

Do University-Industry Collaborations Promote Outward Foreign Direct Investments? The Moderating Effect of the Education System

Üniversite-Sanayi İşbirlikleri Dışa Yönelik Yabancı Yatırımları Teşvik Ediyor mu?
Eğitim Sisteminin Düzenleyici Etkisi

Fatih Şahin 

Gümüşhane University, Vocational School of Social Sciences, Gümüşhane / Türkiye

Abstract

University-industry collaborations have gained increasing recognition as a key indicator of innovation ecosystems in recent years. However, existing literature often overlooks the expanding and diversifying roles of universities, focusing primarily on their impact on innovation. This study seeks to address this gap by exploring the effects of university-industry collaborations on outward foreign direct investment (FDI) activities in underdeveloped and developing countries, which face significant disadvantages in terms of technological and innovative resources. Additionally, it examines the regulatory role of the quality of the education system, which is believed to influence the effectiveness of these collaborations in fostering outward FDI. Using a sample of 80 underdeveloped and developing countries, panel regression analysis was conducted on secondary data covering the years 2013-2022. The findings reveal that university-industry collaborations positively influence cross-border investments, with these effects being stronger in countries with higher levels of education expenditures. These positive effects, however, disappear in contexts where education expenditures are low. This study makes important theoretical contributions to the literature on the determinants of outward FDI in underdeveloped and developing countries, highlighting the significance of university collaborations and the education system, in contrast to firm-specific resources. It also provides valuable policy recommendations for decision-makers in these countries.

Keywords: University-Industry Collaboration, Quality of Education System, Outward Foreign Direct Investment, Developing Countries

Özet

Üniversiteler ve sanayii firmaları arasında geliştirilen işbirlikleri son yıllarda yenilikçilik ekosisteminin önemli bir göstergesi olarak ön plana çıkmaktadır. Ancak mevcut yazın üniversite-sanayii işbirliklerini ele alırken üniversitelerin genişleyen ve çeşitlenen misyonlarını göz ardı ederek yalnızca yenilikçiliğe etkilerine odaklanmaktadır. Bu çalışmada ise söz konusu kısıtlılığın ötesine geçerek üniversite-sanayii işbirliklerinin teknolojik ve yenilikçi kaynaklar konusunda dezavantajlı olan az gelişmiş ve gelişmekte olan ülkelerde dışa doğru doğrudan yabancı sermaye faaliyetleri üzerine etkilerini ve bu ilişkide üniversite-sanayii işbirliklerinin etkinliğini yönlendireceği düşünülen eğitim sisteminin kalitesinin düzenleyici rolünü ortaya çıkarmak amaçlanmaktadır. 80 az gelişmiş ve gelişmekte olan ülke örneğinde gerçekleştirilen çalışmada 2013-2022 yıllarını kapsayan ikincil verilerden hareketle panel regresyon analizi uygulanmıştır. Bulgular, üniversite sanayii işbirliklerinin sınır ötesi yatırımları olumlu yönde etkilediğini, bu etkilerin ise eğitim sistemine yapılan harcamaların yüksek düzeyinde güçlenerek arttığını göstermektedir. Eğitim sistemine yapılan harcamaların düşük düzeylerinde ise söz konusu olumlu etkiler ortadan kalkmaktadır. Az gelişmiş ve gelişmekte olan ülkelere dışa doğru yabancı yatırımların belirleyicilerine odaklanan yazına firmaya özgü kaynaklar dışında üniversitelerle kurulan işbirlikleri ve eğitim sisteminin önemini vurgulayarak teorik katkılar sunan bu çalışma aynı zamanda politika yapımcılar için çeşitli öneriler sunmaktadır.

Anahtar Kelimeler: Üniversite-Sanayii İşbirlikleri, Eğitim Sisteminin Kalitesi, Dışa Dönük Doğrudan Yabancı Yatırımlar, Gelişmekte Olan Ülkeler

The internationalization of emerging countries' multinational enterprises (EMNE) has emerged as a prominent area of interest within the field of international business literature in recent years (İlhan-Nas et al., 2018; Li & Ding, 2017; Mathews, 2006). The existing literature claims that in developing countries, in

contrast to their counterparts in developed countries, do not engage in international activities by using their assets and capabilities, but rather to access these assets (Luo & Tung, 2007; Mathews, 2006; Ramamurthi & Singh, 2009; Fu et al., 2018). Despite this view shaped by the argument that outward foreign direct investments (OFDI) are a

İletişim / Correspondence:

