooperate tax and innovation performance

On the one hand, many studies have explored the distinct effects of corporate tax on innovation. Mukherjee, Singh, and Žaldokas (2017) found that higher corporate taxes are positively correlated with a reduction in the quantity and quality of innovation outputs, measurable by the number of patents and citations. Their research suggests that increased tax burdens may lead firms to curb R&D expenditures, hence hindering innovation.

Similarly, Atanassov and Liu (2019) demonstrated that elevated corporate tax rates can worsen capital shortage, especially for firms reliant on external financing for R&D activities. Their findings deduce that such constraints can induce a fall in innovative outputs, since firms may be unable to sustain necessary investment levels under higher tax regimes.

On the other hand, tax incentives specifically designed to encourage R&D investment have been proven to positively impact innovation performance. For instance, a study examining the impact of R&D tax credits across various countries implied that such incentives effectively stimulate corporate innovation, with firms increasing their R&D spending in response to tax benefits (Bloom, Griffith, and Van Reenen, 2002).

2.1.3 R&D expenditures and innovation performance

Endogenous growth theory posits that economic growth is driven primarily by internal factors such as technological advancements and knowledge spillovers resulting from R&D investments (Romer, 1990). When companies put money into developing new ideas, they're

not just improving their own operations—they're also adding to the broader pool of knowledge and innovation that fuels economic growth.

Empirical studies confirm a positive correlation between R&D expenditures and innovation performance. For instance, a panel data analysis of selected OECD countries revealed a bidirectional causality between R&D spending and high-tech product exports, as well as between R&D expenditures and patent applications. This finding underscores the active role that R&D investments play in fostering innovative development (Sözen, İ. and Tufaner, M.B., 2020).

What is more, further research indicates that the capitalization of R&D expenditures can serve as a leading indicator of future innovation performance. A study analyzing data under International Financial Reporting Standards (IFRS) found that the rate at which R&D costs are capitalized is positively associated with subsequent patent applications and citations. This suggests that when firms capitalize R&D expenses, reflecting a high likelihood of successful outcomes, it correlates with enhanced innovative outputs (Kostakis and Sander, 2024).

Kostakis and Sander (2024) also found that capitalized R&D expenditures serve as a leading indicator of future patent applications, reflecting the predictive value of R&D investments. In industries with intensive R&D demands, such as pharmaceuticals, sustained investment in innovation has been linked to stronger financial performance (Asad & Homolka, 2023). Additionally, Griliches (2000) noted that R&D efforts generally lead to higher productivity levels, though the magnitude of this effect varies by methodology and industry.

2.1.4 Rule of law and innovation performance

A transparent and enforceable legal framework is essential for fostering an innovation-friendly environment. A robust legal system underpins the confidence of individuals and firms to invest in innovative endeavors. The assurance of secure property rights and effective contract enforcement reduces uncertainties associated with R&D investments, thereby encouraging the allocation of resources toward innovation (Acemoglu and Johnson, 2005). Moreover, the protection of IPRs through specialized judicial mechanisms deters infringement and fosters a competitive market, incentivizing firms to pursue novel developments.

Empirical evidence highlights the positive impact of legal protections on innovation outcomes. A good example of this is China's Intellectual Property Courts (IPCs), established in Beijing, Shanghai, and Guangzhou in 2014. These courts provided a natural test case for studying the effects of stronger legal protections on firm performance. Research found that companies operating in these regions experienced significant growth, largely because they could now rely on better legal enforcement of their intellectual property rights (Hao et al., 2024). Specifically, the policy effect was more pronounced among firms with previously low innovation capacity and those with greater reliance on external financing.

Further research highlights the role of legal frameworks in shaping innovation systems. For instance, China's establishment of Intellectual Property Courts (IPCs) in 2014 led to improved firm performance due to stronger intellectual property enforcement (Hao et al., 2024). Stojčić, Vujanović, and Baum (2024) further argued that well-designed legal frameworks help bridge regulatory gaps, fostering environments conducive to innovation. Additionally, Lee (2023) contended that procedural innovations in legal systems strengthen civil rights protections, creating an atmosphere where risk-taking and creativity thrive.

