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Impact of Innovation and Exports on Productivity: Are There Complementary Effects?

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Abstract: The relationship between firms' exports and increases in productivity is generally regarded as positive. While the causal effects of process innovation are straightforward and positive, the effect of product innovation on productivity is ambiguous. However, there is a lack of empirical evidence on a joint effect that innovation and exports have on firms' productivity. In our attempt to fill this gap, we explore individual and joint effects of innovation and exports on productivity by employing cross-sectional firm-level data. We use the sixth wave of the Business Environment and Enterprise Performance Survey (BEEPS VI: 2018–2020) conducted by the EBRD and the World Bank. Using a stratified random sampling, the data was collected from interviews with representatives of randomly chosen firms from 32 countries. The overall results suggest that exporting firms are more productive than non-exporters, while the impact of innovation is more heterogeneous. Whereas EU and high-income countries reap the productivity benefits, this effect is absent in other regions and countries with medium and low-income levels. Finally, our results indicate the absence of a joint effect of innovation and exports on productivity, across different geographical regions and countries of different income levels.

Keywords: exports; innovation; learning-by-exporting (LBE); labor productivity

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1. Introduction

When Paul Romer developed a theory on endogenous growth in the early 1980s and published his seminal paper [1] in 1990, the grounds for a new understanding of economic growth were set, with new ideas produced by researchers being at the heart of productivity and, ultimately, output growth. Growth models developed on those grounds account for private R&D and researchers as primary drivers of growth, proving that an increase in these two variables is associated with higher output levels. Following the same analogy of innovation affecting a country's productivity, an increase in innovation is associated with higher productivity at a firm level.

Combined use of informational technology (IT) and research and development (R&D) inputs yields a higher productivity growth [2]. Using IT provides for the creation of knowledge associated with productivity gains and improved firms' performance [3,4]. Many studies confirm the positive impacts of firm innovations on productivity measured by total revenues [5,6]. Developing new products, services, and processes is instrumental in creating, surviving, and growing entrepreneurial ventures [7]. Innovation per se does not increase the number of productive resources, yet it affects growth mainly by increasing productivity [8]. While the relationship between process innovation and a firm's productivity is rather straightforward and positive, the relationship between product innovation and productivity is somewhat ambiguous. Namely, a firm engaging in process innovation

means new production methods development, which generally increases productivity. However, a product innovation may or may not require firms to increase their productivity.

International trade is traditionally considered an essential driver of productivity, for multiple reasons. Some of the most widely discussed are gains from increased exports (and innovation). The substantial literature deliberates on the benefits of learning-by-exporting (LBE), finding the relationship between exports and productivity generally positive [2,9], notwithstanding that export learning has a different impact depending upon the innovation position of the exporter [10]. Furthermore, a firm's productivity is contingent upon a firm's specifics [11]. Similarly, decisions to export and innovate depend on firm characteristics, but also on the business environment [12]. Factors affecting a firm's innovation capabilities include, among others, a number of employees engaging in R&D activities, and a firm's expenditures on R&D [13]. As for SMEs, access to knowledge and finance [14] mainly determine a firm's overall access to innovation.

Despite the abundant literature on the individual effects of exports and innovation on a firm's productivity [15,16], there is still a lack of evidence on the joint effects of innovation and exports on productivity. In bringing together exports and innovation in assessing their effects on a firm's productivity [16], the research problem we want to address is whether there are any complementary effects between them. Generally, there are two viewpoints on the relationship between exporting and productivity. One research stream investigates why firms self-select to export [17]. According to this theory, productivity precedes a firm's decision to innovate, which means innovation is an export driver. The other stream of research extends these views, arguing that exporting may as well be a cause of increasing productivity. These views are shaped by the so-called learning-by-exporting (LBE) paradigm [8]. The main idea of LBE is the two-way relationship between exports, innovation, and productivity, meaning that there is a feedback loop from exporting in terms of it affecting a firm's productivity ex post through innovation [18]. Two main channels of a feedback loop encompass firms adopting more productive practices (i.e., technical expertise) and engaging in innovation to maintain their comparative advantage.