Dr. Öğr. Üyesi Fatih Şahin
Gümüşhane University Vocational
School of Social Sciences, Başlarbaşı,
Gümüşhane / Türkiye
e-mail: fatihsahin@gumushane.edu.tr

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ORCID: F. Şahin: 0000-0002-5515-7692

source of external learning, studies in recent years have drawn attention to the fact that the mentioned learning begins in the home country (e.g., İlhan-Nas & Şahin, 2023; Lu et al., 2017). Contrary to the resource-seeking motivated internationalization approach that the existing literature generalizes to developing countries through China-centered studies, this view posits that the internationalization of these organizations can be possible by developing the previous knowledge and innovation stock (Fu et al., 2018). Given the vital importance of innovation in a globalized competitive environment, this cannot be attributed solely to developed countries (Rask, 2014).

It is argued that EMNEs lack advanced technology and feel the pain of being latecomers in global competition when compared to developed countries (Buckley et al., 2007; Fu et al., 2018; Marin & Bell, 2010). Therefore, these organizations need external resources and collaborations to improve their existing capabilities and develop the innovative capacities necessary to secure a position for themselves in global competition. Inward FDI connections (spillovers), government R&D support, incentives and collaborations represent these external resources. It is through these external resources and collaborations that EMNEs can overcome their ownership disadvantages and develop the innovation capabilities required for their international operations (Audretsch & Guenther, 2023; Tajeddin & Carney, 2019).

The existing literature tends to measure innovation by outputs such as patent numbers and R&D investments when examining innovation-based internationalization processes (e.g., Aw et al., 2007; Qiao et al., 2020). However, the success of firms in international operations depends on their resource bases as well as their home country bases that will provide institutional benefits for them to use them effectively (Landau et al., 2016). Therefore, the home country's institutional context supporting innovation emerges as an issue that requires more attention. At this point, it can be expected that university-industry collaborations (UIC), which the existing literature tends to overlook, will direct OFDI as an important element of innovation culture and capacity.

UIC can provide significant benefits thanks to its potential to improve the innovation capacity of countries (Fischer et al., 2018; Lilles et al., 2020). In fact, owing to this feature, it is also accepted as an indicator of innovation by many international institutions and organizations (e.g., Worldbank, Global Innovation Index etc.). With this potential, UIC are encouraged by the governments of developing countries (Bertoletti & Johnes, 2021; Guimón, 2013). This is because, contrary to traditional views, the mission of universities is not limited to education; rather, the role of universities has recently been seen as a catalyst for technological development and entrepreneurial activities (Mueller, 2006). Therefore, UIC are thought to be an important source of the knowledge stock that encourages EMNEs' international activities.

Despite these potential benefits, UIC may not always generate the expected positive effects. The assumption that universities will be in close relations with industry and that the innovation and internationalization capacity in the country will increase as a result of these relations is contingent upon the quality of research and education of universities and their ability to transfer this potential to industry. Existing literature shows that the cross-border activities of local organizations in developing economies are highly sensitive to the quality of national innovation systems formed by the triple helix formed by industrial organizations, universities and government institutions (Corsi et al., 2023). Analyses indicate that the quality of the education system shaped by the national state benefits the innovation outputs of the developed collaborations (Schott & Sedaghat, 2014). In other words, the quality of UIC can be expected to support and increase the cross-border activities through the potential benefits they provide to industrial firms such as undertaking new projects, obtaining patents by developing innovative products, and training labour force that can improve their technical and managerial resources.

In light of these views, this study aims to examine the effects of UIC, which are seen as an important determinant of innovation in developing countries, on OFDI and to reveal the role of the quality of the education system in this relationship. By addressing this research question, this study makes a methodological contribution to the existing literature that seeks to explain OFDI with different variables, both in terms of theoretical perspective and selected variables. Firstly, the developed research model is expected to contribute to the literature on the cross-border activities of EMNEs by examining innovation-based internationalization from the perspective of UIC. Secondly, following the literature that explains national innovation systems with the triple helix of university-industry and state, this study emphasizes the quality of the education system by modelling the conditional effects of the education system and has the potential to offer suggestions to policymakers in terms of improving the education system. The third significant contribution of the study is the choice of using a time-extended methodology with a wide panel data set focusing on developing countries.