2.2 Research Gap and Hypothesis Development

Research has shown that R&D expenditure, corporate tax, and the rule of law influence innovation performance across different economic contexts. Despite these concrete relationships, several critical research gaps remain in the literature. Most existing studies have examined these variables individually, focusing either on the effect of R&D spending on innovation (Sözen, İ. and Tufaner, M.B., 2020) or on how corporate tax policies affect firm innovation strategies (Mukherjee, Singh, and Žaldokas, 2017). What is missing is a comprehensive analysis of how these three elements interact particularly in upper-middle-income countries (UMICs), where economic structures and policy environments differ from those of high-income nations.

So far, research has primarily centered on OECD countries, the United States, and China, where innovation ecosystems are already well-established (Dechezleprêtre et al., 2016; Balsalobre-Lorente et al., 2021). There is still a considerable gap in understanding how these relationships unfold in UMICs, where the economic structure, legal frameworks, and fiscal policies differ significantly from high-income countries. Addressing this gap is crucial, as findings from developed nations may not directly apply to emerging economies.

While some existing literature reviews, such as Peng Qiong et al. (2024) and Aulia Kartika Putri et al. (2023), provide valuable syntheses of prior research, they do not contribute original statistical analysis. Their findings are entirely based on secondary sources, limiting the ability to establish causal relationships or derive data-driven policy recommendations. To bridge this gap, this study aims to conduct an original econometric analysis, leveraging panel data from UMICs to provide empirical evidence on the interaction between corporate tax, R&D investment, and the rule of law. After examining the interplay between corporate tax, R&D expenditures, and legal institutions and how they influence innovation determinants, the group of authors will offer policy recommendations applicable to upper-middle-income economies, where innovation policies must balance fiscal constraints, legal reforms, and investment incentives.

Based on the literature review, the authors of this paper propose the following hypotheses:

- **H1 (+):** R&D expenditure positively influences innovation performance.
- **H2 (-):** Corporate tax rates negatively influence innovation performance.
- **H3 (+):** The rule of law positively influences innovation performance.

3. Research Methodology

3.1 Research model

Based on the previous studies and research hypothesis in Section 2, we propose to construct a quantitative model as follow:

$$\text{LogIn}_{i,t} = \beta_0 + \beta_1 \times \text{RDE}_{i,t} + \beta_2 \times \text{CT}_{i,t} + \beta_3 \times \text{RL}_{i,t} + \varepsilon_{i,t}$$

where $\text{LogIn}_{i,t}$ represents the logarithm of the Global Innovation Index (GII) for country i in year t ; $\text{RDE}_{i,t}$ stands for R&D expenditure as a percentage of GDP for country i in year t ; $\text{CT}_{i,t}$ represents the statutory corporate tax rate in country i year t ; $\text{RL}_{i,t}$ denotes the Rule of Law Index for country i in year t ; β_0 is the coefficient of logarithm of innovation; β_1 , β_2 , β_3 is respectively the coefficient of R&D expenditure, corporate tax rate, and Rule of Law Index; $\varepsilon_{i,t}$ is the error term, accounting for unobserved factors influencing innovation that are not captured by the model.

By logging the Global Innovation Index, the research is viable to investigate the non-linear relationship between the independent variables and the dependent variable. The log transformation of the dependent variables, allows the coefficient to be interpreted as percentage changes, which means one unit change in R&D expenditure, corporate tax rate, and Rule of Law Index leads to a percentage change in the Global Innovation Index.