We adopt the basic assumption of the LBE doctrine, accounting for a two-way relationship between exports, innovation, and productivity. Though many studies investigate the role of innovative activities on the export–productivity relationship, rather less effort is devoted to disentangling the effects of export and innovation on a firm's productivity [12]. That is, as much as exporting allows for a higher return of innovation, so does a firm have to engage more in R&D to seize knowledge spillovers from foreign markets. In this way, the two-way flow allows for multiplicative effects, suggesting that failing to capture the synergetic effects of innovation and exports might lead to underestimating the actual impact of these on a firm's productivity.

Building upon the rich body of existing literature, we assess the simultaneous and synergetic effects of exports and innovation on productivity. This study aims to explore the nature of the relationship between exports, innovation, and productivity. Amidst global shifts in international trade and disruptions in global value chains, we believe this to be the most opportune time for investigating the actual effects of innovation and exports on productivity during normal times to better understand what "the new normal" might impose on a country. Given the intrinsic characteristics of less developed economies that make them less resilient to global shocks, focusing on this subsample is particularly important for firms' managers and policymakers in these countries. The research question in this study is whether innovation and exports have complementary effects on firms' productivity, particularly in less developed economies.

This study contributes to the existing literature in several ways. Firstly, we bring together two streams of research on potential drivers of productivity increases, one being focused on innovation and the other on exports. Secondly, we take a step further by introducing the joint effect of innovation and exports on productivity, which, though referenced in previous research, remains under-investigated. Finally, we provide policy and managerial recommendations concerning using evidence from this study to better

navigate future steps in less developed economies towards adjusting to the "new normal" in part of disruption in international trade and global value chains, while allowing for an increase in domestic productivity.

The rest of this study is organized as follows. In Section 2, we review the literature related to the influence of technological (process and product) innovation and exports separately as well as jointly with labor productivity, in particular, in less developed economies. Section 3 presents the methodology by explaining the sample, model specification, and empirical strategy. Section 4 presents empirical results, followed by the discussion and main conclusions, limitations, and ideas for future research.

2. Theoretical Background and Hypothesis Development

2.1. Impact of Technological Innovation on Productivity

Technological innovations, both product and process, strongly improve the competitive position of firms of all sizes. In contrast to the conventional economic wisdom that innovation is an exogenous random shock similar to *manna falling from heaven*, the economics of innovation considers innovation to be a deliberate and intentional result of a firm's ability to generate new knowledge and create new products and processes [19]. Growing literature shows that innovation and productivity are related [20] and many studies confirm the positive impacts of firm innovations on a firm's productivity as measured by total revenues [5,6]. However, the question is, what evidence do we have for innovation increasing productivity? Do product and process technological innovations increase productivity, particularly in less developed economies? Taking up these questions, we frame our research around answering whether there are individual and synergetic effects of innovation and export on a firm's productivity.

In defining product and process innovations, we adopt the definitions of innovation following the Oslo manual [21] (p. 8), as follows: A technological product innovation is the implementation/commercialization of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods, or a combination of these. Focusing on product and process innovation, we introduce the assumption of organizational, marketing, and soft innovations being constant [22].

The ability of firms of all sizes to increase their productivity while upgrading their technological and innovation capacity is regarded as an essential determinant of competitiveness [23]. Knowledge augments physical labor so that learning or absorbing knowledge increases labor productivity [24,25]. Although much of the literature argues productivity allows substituting labor for capital through innovation and R&D, recent studies show that knowledge frameworks determine the substitutivity between factors of production [26]. Audretsch and Belitsky [27] find that complementarities between R&D and knowledge spillovers are strongly associated with firm productivity rather than firm innovation. R&D is important for innovation and productivity, while knowledge spillovers seem to matter more than R&D for a firm's productivity [27].

Furthermore, knowledge spillovers, along with organizational restructuring and entrepreneurial orientation [28], may lead to a process of structural transformation both at the firm and country levels. The structural transformation includes moving resources from low to higher productivity and skill-intensive sectors, facilitating catching-up effects [29]. Adhikari and Tesfachew [29] point out that while many countries have achieved structural transformation in decades, the least developed countries (LDCs) have been notoriously slow in this respect. Capital investments and R&D are some of the prerequisites for technological innovation. On the other hand, technological innovations, and especially process innovations, lead to increased productivity. Hence, firms that do not innovate inevitably face underperformance or dissolution [30,31].