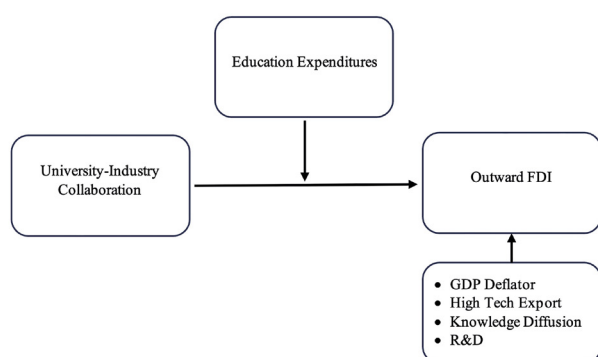
Conceptual Framework and Hypotheses

The research model, which attempts to explain cross-border activities from developing countries based on the triple helix model with UIC and the quality of the education system, is presented in  Figure 1. The basic assumption of the research model is that EMNEs' cross-border activities will be sensitive to the level of UIC they develop in their home countries and that this relationship will differ according to the level of quality of the education system. Production of outputs in the expected direction of the industry collaborations of universities, which are considered important actors in the triple helix model, will be dependent



on the quality of the education system supported and shaped by the state institutions in that country. Particularly in the sample of developing and less developed countries, while efforts are being made to ensure that the education system is isomorphic with that of developed countries, it is a matter of debate whether, despite these efforts, the quality of education is at the expected level (Wiseman & Anderson, 2012). Therefore, the quality of the education system is an essential conditional variable in the focus of the research model developed in the light of these discussions.

Figure 1
Research Model



The triple helix model, which forms the basic framework of the developed research model, claims that the interactions between academia, industry and government can help firms overcome barriers that they cannot overcome on their own, access the innovative resources they need and develop their capacities in this direction (Leydesdorff & Etzkowitz, 2003; Pereira & Franco, 2022; Wawak et al., 2024). This basic assumption of the model is fully compatible with the realities of local organizations in developing countries. The triple helix model challenges traditional approaches based on internal innovation activities of firms and encourages universities, industry and government institutions to go beyond their main tasks and collaborate to produce innovation (Wawak et al., 2024). The model defines universities as the creators of knowledge and technologies commercialized by industry (Corsi et al., 2023), and government institutions as a catalyst for policies that determine the effectiveness and success of UIC. Therefore, the cooperation of these three actors is crucial for the development of the innovative capacity of firms that will encourage their cross-border activities.

Internationalization from developing and less developed countries

As emphasized earlier, EMNEs need external resources in order to access ownership advantages that will guide their international activities (Meyer et al., 2009; Ramamurthi & Singh, 2009). It forms the basis of theories explaining the internationalization of developing country organizations. According to the first of these dominant perspectives, these organizations engage in international activities not with resource exploitation motivation but with a

resource search motivation because they do not have the resources in question (Mathews, 2006). In other words, the main driving force behind the internationalization of organizations in these countries is access to resources, and the relationships they establish in host countries through their cross-border activities can provide access to these resources. Similarly, some other perspectives argue that external connections in host countries act as a “springboard” and that cross-border investments create a great learning potential (Luo & Tung, 2007).

Although these perspectives provide important insights into the cross-border activities of EMNEs, they also have some limitations. First, they explain learning-based internationalization by focusing only on external linkages, that is, linkages developed in host countries after cross-border activities are carried out. However, recent evidence suggests that learning begins in the home country before cross-border activities are carried out and that internal linkages can also be an important source of organizational learning (Duysters et al., 2009; İlhan-Nas & Şahin, 2023; Lu et al., 2017). According to this perspective, the innovation capacity that drives cross-border activities depends on the development of existing knowledge (Fu et al., 2018). That is, even if developing country organizations engage in cross-border activities with a resource-seeking strategy, they need a minimum level of resources for these activities.

These recent developments in the existing literature indicate that the boundaries between the motivations for internationalization between developed and developing countries are diminishing and that innovation-based internationalization, which is attributed only to developed countries, may now also be valid in developing countries, and reveal that traditional views should be questioned. In parallel, several recent studies (e.g., Bortoluzzi et al., 2018; Ismail et al., 2018) have contributed to this questioning by emphasizing that the role of innovation in cross-border activities is sufficiently comprehensive in the context of developed countries and that research in this direction should now be studied more in the context of developing countries.

Despite the significance of this issue, it is challenging to engage in innovation activities that can produce successful outputs, as successful innovation activities of firms depend on the existence of an effective national institutional system (Carayannis et al., 2011), and this dependency is much stronger for developing country organizations that have difficulty accessing the resources they need (Cassiman & Golovko, 2011). Therefore, external linkages, collaborations and incentives are needed for innovation that will encourage cross-border activities in these countries (Audretsch & Guenther, 2023). The current literature has recently paid primary attention to these external resources and collaborations, examining the linkages established with foreign-owned organizations in the home country and the

resulting internationalization spillovers (Buckley et al., 2002), the effect of government incentives for cross-border activities (Takyi et al., 2022) and the effect of R&D and patent networks on international activities (Van Beers et al., 2008). In this respect, although the developments in the current literature are seen as seminal for the cross-border activities of developing country organizations, the role of UIC, which represents one of the most important actors of the triple helix model and is an important determinant of innovation with its role as a source of technology and knowledge, is ignored.