3.2 Research data

The study sample comprises panel data collected from 21 upper-middle-income countries between 2011 and 2022, including Azerbaijan, Argentina, Armenia, Bosnia and

Herzegovina, Brazil, Belarus, China, Colombia, Costa Rica, Georgia, Guatemala, Indonesia, Kazakhstan, Mexico, Malaysia, Mongolia, Paraguay, Peru, South Africa, Thailand, Turkiye. According to the World Bank's income classification, 54 countries are categorized as upper-middle-income. However, some of these countries lacked sufficient data for the period from 2011 to 2022. Consequently, 21 countries with comprehensive datasets were chosen for the analysis. These selected countries are also among the largest economies within the upper-middle-income group, making them ideal for the research. Our study uses the R&D expenditure, corporate tax rate, and rule of law index collected from the World Bank Database (2025), and the Global Innovation Index collected from the The World Intellectual Property Organization (WIPO). Table 1 exhibits the detailed description of the study variables.

Table 1. Summary of variables, datasources, and expectation sign

Variables	Symbols	Measurement unit	Expectation sign	Source
Global Innovation Index	In	Points		WIPO (2024)
R&D Expenditure	RDE	% of GDP	+	World Bank (2025)
Corporate Tax Rate	CT	% of commercial profits	-	World Bank (2025)
Rule of Law Index	RL	Points	+	World Bank (2025)

Source: Author's compilation

3.3 Data Analysis Methods

This study employs descriptive statistics to outline the characteristics of each variable in the model and uses correlation analysis to determine whether any variables are perfectly or linearly correlated, thereby preventing multicollinearity. The analysis is conducted using three models: pooled ordinary least squares (pooled OLS), fixed effects model (FEM), and random effects model (REM). The choice of the optimal model is determined through the Breusch-Pagan test, F-test and Hausman test; the research then follows the FEM estimation method. Furthermore, multicollinearity is assessed using variance inflation factors (VIF). To test heteroskedasticity in FEM, we apply the Wald test and to detect serial correlation in panel data, we apply the Wooldridge test. If any diagnostic issues arise, Generalized Least Squares (GLS) are used to address these problems.

4. Results and discussions

4.1 Descriptive statistics and correlation analysis

Table 2 below presents the descriptive statistics for the variables included in the analysis. It provides descriptive and informative statistics on the indicators and determinants of innovation for the 21 selected upper-middle-income countries over a twelve-year period. The table includes an analysis of the mean, maximum, and minimum values for each variable.

Table 2. Descriptive statistics

Variable	Observation	Mean	Std. Dev.	Min	Max
logIn	251	3.517612	0.1616598	2.879198	4.012773
RDE	223	0.5064295	0.5106816	0.02311	2.4326
CT	252	23.67897	6.891629	10	35
RL	252	-0.3223988	0.4034774	-1.221	0.5833748

Source: Author's calculation

Table 3 shows the correlation coefficients between the independent variables RDE, CT, RL and the dependent variable logIn are positive, indicating a positive relationship with innovation performance. Regarding the correlation between the independent variables, all variables exhibit moderate correlations. Even though the indicators present a high correlation to innovation, this does not cause any multicollinearity problem among the model's representatives.

Table 3. Correlation Matrix

	logIn	RDE	CT	RL
logIn	1.0000			

RDE	0.7416	1.0000		
CT	0.2284	0.2143	1.0000	
RL	0.4937	0.3030	0.0683	1.0000

Source: Author's calculation

4.2 Empirical Findings

4.2.1 Diagnosis tests and regression results

The panel data analysis employed POLS, REM, and FEM models to examine the relationship between key factors and innovation performance across 21 upper-middle-income countries from 2011 to 2022. First, the Pooled OLS model was conducted to estimate the impacts of RDE, CT, and RL on LogIn. The R-squared value was 0.635, indicating that 63.5% of the dependent variable LogIn could be explained by the independent variables, including RDE, CT, and HDI. However, the R-squared value for REM was only 0.038, which suggested that this model explained a much smaller proportion of the variation in LogIn compared to POLS.