As investment in R&D is rather expensive, innovation occurs more often in larger firms. Still, innovation, particularly process, is important for SMEs [32]. Hence, understanding the productivity effects of technological innovation is paramount for firms' managers and business policymakers [2]. For example, a study on Italian manufacturing SMEs covering 1995–2003 shows that investment in equipment, i.e., capital investment, enhances the likelihood of both process and product innovation. This, in turn, positively impacts a firm's productivity, especially through process innovation [6]. Taking R&D as one of the key technological innovation sources in firms besides open innovation (inbound, outbound, and coupled innovation), in line with endogenous growth theories, R&D is a significant source of productivity growth [33].

Though rather ambiguous empirically, the deterministic role of R&D in productivity levels is crucial in most public debates. While the positive role of innovation in enhancing a firm's productivity is acknowledged [34,35], there is a lack of evidence about the role of innovation in enhancing a firm's productivity in less developed countries. Interestingly, despite meeting the theoretical assumptions, some largely industrialized and knowledge-driven economies, like Japan, still show rather low productivity levels [33]. Empirical evidence contesting theorical predictions raises skepticism and opens the floor to questions on the relationship between innovation and productivity more generally. Many firm-level studies using cross-section data tried to fill this gap [8]. Despite strong theoretical arguments presented, there is yet no consensus about whether innovation increases productivity levels in practice. One of the plausible explanations for the heterogeneity of conclusions regarding the effects of innovation is a vagueness in, firstly, defining innovation, i.e., what types of innovation are associated with changes in the level of productivity; and secondly, in defining productivity. Taken altogether, this leads us to our first hypothesis:

H1. *Technological (product and process) innovations have a positive effect on labor productivity.*

2.2. Exports and Productivity—Learning by Exporting

Exporting is the most common foreign market entry mode. Quite often, it is the first stage of internationalization, especially for SMEs [36]. For smaller firms, especially, international activities often represent the only path to substantial growth [37]. Empirical evidence emphasizes that rather a small percentage of firms sell abroad, though after controlling for industry-level heterogeneities, exporting firms are more efficient than their counterparts [10,38,39]. Furthermore, in some cases, export-oriented firms are more technology-intensive and more productive than non-exporting firms [2]. Micro-level studies found strong linkages between trade in goods behavior and business-level productivity, showing that, for example, in the UK, firms engaging in trade were exhibiting approximately 70% higher productivity, even after controlling for multiple aspects (such as ownership status, size, and industry) [40].

Substantial empirical literature shows that exporting firms are generally more productive than non-exporters [12,41–43]. Despite the widespread consensus of a positive correlation between exports and productivity, the direction of the causation remains a continuing debate. This paper attempts to fill this gap by identifying the role of exporting on productivity, particularly in less developed economies. Much of the discussion on this topic concerns the issue of self-selection versus learning by exporting [9,17]. Namely, "the export premium" can result from increasing productivity, in which case the more productive firms are self-selecting into exporting. Conversely, productivity growth may result from knowledge and experience gained from exporting [36]. The former viewpoint is generally known as self-selection (SS) into exporting, while the latter is an extension introduced by the learning-by-exporting (LBE) doctrine. Apart from solid theoretical reasoning, there is strong empirical evidence for both directions of the relationship between exporting and productivity.

Referring to the new theory of international trade, Wagner [41] shows that productivity affects a firm's export propensity and its internationalization [34]. Plentiful research on

developed economies, in particular OECD countries, demonstrates strong evidence of the self-selection of firms into exporting [41,44]. Recent studies find that only a small group of highly productive firms export, while there is a clear effect between productivity and the export status of enterprises [10]. However, Dalgıç et al. [9] present evidence for the learning-by-exporting hypothesis. After controlling for the composition of exports, they find strong evidence of productivity gains, particularly for exports to high-income countries instead of middle-low-income countries. Furthermore, after controlling for productivity differences and self-selection into exporting, Antonelli [45] finds strong evidence of increased productivity after entering an exporting market. Recent literature finds evidence for an LBE effect [10,46–48].