University-Industry Collaborations and Outward Foreign Direct Investment

Universities have long been seen as a supporting institution of entrepreneurship and innovation ecosystems (Dorfman, 1983; Fischer et al., 2018). Although such a supporting role is generally associated with knowledge transfer and entrepreneurial activities (Etzkowitz, 1998), in recent years the role attributed to universities and higher education institutions has expanded and become more important. The framework of this expanded role is called UIC and refers to various grounds for interactions between a part of the higher education system and industry, involving knowledge or technology transfer (Bertoletti & Johnes, 2021; Siegel et al., 2003). These collaborations cause the support role attributed to universities for the innovation ecosystem to be surpassed and now they have become a main actor.

The main motivation behind the collaborations with universities also differs between developed and developing countries. While it is claimed that the reason behind these collaborations in developed economies is the increase in the knowledge base of companies (Fischer et al., 2018), in developing economies, the lack of knowledge and ownership disadvantages of companies represent the main motivation for these collaborations. In addition, providing access to talented students and graduates, solving certain technical or design-related problems, providing access to the latest technological information and devices, and participating in international R&D networks constitute the sub-motives of these relationships (Lee, 2000; Lilles et al., 2020). However, the role of universities in these relationships is expected to be more of a consultant who is a source of technical and managerial knowledge rather than a solution or project partner. This expanding role of universities within the innovation ecosystem and transformation for economic development has led developing country governments to pay more and more attention to policies and initiatives that encourage UIC (Bertoletti & Johnes, 2021; Fischer et al., 2018).

In many developing economies, especially large universities can have R&D facilities and state-of-the-art technological devices that private companies may find challenging to acquire. In this way, collaborations with universities can reduce firms' R&D costs (Agrawal, 2001), facilitate access to technological knowledge and thus increase their innovative

potential (Fischer et al., 2018). Thus, it is argued that the technology gap between countries, which is one of the sources of asymmetry in innovative activities, is caused by the difference in the frequency and quality of collaborations between universities and industry (Tijssen & van Wijk, 1999). A large body of existing literature also shows that UIC increases innovation, reduces the risks posed by R&D for firms, and provides companies with access to advanced technological knowledge (Corsi et al., 2023; Lilles et al., 2020; Pereira & Franco, 2022; Van Beers et al., 2008).

UIC facilitate the generation of valuable innovations through the combination of firms' market-based expertise and universities' scientific knowledge (Petruselli & Murgia, 2020). They are becoming a primary driver of the national innovation ecosystem, with a growing body of evidence suggesting that R&D collaborations, in particular, encourage firms' internal R&D activities (Hall et al., 2009). In this respect, UICs represent an alternative ownership advantage (Dunning, 2001) to traditional proxies such as R&D and patent numbers as an indicator of innovation. Although the positive impact of UIC on firm innovation has been well documented and widely accepted, there is limited evidence on how it affects firms' cross-border activities as an indicator of innovation. As previously stated, EMNEs' have limited innovative resources and capacities for their cross-border activities and often need external resources and support. Therefore, for EMNEs' that have difficulty in carrying out innovative activities with their own efforts, UIC can serve as a valuable learning resource, potentially enhancing their cross-border activities. As it is known that learning in the home country facilitates access to international market information (Cesinger et al., 2016).

In addition to influencing firms' internationalization through learning and collaborations from external sources in the home country, UIC can also drive cross-border activities due to some other factors. Given the inherent uncertainty associated with internationalization, firms must learn to overcome this challenge. The learning requirement is much stronger for FDI, which are considered the riskiest international entry strategy. Studies that associate foreign market entry strategies and FDI decisions, which have a special importance for these strategies, with uncertainty and risk claim that collaborations that have the potential to reduce uncertainty for investing firms will be effective in making bolder entry strategy decisions (Rhoades & Rechner, 2001). Although these claims are typically associated with the selection of a foreign partner in the host country, UIC can similarly encourage OFDI decisions, which will help reduce uncertainty. Moreover, it is known that universities serve not only as creators and distributors of technological knowledge, but also as gateways to foreign markets (Corsi et al. 2023; Edeh et al., 2020). In light of the aforementioned roles of international networks of universities and academics in the creation of technological and managerial knowledge, the following hypothesis is developed:



H1: As the level of university-industry collaboration increases, the level of outward FDI will increase.