Multicollinearity was assessed using the variance inflation factor (VIF), which were all below 1.5 and had a mean of 1.10, which significantly below the critical threshold of 10. As a result, there was no remarkable multicollinearity problem among the variables.

To determine the most suitable model, various statistical tests were conducted. Using the Breusch and Pagan test, the result was given as $\text{Prob} > \chi^2 = 0.0000$, which means that REM is more appropriate than POLS. Additionally The F-test ($\text{Prob} > F = 0.0000$) indicated that FEM is preferable than pooled OLS, while the Hausman test ($\text{Prob} > \chi^2 = 0.0031$) indicated that FEM is more suitable than REM. Based on these results, the three tests mentioned above suggest that the best-fit model for hypothesis testing was FEM.

Table 4. Regression results

Variables	POLS	REM	FEM
RDE	0.189*** (14.51)	0.100* (2.21)	0.171*** (6.91)
CT	-0.00157 (1.71)	0.00640 (1.84)	-0.00314 (1.76)
RL	0.115*** (6.89)	-0.00846 (-0.19)	0.0732* (2.53)
_cons	3.428*** (146.72)	3.317*** (38.19)	3.385*** (73.81)
Observations	222	222	222
R-squared	0.635	0.038	

Source: Author's calculation

Notes: The figures in parentheses are the standard error. *, **, *** representatively implies statistical significance at 10%, 5% and 1%.

4.2.2 Regression result

Additional diagnostic tests were conducted to assess the robustness of the model. The Wald test returned a Prob value of 0.0000 (<0.5), confirming the presence of heteroskedasticity. The Wooldridge test produced a Prob value of 0.0020 (<0.5), indicating serial correlation. Since both heteroskedasticity and serial correlation were present, the Generalized Least Squares (GLS) method was applied for correcting. The final regression results, reflecting these corrections, are presented in Table 5.

Table 5. Regression results after GLS

logIn	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]	
RDE	0.1610677	0.0218749	7.36	0.000	0.1181937	0.2039417
CT	-0.0023846	0.0012023	-1.98	0.047	-0.0047411	-0.0000282
RL	0.090233	0.0179269	5.03	0.000	0.055097	0.1253691
_cons	3.418887	0.0331854	103.02	0.000	3.353844	3.483929

Source: Author's calculation

Analyzing the regression results, we can conclude that except for the corporate tax (CT) variable, all other variables are highly significant at P-value <0.01. Therefore, the hypotheses of the impact of R&D expenditure (RDE) and rule of law (RL) on innovation (logIn) are fully substantiated. Specifically, the regression results performed a positive relationship between RDE and innovation. A 1 unit increase in R&D expenditure leads to 0.1611% increase in innovation (logarithm), assuming other factors remain constant. Similarly, the relationship between rule of law and innovation is positive, as a one-unit increase in RL corresponds to a 0.0902% increase in innovation (logarithm), assuming other factors remain constant.

On the other hand, corporate tax is only statistically significant at the 5% level, which illustrates its little impacts. Corporate tax (CT) has a negative effect on innovation. Innovation declines by 0.0024% for every unit rise in corporate tax.

4.3 Discussion & Policy Implications

4.3.1 Discussions

The findings align with previous published research papers on the impacts of R&D expenditures, corporate tax rates and the rule of law on innovation performance.

The results confirmed the hypothesis H1 that was proposed by the author, which is about the positive relationship between R&D investment and innovation. This supports the theoretical foundation established by Romer's (1990) endogenous growth theory and Sözen and Tufaner (2020). Both relate to R&D expenditures and innovation outputs. Additionally, the positive correlation between R&D investment and financial performance observed in the pharmaceutical industry (Asad & Homolka, 2023) also reinforces the result that R&D investments enhance innovation, and the economic development in general as well.