Overall, which of the two, SS or LBE, prevails depends upon the level of development of an economy, as less developed economies are more likely to learn by exporting, whereas in more advanced economies, the more productive firms self-select into exporting [17,45]. Furthermore, the direction of the relationship depends on the exporting destination. For example, Kiendrebeogo [49] argues that SS prevails with exporting to non-OECD countries, while the LBE effect is more likely when exporting to the OECD countries. Following this literature and given the sample of countries we study, we adopt the LBE doctrine in our study.

Despite strong evidence of positive LBE effects, most previous studies have not addressed how firms learn from exporting activities [10,41,50]. LBE doctrine identifies various channels whereby trade liberalization affects innovation-led productivity growth across firms [51]. Generally, learning effects are proved important in helping to explain why exporters are more productive than non-exporters, and why export-capable firms are more productive than firms in no position to engage in exporting [36]. More broadly, there are two main channels through which firms benefit from LBE: first, by adopting more productive business practices, i.e., importing technical expertise, and second, by innovating to keep up with the competition in exporting markets [17]. This leads to our second hypothesis:

H2. *Exports has a positive effect on labor productivity.*

2.3. Joint Impact of Innovation and Exports on Productivity

Both exports and innovation, in particular R&D, are key factors for the growth of firms and economies, but there is rather limited research on the combined impact of exports and innovation on the growth and productivity of firms and economics, especially in less developed countries [52]. Generally, higher productivity is associated with more innovative and export oriented firms [32]. Firms' decisions to export and innovate are interdependent and can jointly affect a firm's future performance [12]. Gkypali et al. [36] find that the effect of innovation on the probability of exporting is strong, but does not work exclusively through product innovation, as suggested by Cassiman et al. [53]. It is process innovation that differentiates export-capable firms from other non-exporters (i.e., DFFs), while the key influence of product innovation is in helping firms move from the export capability to actually exporting. Vicente et al. [54] find that several dimensions of innovation capability, including innovativeness, technological capability, innovation strategies, and product innovation, have positive effects on a firm's exporting.

Since export and innovation decisions can be firms' mutually exclusive strategies as well as a joint strategy, Dai et al. [12] use a multinomial logit model to estimate firms' probabilities of choosing each of the states. Their [12] results suggest a complementary effect between export and innovation on the performance of Chinese manufacturing firms. Lööf and Nabavi [55] establish a dynamic model using data collected from nearly 10,000 Swedish exporting firms over 12 years, and reveal that persistent innovators benefit significantly more than other exporters from access to a wide spectrum of nearby knowledge. Many studies on trade that use micro-data confirm the theoretical prediction that innovation is associated with the likelihood of entering export markets [56], and there is strong em-

pirical evidence that innovative exporters account for a disproportionally large share of exports [55].

Despite the prevailing evidence on positive effects of export on productivity, some studies report mixed results. For example, in their research conducted for Chinese firms, Wu [57] finds that the LBE effect is contingent on a firm's innovation capabilities. Only those sufficiently innovating firms are more productive due to exporting. For non-innovating firms, exporting could even result in decreased productivity. In research conducted in Chile, Bravo-Ortega et al. [52] find that exporting does not stimulate investment in R&D, though exports and R&D have a joint effect on improving productivity. Hence, in our study, we seek to answer if participating in international markets complements a firm's ability to innovate and thus enhance productivity.

Our approach is consistent with the evidence of Aw et al. [58], who consider that exports impact R&D investment, promote product and process innovation, and eventually stimulate a firm's productivity [10]. Using data for Italian manufacturing firms over the period 1998–2006, Iandolo and Ferragina [16] show that persistently innovative and exporting firms are more productive compared to persistently exporting (innovating) firms with non-persistent innovation (exports). Combining both strategies could be an opportunity to internalize knowledge flows from long-lasting exposure to foreign markets. These results hold especially for small firms [16]. When a firm enters into foreign markets, this improves its efficiency (process innovation) and enhances its product differentiation (product innovation), thus improving its productivity levels [59].