The Role of the Education System in University-Industry Collaborations and Internationalization Relationship

The perception of UIC as a source of learning in the home country and the notion that universities have the potential to significantly impact cross-border activities due to the facilitating effects of their networks situates universities in a pivotal role with regard to the economic development of countries. However, it may not always be possible for these potential effects of UIC to emerge (Bercovitz & Feldman, 2006). For example, Edeh et al. (2020) reveal that the potential advantages of UIC cannot be actualized due to the inadequate standards of local universities and even collaborations established with universities negatively affect cross-border activities in the Nigerian sample. In the Turkish sample, Şahin (2022) reveals that UIC are far from showing the expected effects due to the asymmetry created by different expectations and goals.

At this point, an important determinant to consider is the efficacy of the education system. A significant number of studies establish a relationship between the effectiveness of the education system and the economic development of countries and recommend governments implement policies to strengthen the effectiveness of the education system (e.g., Edeh et al., 2020; Wiseman & Anderson, 2012). These studies typically assert that increased spending on the education system will lead to enhanced quality, thereby providing companies with access to a more qualified human resource base (Mehrbani, 2018). It is further posited that they will be able to receive academic consultancy services in terms of implementing innovative product and process ideas (Bell et al., 2019; Biasi et al., 2021), and more effective support from universities on managerial and strategic issues, which are especially important in terms of foreign investments.

One of the main motivations of UIC is to access resources that firms are not able to have on their own, and this may arise depending on the quality of the education system. Therefore, it can be expected that an innovative indicator with a predominant social aspect such as UIC would be more intensely related to the effectiveness of the education system than other proxies such as the number of R&D and patents. More precisely, in contexts where public expenditures on the education system are low, it may not be possible for the private sector to access the resources it needs through universities. In addition, training educated employees, which is the primary mission of universities and higher education institutions (Corsi et al., 2023), may also be directly affected by expenditure on the education system and determine the effectiveness of UIC. Since the impact of human capital on economic growth and innovation is clear (Bianchi & Giorcelli, 2019; Biasi et al., 2021). Therefore, it will be more possible

for collaborations to be developed between academics and private sector decision-makers, which emerge as the product of an effective education system, to realize their potential and lead to positive outcomes. Supporting the above inferences, there is empirical evidence that both public and private networks and collaborations are highly sensitive to the quality of the education system (Schott & Sedaghat, 2014).

The importance of being a part of an international economy reveals the need for legitimization within a global community (Robertson, 2005). The primary means of legitimization is the existence of quality education systems and educational institutions that support national innovation systems (Wiseman & Anderson, 2012). Therefore, the level of public expenditure on the education system can regulate the effects of these collaborations by directing the legitimacy perceptions of the actors involved in UIC. A study conducted in the Turkish context, for example, reveals that industry representatives realize their collaborations only to the extent that they can respond to regulatory institutional pressures and with a low belief in outputs due to their low perception of legitimacy towards universities and academics (İlhan-Nas & Şahin, 2023). Consequently, the following hypothesis was developed with the expectation that the effects of UIC on outward FDI activities will be sensitive to the effectiveness of the education system in the context considered;

H2: The education expenditures will play a moderating role in the relationship between the level of UIC and outward

FDI: In cases where education expenditures are high, the positive effect of UIC on outward FDI will be stronger.

Methodology

Sample

The universe of this research conducted at the country level consists of underdeveloped and developing countries. While determining the scope of the research, it is thought that the sample of underdeveloped and developing countries constitutes a good research area for the causal explanations between these variables within the framework of the research model and the privileged importance of UIC, state expenditures for education and FDI out variables. Within the framework of the limitations and purpose of the research, 80 underdeveloped and developing countries whose data can be regularly accessed within the specified time period (2013-2022) were included in the sample.

Variables and Measurement

Dependent Variable: *Outward FDI flows* from developing and underdeveloped countries constitute the dependent variable of the research. The dependent variable is measured by calculating the share of outward FDI of countries in GDP and is obtained from the World Bank.

Independent Variable: The independent variable of the study, *university-industry collaborations*, was obtained from the Global Innovation Index (GII) published annually by the World Intellectual Property Organization (WIPO). The variable, considered as a sub-dimension of the innovation input index in the GII, represents the level of R&D collaborations between universities and companies in the country. The variable is obtained using a 7-point Likert scale from the survey question directed to the managers of private sector companies. The variable is normalized to take a value between 0-100.