The strong positive correlation between R&D investment and innovation performance suggests that increased financial support for research and development leads to greater product innovation. This includes introducing new products, enhancing production efficiency, and remaining competitive in global markets. From a macroeconomic perspective, higher R&D spending contributes to long-term economic growth by fostering knowledge creation, improving productivity, and generating high-value employment opportunities. Upper-middle-income countries that prioritize R&D funding are more likely to develop advanced industries and maintain a strong global market position.

The research results also refer to the negative relationship between corporate tax rates and innovation. This not only matches with the hypothesis H2 of the team but also aligns with prior research. Mukherjee, Singh, and Žaldokas (2017) previously found that increased corporate taxes discourage innovation by limiting financial resources available for R&D activities. Atanassov and Liu (2019) demonstrated that high tax rates contribute to financial constraints, particularly for firms relying on external financing. This did hinder the expansion of patenting and technological advancements. All of the information, along with the paperwork of the group of authors, suggests that reasonable tax policies in the field of corporate can help stimulate innovation.

The negative relationship between corporate tax rate and innovation is equivalent to the negative impact of high corporate tax rate, which presents a critical concern for businesses and policymakers. When corporate taxes increase, firms experience reduced profit margins, limiting their ability to allocate funds to research and development. This is particularly detrimental for startups and small to medium-sized enterprises that depend on external financing in terms of innovation projects. Specifically, countries with high corporate tax rates may experience slower patenting activity, fewer technological breakthroughs, and diminished global competitiveness.

Moreover, the study provides empirical support for the hypothesis that the rule of law positively influences innovation. The results align with Acemoglu and Johnson's (2005) argument that strong legal institutions, including secure property rights and effective contract enforcement, create an environment conducive to innovation. This is further supported by analysis of Intellectual Property Courts in China - Hao et al. (2024) - demonstrating that stronger legal practice improves innovation quality, especially among firms with previously low innovation capacity. Additionally, Stojčić, Vujanović, and Baum (2024) also highlight the role of legal and regulatory frameworks in innovation. They emphasized that clear regulatory frameworks reduce uncertainty and encourage long-term investment in innovative activities. These studies strongly confirm that the legal system strengthens firms' incentives to engage in innovative activities.

As a result, a strong legal framework plays a crucial role in fostering innovation by ensuring a stable and predictable business environment. When businesses have confidence in the legal system, they are more willing to invest in research and development as their intellectual property rights are fully protected. Stronger enforcement of intellectual property laws specially supports smaller firms and startups by preventing not only patent infringement but also unfair competition with some of the large corporations.

Overall, the study's findings are consistent with the research team's initial hypotheses. The results found in upper-middle-income countries do not see any outstanding differences compared to the previous study of other authors in different geographical scales in terms of the relationship between innovation and R&D expenditure, rule of law, and corporate tax. If companies put more money into research, they tend to come up with more new ideas and technologies. On the flip side, high corporate tax rates seem to slow innovation down. We also conclude that strong legal systems help encourage innovation. Our results highlight the importance of policies that support R&D spending, keep tax rates at a level that encourage innovation, and strengthen legal protections to create an environment for growing innovation.

4.3.2 Policy Implications

The findings revealed that the R&D expenditure, corporate tax and rule of law have an impact on innovation development in upper-middle-income countries. Given these relationships between variables and innovation (logarithm), strengthening government support for R&D investments and reinforcing the legal framework would foster greater innovation. In contrast, corporate tax would be considered a factor hindering the innovation within these

countries. These results align with previous published research, reinforcing its validity. Because of that, based on these insights, our research team proposes some recommendations to encourage innovation in upper-middle-income countries.

First, the government should pay attention to enhancing R&D investments. Government should increase financial support for R&D initiatives, ensuring that both public research institutions and private enterprises have access to adequate funding. This can be achieved through direct government funding or promoting public-private partnerships. For example, the collaboration between universities, research institutions, and private companies. Additionally, governments should establish grant programs to support startups, small and medium enterprises (SMEs), and potential research projects in emerging products of technology.