Referring to the extant body of research, Salomon and Shaver [18] account for more productive firms being more likely to become exporters while showing that LBE effects emerge ex post. Namely, considering the dynamics of innovation and exports manifested in the lagged export variable, they show that export leads to a subsequent increase in innovation, ultimately leading to productivity growth. Considering the scarcity and lack of empirical evidence, in our attempts to provide a more decisive answer on the joint effects of innovation and export, we define our third hypothesis as follows:

H3. *Innovation and exports jointly have a positive effect on labor productivity*.

3. Methodology

3.1. Data

We employ cross-sectional firm-level data for empirical analysis that is the sixth wave of the Business Environment and Enterprise Performance Survey (BEEPS VI 2018–2020). This survey was conducted by the European Bank for Reconstruction and Development (EBRD) and the World Bank Group. By using a stratified random sampling technique, the data was collected from the interview with the representatives of randomly chosen firms from 32 countries. The BEEPS VI dataset includes 17,847 observations, i.e., firms, which we refer to as the full sample. Notwithstanding, when discussing the size of the sample, it is worthwhile considering properties of propensity score matching in the part where the estimators are obtained by fitting the model to part of the sample, that is, the paired controlled and uncontrolled variables. For each estimated regression, in a table showing empirical results, we present a number of observations (firms) that were able to be paired and hence were used for estimating the parameters.

3.2. Empirical Strategy

When estimating the impact of exports and innovation on productivity (or other measures of firm performance), our empirical strategy needs to consider the endogeneity arising from selection bias [12]. Namely, more productive firms could self-select into exporting and innovating. In a cross-sectional setting like ours, treatment effects can be estimated either using the instrumental variable (IV) approach or matching estimators. Matching estimators have a few advantages over other cross-section empirical strategies. Compared to the IV approach, matching does not require valid instruments and does not

make any assumptions about the functional form of the outcome equation [60]. However, the main disadvantage of matching estimators is the assumption of unconfoundedness or selection of observables. This means that matching estimators assume that unobserved heterogeneity is unlikely to arise. In practice, researchers include many matching (control) variables to mitigate unobserved heterogeneity [60].

Given that firms might simultaneously engage in exports and innovation, we estimate treatment effects in multiple treatment contexts through the matching approach with multiple treatments introduced by Lechner [61]. We have M + 1 treatments, whereby treatment = 0 denotes firms that do not innovate and export; treatment = 1 denotes engagement only in innovation; treatment = 2 refers to engagement only in exporting; and treatment = 3 refers to engagement in both innovation and exporting. The average treatment effect on the treated (ATT) effect is then calculated as follows:

$$\mathrm{ATT} = \mathrm{E}(\mathrm{Y}^{\mathrm{m}} \mid \mathrm{T} = \mathrm{m}) - \mathrm{E}(\mathrm{Y}^{\mathrm{l}} \mid \mathrm{T} = \mathrm{m}) \quad (1)$$

Thereby, m denotes the treatment level, l represents the comparison group (the treatment level to which m is compared, termed matched controls by Czarnitzki et al. [60], and Y^m and Y^l denote outcomes in states m and l respectively. To estimate the model in Equation (1), we employ propensity score matching combined with entropy balancing.

Before estimating treatment effects, we must select matching (control) variables X. The literature suggests that observed variables that simultaneously affect treatment assignment and the outcome should be included. After selecting matching variables, the next step is estimating the propensity score model using either probit or logit models, as they usually yield similar results [62]. The subsequent step is the selection of the matching algorithm. The preferred estimator is a propensity score matching combined with entropy balancing [63]. Entropy balancing is a method of pre-processing data whereby the objective is to achieve a well-balanced sample prior to the estimation of causal effects. A well-balanced sample is found by adjusting the covariate distribution of the control group by reweighting or discarding control units until the covariate distribution of the comparison group is as similar as possible to the distribution of the treatment group [64]. Entropy balancing has an advantage over other pre-processing methods, as it achieves the best balance on all important covariates [64–66].