Moderator Variable: The moderator variable of the research is the *education expenditure* obtained from the GII published by WIPO. The variable included in the index as human capital and a sub-dimension of the research was measured by the ratio of public expenditures on the education system in the country to GDP.

Control Variables: The first control variable of the study is the *GDP deflator*. The variable obtained from the World Bank represents the price change for total GDP. The other control variable, *high-tech exports*, is measured by dividing the country's high-tech exports (in US dollars) by GDP and is obtained from the World Bank. Another control variable, *knowledge absorption*, is obtained from the GII published by WIPO and represents the knowledge absorption capacity of organizations in the country. Finally, the *R&D* variable is also obtained from the GII and represents the R&D capacity of countries. This variable is obtained by indexing the sub-variables of number of researchers (per million population), gross expenditure on R&D (%GDP), global corporate R&D investors (top 3, mn USD), QS university ranking (top 3) to take values between 0-100.

Data Analysis and Findings

The developed research model was tested using a time-extended dataset covering the years 2013-2022. Considering this data structure, a panel regression model was used for

data analysis. The analysis procedures suggested by Baron and Kenny (1986) and Aiken and West (1991) were followed to test the moderator relationship included in the research model. Within the framework of this analysis procedure, the significance of the interaction variable produced by multiplying UIC (independent variable) and the education expenditures (moderator variable) provides evidence for the existence of the moderator relationship. The Simple Slope Test (Aiken & West, 1991) was used to interpret the resulting relationship pattern. To eliminate the multiple linear connection problem that may arise in the moderator model, the independent variable and the moderator variables were centralized and included in the model.

In the first step of the analysis process, LLC unit root test was applied to test the stationarity of the variables (Levin et al., 2002). As a result of the analysis, H0 hypothesis was rejected, and evidence was obtained for the stationarity of the series. Hausman test was applied to select the panel regression model to be used in the analysis process and H1 hypothesis, which states that the difference between the coefficients is systematic, was accepted. Therefore, it was decided to use the fixed effects estimator in the model selection. Finally, the F test was performed to test the fixed unit and/or time effects in the panel regression model and as a result of this test, the fixed effects model including unit effect and time effects was used. As a result of the preliminary analyzes performed, evidence was obtained for the existence of heteroscedasticity, autocorrelation and cross-sectional dependency problems and the "Driscoll/Kraay robust estimator" used to eliminate these problems (Tatoğlu, 2018) was used.

Descriptive statistics of the variables and correlation coefficients between the variables are presented in Table 1. When the correlation coefficients in the table are examined, it is seen that all coefficients are less than 0.80, so the problem of multicollinearity does not arise (Okan et al., 2020).

Table 1
Descriptive Statistics and Correlations

Variables ^a	1	2	3	4	5	6	7
Mean	1,17	41,32	34,39	28,95	163,46	0,01	10,48
s.d.	18,10	10,07	19,37	9,78	505,95	0,04	12,21
min.	-137,3	14,2	0	7,30	35,11	-0,00	0
max.	284,39	74,50	100	72,70	11357,8	0,33	70,50
1- Outward FDI	1						
2- Uni-Ind Coll	,044	1					
3- Education exp.	,023	,031	1				
4- Knowledge dif.	-,020	,291**	,176**	1			
5- GDP deflator	-,001	-,014	,040	,067	1		
6- High-tech exports	-,015	,302**	,105**	,448**	-,026	1	
7- R&D	,017	,471**	,114**	,450**	,083*	,320**	1
+p<,10; * p <,05; ** p <,01							

**Table 2**

Regression Analysis Results

Variables	Outward FDI					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Independent						
Uni-Ind Coll.	,121*	,133*	,121*	,135*	,157*	,173*
Moderator Variable						
Education exp.			-,003	,005	-,003	,005
Interaction						
Uni-Ind Coll x Education exp.					,006*	,006*
Controls						
Knowledge dif.		-,217		-,217		-,219
GDP deflator		,000		,000		,000*
High-tech export		-80,81**		-80,60**		-85,77**
R&D		,318**		,318**		,306**
Constant	1,17*	5,58	1,17*	5,60	1,13*	5,81
F	5,33*	6,37**	3,26*	5,47**	2,71*	21,70**
R ² (within)	,017	,013	,001	,013	,003	,015
N	800	800	800	800	800	800