Second, a strong legal and regulatory framework is equally essential in fostering innovation. The government should effectively monitor the allocation of public funds, ensuring that government spending on R&D and tax incentives for innovation are distributed reasonably and transparently. This can include stricter oversight mechanisms to track government spending, clear legal guidelines to ensure that the support reaches the research institutions and innovative enterprises. Moreover, the government should also publicly disclose the innovation-related expenditures and introduce independent audits to evaluate the effectiveness of tax allocation.

Third, governments need to reform tax policies to create a more supportive environment for innovation. They can consider adjusting corporate tax structures so that companies are encouraged to invest more in research and development. This could include offering tax deductions or credits for R&D expenses, lowering tax rates on profits earned from patented technologies, or temporarily reducing taxes for startups in high-tech industries. Tax exemption is one of the financial techniques used to promote technological advancement. A new tax system that is compatible with technology enterprises with unique characteristics needs to be designed to develop the governance of expenditure, particularly R&D expenditure, as a necessary input for technology.

5. Conclusion

This study examined the impact of corporate tax rates and R&D expenditure on innovation performance in 21 upper-middle-income countries between 2011 and 2022. Using various econometric models, including Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), Random Effects Model (REM), and Generalized Least Squares (GLS), the analysis revealed three key findings. First, higher corporate tax rates were found to negatively impact innovation, as increased tax burdens limit the financial resources available for firms to invest in research and technological advancement. Second, R&D expenditure played a crucial role in fostering innovation, reinforcing the idea that sustained investment in research leads to technological progress. Third, governance quality, particularly the rule of law, positively influences innovation by creating a stable and predictable environment for businesses to invest in new ideas.

Based on these findings, several policy recommendations are proposed. Governments should strengthen support for R&D by increasing financial resources for research initiatives, facilitating collaborations between public and private sectors, and expanding grant programs targeted at innovation-driven industries. At the same time, corporate tax policies should be designed to strike a balance between fiscal sustainability and innovation incentives. Introducing tax credits or deductions for R&D investments and offering preferential tax rates for businesses operating in high-tech industries could encourage greater investment in innovation. Moreover, strengthening the legal and regulatory framework, such as ensuring strong intellectual property protections and enforcing contract laws, is essential for sustaining long-term innovation.

Despite its contributions, this study has several limitations. The analysis focused on 21 upper-middle-income countries, which may not fully capture the broader global landscape of corporate taxation and innovation. Some countries were excluded due to incomplete or inconsistent data, which may have affected the representativeness of the sample. Additionally, this research relies on national-level measures of innovation performance, such as the Global Innovation Index (GII), which may not fully reflect variations at the industry or firm level. Another limitation is that the paper primarily employed quantitative methods, which, while effective in identifying statistical relationships, do not account for qualitative factors such as firm-specific R&D strategies, managerial decision-making, or cultural influences on innovation. Furthermore, the study does not assess potential lag effects, as tax policy and R&D investments often take time to produce measurable impacts on innovation outcomes.

To address these limitations, future research could expand the dataset by including a broader range of countries and extending the study period to capture long-term trends. A comparative analysis of both lower-income and high-income economies would provide a more comprehensive understanding of how fiscal policies impact innovation in different economic contexts. Additionally, integrating qualitative methods, such as case studies or expert interviews, could offer deeper insights into how firms respond to tax policies and R&D incentives in practice. Further refinements to the econometric models, such as using dynamic panel data techniques or time-series analysis, would also improve the ability to assess delayed effects of policy changes on innovation. Finally, future research could consider additional factors, such as corporate tax structures, government R&D subsidies, and the number of R&D personnel per capita, to gain a better understanding of how fiscal policies shape national and industry-specific innovation performance.

In summary, this study highlights the importance of corporate tax policies, R&D investment, and governance quality in shaping national innovation performance. By implementing well-designed tax structures, increasing financial support for R&D, and strengthening institutional frameworks, policymakers can create an environment that fosters long-term innovation and economic growth in upper-middle-income countries.

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