The outcome variable (Y) in our model is productivity. Generally, the two main approaches in measuring productivity are labor productivity and total factor productivity (TFP) or multi-factor productivity (MFP). Whereas most macroeconomic studies focus on TFP, given the availability of panel data, microeconomic studies mainly focus on labor productivity, particularly when panel data is unavailable. Labor productivity is expressed as output divided by a measure of labor input, which is either hours worked or the number of workers. We construct a measure of labor productivity by dividing a firm's total annual sales by the number of permanent, full-time employees. This way, we calculate the average output per worker. Next, we transform the level data in natural logarithms, as coefficients on the logarithm scale are directly interpretable as approximate proportional differences [52,67,68].

As explained above, the variables of interest are *innovation*, *export*, and the *joint effect of innovation and export*, respectively. Each of the three treatment variables is coded as a binary variable. The first treatment variable is *innovation*, which is a dummy variable equal to 1 if a firm engages in either product, process, or product and process innovation jointly. Product innovation refers to introducing products or services that are either completely new to the market or feature significant improvements [69]. Process innovation captures the introduction of new methods of manufacturing products or offering services and substantial changes in logistics, delivery, distribution, or supporting activities [70]. The second treatment variable is *export*, which is a dummy variable equal to 1 if a firm engages in either direct, indirect, or both direct and indirect exports. Direct exports suggest selling goods where an immediate recipient is outside the country's borders. Indirect exports refer to selling goods or occasionally services to a trader or a third party who then exports

products without modification. The third treatment variable is the *joint effect of innovation and export* (*both*), which is a dummy variable equal to 1 if a firm engages in innovation and export simultaneously, and equal to zero otherwise [71–74].

The set of control (matching) variables include total R&D expenditures (in logarithm), firm size measured by the number of employees (in logarithm), and a firm's age (in logarithm). A positive effect of R&D on firm productivity is well established in the knowledge capital framework developed by Griliches [75]. In this framework, R&D investment enters the knowledge production function to account for the accumulation of firms' stocks of knowledge [67,76]. Traditionally, differences in productivity levels across the firms were associated with various firms' characteristics. Firm size is generally positively correlated with labor productivity and innovation [71,74]. Small firms face various financial and non-financial impediments to innovation [77,78]. However, some studies find evidence of a negative correlation between a firm's size and productivity [72]. Hence, the sign of the relationship between a firm's size and productivity remains vague, with evidence of small firms being riskier yet more productive [79], along with evidence of larger firms enjoying effects from productivity accumulation [80]. Unambiguously, on the other side, a firm's size is found to be positively correlated with exports [81,82]. Our models control for firm age, as older firms are typically considered to have more experience, and hence are more competitive and have more capacities to innovate [74].

Furthermore, we include a dummy variable for having a website. The ever-growing research on the new trade theory emphasizes the importance of networking, including communication networks. Accordingly, firms having a website are more productive and export-oriented [83,84]. Moreover, having a website is associated with firms engaging more in innovative activities [85,86]. Besides firm characteristics, extensive literature argues that a firm's productivity is dependent upon market structure [87–89]. To account for market structure, we include a set of dummy variables for monopoly, oligopoly, monopolistic, and perfect competition. The literature suggests that larger and more dominant firms are generally more productive. However, surviving competition pushes small, less competitive firms to increase their productivity. Market structure is also found to affect innovation [90–92] and exporting capacities [93]. Lastly, we control for country and industry fixed effects by including dummies for countries and grouping industries according to their technological intensity (low tech, medium low tech, medium high tech, and high tech). Controlling industry or sector effects have been used in other studies on a firm's productivity and innovation to capture underlying industry-specific characteristics [71,74].

We consider that EU membership allows firms to access various funds supporting innovation and to enjoy the benefits of free trade. Consequentially, firms located in the EU have an environment more conducive to innovation and exporting activities [94]. For this reason, we explore the effects of innovation and exports on productivity in the subsample of EU firms. Furthermore, we explore whether the effects of innovation and exports depend on the geographical region [95]. This way, we split our sample into three groups: Europe, Central Asia, and MENA (Middle East and North Africa). The reasoning behind this is the abundant literature arguing the importance of distance and location for trade [96,97], and, particularly, for export [98]. With trade, including exports, being highly dependent on distance and location, we would expect that establishments within different regions might exhibit different relationships between innovation, exports, and labor productivity. The world map of countries by export (that the World Bank provides annually) shows differences in exports among regions, which are also visible when observing any data on exports on a global level.