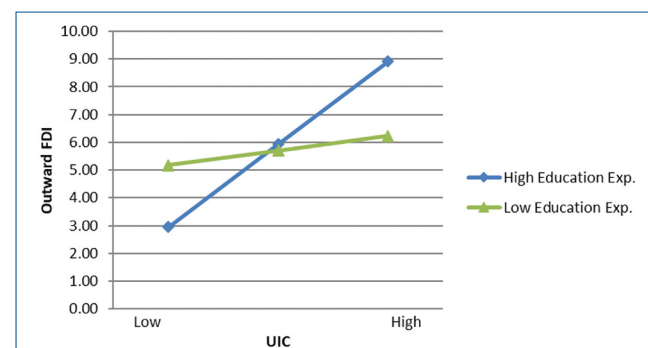
Table 2 presents the panel regression analysis findings. When the table is examined, it is revealed that UIC has a statistically significant and positive effect on outward FDI in both the models where control variables are not included (model 1 - $\beta = .121$; $p < .05$) and the models where control variables are included (model 2 - $\beta = .133$; $p < .05$). The findings in question show that the H1 hypothesis, which is expressed as the intensity of outward FDI will increase as the level of UIC increases, is supported. The table also includes the effects of the variables included as control variables in the research model. Accordingly, it is seen that the knowledge diffusion and GDP deflator variables do not have a statistically significant effect on outward FDI. The effect of the other control variables, high tech export, on outward FDI is statistically significant and negative ($\beta = -80.81$; $p < .01$), while the effect of R&D is statistically significant and positive ($\beta = .318$; $p < .01$). When these results are interpreted specifically for high tech export, it can be said that in underdeveloped and developing countries, outward FDI and export, which represents another cross-border activity, act as substitutes for each other. When interpreted for R&D, it can be said that there are findings that support the assumption that innovation, which represents the basic perspective of the research, will be an incentive factor for cross-border activities.

Table 3

Interaction Effect

	b	SE	t	95%CI	P
Low Education Exp.	0.051631	0.033525	1.54	-0.01 to 0.12	0.158
Z (Medium)	0.173552	0.065994	2.63	0.04 to 0.30	0.027
High Education Exp.	0.295473	0.115120	2.57	0.07 to 0.52	0.030

In the next step of the research process, education expenditures, which represent the moderator variable of the study, were included in the model (Model 3 and Model 4). It is revealed that the education expenditure does not have a statistically significant effect on the dependent variable, outward FDI ($p > .10$). In Model 5 and Model 6, the interaction effects obtained by multiplying the independent variable by the moderator variable were included in the model. The findings reveal that the effect of the education expenditures on outward FDI is statistically significant and positive ($\beta = .006$; $p < .05$). For this model, where the interaction effect is significant on the dependent variable, the analysis process suggested by Aiken and West (1991) was followed and the graph was obtained and the significance of the regression lines shown in these graphs was examined (Table 3).



When ■ Table 3, which shows the results of the moderator hypothesis test, is examined, it is seen that the effects of UIC on OFDI are not significant in contexts where the education expenditures are low ($p>.10$). In other words, it is revealed that the positive effect of UIC on OFDI disappears at low levels of education system quality. In addition, it is seen that the positive effect of UIC on OFDI is statistically significant and positive at high levels of education expenditures ($\beta=.295$; $p<.05$). Moreover, the findings show that the positive effect in question is stronger in contexts where the education expenditures are high. According to these findings, the education expenditures will play a moderator role in the relationship between the level of UIC and outward FDI: It can be said that the research hypothesis (H2) stated as the positive effect of UIC on outward FDI will be stronger in cases where the education is high is supported.

Discussion and Conclusion

This study examines how UIC, which is shown as an important indicator of innovation, affects cross-border investments in underdeveloped and developing countries and how this effect varies depending on the quality of the education system. In this respect, the study differs from the relevant literature in several points and has the potential to offer important theoretical and empirical contributions.

This study is, to the best of our knowledge, the first to directly examine the effects of UIC on outward FDIs by using them as an indicator of innovation. Its contribution to the existing literature is particularly significant when considering the context of underdeveloped and developing countries. In examining outward FDI activities, previous research typically focuses on proxies like R&D and patents to measure innovation, particularly in developed countries and their organizations. However, these proxies, which are firm-specific resources, do not hold the same explanatory power in underdeveloped and developing countries. This is because firms in these regions often lack the resources necessary to create ownership advantages, such as technology and innovation (Buckley et al., 2007; Fu et al., 2018). Consequently, supports and collaborations that foster local organizations' innovative capabilities are especially crucial in these contexts. University collaborations that provide local firms access to resources they would struggle to obtain independently serve as a key source of learning, helping to overcome these disadvantages. Our findings reveal a relationship pattern that challenges the existing literature (Mathews, 2006), which suggests that FDI activities from underdeveloped and developing countries occur mainly to acquire resources and exploit learning opportunities in host countries. In contrast, our findings align with more recent studies that suggest learning from collaborations within the home country can drive cross-border activities (Lu et al., 2017). As a result, this study contributes to ongoing discussions about the need for more in-depth

exploration of innovation-driven internationalization in developing countries (Bortoluzzi et al., 2018; Ismail et al., 2018). Furthermore, this study introduces a research model that better captures the context of these countries by considering UIC, which plays a critical role in granting access to resources that organizations in developing countries lack, in place of firm-specific innovation proxies like R&D and patents.