Taking into account these arguments, it could be that the relationship between export and labor productivity (as well as the relationship between the joint effects of innovation and export on labor productivity) might differ depending upon the establishment's positioning within these geographical areas, which appear to be certain "export" regions (regions with higher and lower export). Furthermore, setting subsamples depending upon geography is supported by the finding in the literature that the environment of a firm

(including location and regional positioning) affects a firm's innovation [99,100]. Moreover, the grounds for dividing the full sample depending on geography are provided by the seminal studies explaining why and how geography matters for innovative activity, explaining that location matters for innovative activity, and explaining what ultimately allows for an increase in international competitive advantage [101]. Building on that, several studies contend that a firm's innovation and export are subject to space and territory. This standpoint follows from arguments that the emergence of innovation clusters depends on the region. The location appears to be especially significant given the relative immobility of resources needed for the engagement in innovation, such as knowledge, skills, and institutional and organizational structures [102].

Additionally, we account for mixed evidence on the relationship between innovation, exporting, and productivity depending on the level of development of a home country [34,41,44]. Thus, we group countries depending on the development level classification by the World Bank into high-income, upper-middle-income, and lower-middle-income economies. Observing innovation and exports at a country level, their levels seem associated with a country's development level. More importantly, studies suggest a firm's innovation is conditional upon its environment or the infrastructure it has access to [12]. Environmental factors tend to be strongly correlated with a country's level of development for a few reasons. One of the reasons is that wealthier countries allocate larger portions of their budgets to investment in R&D, which produces positive spill-over effects to individual industries and firms. Furthermore, capturing differences that might arise from a country's development also allows for (at least partially) capturing the type of economy regarding the level of development of individual industries.

Depending upon how developed certain industries are, a firm might have better access and support for innovation (and vice versa). For example, large tech and biomedical giants driving most of R&D globally are usually found in developed economies. This could suggest that SMEs in developing economies lack "giants producing ideas" on whose "shoulders these dwarfs could stand." Another reason for stratifying the sample based on the country's income level is differences in innovation sophistication levels across countries. Put simply, we want to account for the fact that the high-tech industry of a lower-income economy is very likely lower-tech compared to the high-tech industry of a high-income country. Similarly, a country's level of development could explain differences that might arise between firms operating across countries of different income-level groups. This argument finds its grounds in the fact that trade barriers are in a close relationship with a country's level of development. Table 1 shows the description of variables and their summary statistics.

Table 1. Variable description and summary statistics.

Variables	Variable Description	Mean (Standard Deviation)
Outcome variable		
ln_labor_prod	ln(n + 1) for n being the establishment's total annual sales for the last fiscal year	15.64 (4.80)
Treatment variables		
Innovation	dummy variable (DV) = 1 if the establishment has launched new products/services or has introduced new methods of manufacturing products/offering services, substantial changes in logistics, delivery, distribution, or in supporting activities; zero otherwise	0.30 (0.46)
Export	DV = 1 if the establishment has had a percent of direct and/or indirect export exceeding 0%; zero otherwise	0.05 (0.22)
Both	DV = 1 if innovation = 1 and export = 1; zero otherwise	0.03 (0.18)