This study highlights that, given the expanding and diversifying roles of universities, higher levels of UIC can promote outward FDI activities. However, due to institutional gaps and weaknesses in underdeveloped and developing countries, this relationship may not always hold, and the anticipated positive impact of UIC could be influenced by various conditions. The research model developed around this idea suggests that the quality of the education system is a key conditional factor, particularly in developing country contexts. Existing literature indicates that UIC are more effective when supported by the triple helix model, which includes the participation of governments. National innovation systems, created through the joint efforts of universities, industry, and government, are especially crucial for enhancing innovation capacity in developing and underdeveloped countries (Fischer et al., 2018). Education systems in these countries can differ significantly from those in developed nations, often influenced by factors such as socio-economic development levels, delayed industrialization, government support, and the adequacy of education funding. Therefore, government policies aimed at addressing these constraints play a vital role in enabling UIC to foster outward FDI at the expected levels (Şahin, 2022). Our findings align with this view, showing that in contexts with low government spending on education, the positive impact of UIC on outward FDI diminishes, while in contexts with higher spending, these effects are amplified. These results support earlier studies emphasizing that collaborative efforts within the triple helix framework can generate significant outcomes for developing and underdeveloped countries (Wawak et al., 2024). In this regard, the study offers valuable contributions to advancing our theoretical understanding by stressing the importance of considering all three actors universities, industry, and government when analyzing outward FDIs from developing countries.

In addition to the theoretical contributions outlined above, this study also carries significant implications for policymakers in underdeveloped and developing countries. Given the importance of outward FDIs for economic development and global competitiveness, many governments in developing countries are implementing policies to encourage these activities. These policies may include financial incentives that directly support FDI or initiatives aimed at improving national innovation systems to create the necessary infrastructure for these activities. For instance, in Turkey, programs such as



the 1501 TÜBİTAK Industrial R&D Projects Support Program, initiated by the Ministry of Industry, are becoming increasingly vital for enhancing the innovative capacities of local organizations through UIC. In some developing countries, UIC projects and publications are even prioritized in academic promotion criteria (Guimón, 2013). Our findings highlight the importance of these collaborations not only for innovation but also for cross-border activities, suggesting that governments should provide more intensive support for such initiatives. However, there are critiques, particularly in countries like Turkey, that argue these supports and collaborations may fall short of generating the desired outcomes (Edeh et al., 2020; Şahin, 2022). These critiques, which stem from concerns about the perceived low legitimacy of universities and the lack of resources, suggest that collaborations must be complemented by a high-quality education system. Our findings support this view. Therefore, it is crucial for governments and education policymakers to focus on reforms that enhance the quality of the education system in order to enable UIC to effectively promote cross-border activities. These policies could involve increasing university resources and legitimacy through higher education budgets or reshaping the structure of UIC. Evidence suggests that some collaborations are designed merely to meet institutional expectations and may lead to unsatisfactory outcomes (Şahin, 2022). As a result, policymakers should prioritize initiatives that actively promote UIC and strengthen the infrastructure surrounding these collaborations.

In addition to the contributions detailed above, this study also has several limitations. The most significant of these is the lack of data diversity. Due to the methodological approach chosen, general legislative conclusions were drawn using time-extended data. While this objective perspective provides valuable theoretical and methodological contributions to the developed research model, it also posed challenges in selecting variables. For instance, the study's explanatory variable, UIC, focuses solely on R&D collaborations, overlooking other types of UIC. Moreover, because of this methodological preference, an emic approach, which would have reflected the unique characteristics of developing country contexts, was not possible in the variable selection process. For example, the study's conditional variable, the quality of the education system, was measured solely by government expenditures on education. Future studies may benefit from a methodological approach that emphasizes a single-country context, allowing for the development of a model with variables that better reflect the specific country context. Lastly, to test the theoretical claims made in this study, underdeveloped and developing countries were included in the sample. It may be useful for future research to adopt a comparative approach, examining both developed and developing countries to explore these dynamics across different contexts.

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