Table 1. *Cont.*

Variables	Variable Description	Mean (Standard Deviation)
Control (matching) variables		
EU	DV = 1 if a country where the establishment is from is an EU member; zero otherwise	0.33 (0.47)
Europe	DV = 1 if a country where the establishment is from is being classified by the WB as being within Europe; zero otherwise	0.61 (0.49)
Central_Asia	DV = 1 if a country where the establishment is from is being classified by the WB as being within Central Asia; zero otherwise	0.16 (0.36)
MENA	DV = 1 if a country where the establishment is from is being classified by the WB as being within MENA; zero otherwise	0.21 (0.41)
Dev_lowmic	DV = 1 if a country where the establishment is from is being classified by the WB as a lower-middle-income economy in the year observed; zero otherwise	0.30 (0.46)
Dev_upmic	DV = 1 if a country where the establishment is from is being classified by the WB as a higher-middle-income economy in the year observed; zero otherwise	0.40 (0.49)
Dev_hic	DV= 1 if a country where the establishment is from is being classified by the WB as a high-income economy in the year observed; zero otherwise	0.30 (0.46)
Totalrnd	DV = 1 if during the last 3 years the establishment has spent on R&D within the establishment; zero otherwise	0.20 (0.40)
ln_firm_size	ln(n + 1) for n being the establishment's size in terms of number of full-time employees	2.56 (1.30)
ln_firm_age	ln(n + 1) for n being the establishment's age in terms of number of years for which the establishment operates (since the establishment was formally registered)	2.90 (0.65)
Competition_m	DV = 1 if the establishment is a monopoly within their market; zero otherwise	0.04 (0.20)
Competition_o	DV = 1 if the establishment is an oligopoly within their market; zero otherwise	0.18 (0.38)
Competition_some	DV = 1 if there are some competitors in market where the establishment operates (i.e., the type of market in which the establishment operates is a monopolistic competition); zero otherwise	0.22 (0.41)
Competition_many	DV = 1 if there are many competitors in market where the establishment operates (e. the type of market in which the establishment operates is a perfect competition); zero otherwise	0.56 (0.50)
Website	DV = 1 if the establishment owns its own website; zero otherwise	0.62 (0.49)
Industry_services	DV = 1 if the establishment's main industry is services; zero otherwise	0.44 (0.50)
Industry_lowhtech	DV = 1 if the establishment's main industry is a type of low-tech industry; zero otherwise	0.30 (0.46)
Industry_medlowtech	DV = 1 if the establishment's main industry is a type of medium low-tech industry; zero otherwise	0.16 (0.36)
Industry_medhightech	DV = 1 if the establishment's main industry is a type of medium high-tech industry; zero otherwise	0.09 (0.29)
Industry_hightech	DV = 1 if the establishment's main industry is a type of high-tech industry; zero otherwise	0.01 (0.11)

4. Results

Table 2, columns (1) through (3), show results for the models estimated in the full sample. From column (2), we can see that a positive relationship between a firm engaging in exports and an increase in labor productivity is established at the 1% level. Apart from being statistically significant, this result suggests that engaging in exports leads to an increase in labor productivity by 0.17%. As columns (1) and (3) show, we found no evidence of the relationship between innovation and labor productivity, and there is no joint effect of innovation and export on labor productivity.

Table 2. Empirical results for the full sample and EU subsample.

	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Variables	**Full Sample**	**Full Sample**	**Full Sample**	**EU**	**EU**	**EU**
Innovation	0.034 (0.028)			0.064 ** (0.039)		
Export		0.169 *** (0.088)			0.163 *** (0.077)	
Joint/both			−0.027 (0.060)			0.098 (0.088)
No of obs.	17,847	13,240	13,162	5278	3976	3953

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$.

Accounting for the heterogeneity of the full sample concerning control variables, we divide the full sample based on a few criteria. First, we focus on the European Union (EU). Table 2, columns (4) through (6) show results of our estimators for establishments located within the EU. A positive correlation between innovation and labor productivity is established at a 5% level of significance, suggesting that engaging in innovation allows firms to increase labor productivity by 0.06%. For exports, results show a positive correlation at the 1% level, showing that for an establishment headquartered in the EU, engaging in exports yields an increase in labor productivity by 0.16%. However, there is no evidence of the joint effect of innovation and export on labor productivity.

Comparing summary statistics of the EU subsample to the full sample in Table 3, we observe that average productivity in EU firms is qualitatively the same as in the full sample. However, a somewhat larger proportion of EU firms engage in innovation, exports, and innovation and exports jointly. As discussed above, we assume this might result from EU firms having better access to public innovation funds and more freedom of trade within the EU.

Table 3. Summary statistics for the EU subsample.

Variables	**Mean (Standard Deviation)**	
	Full Sample	**EU**
Outcome variable		
ln_labor_prod	15.64 (4.80)	13.17 (3.57)
Treatment variables		
Innovation	0.30 (0.46)	0.34 (0.47)
Export	0.05 (0.22)	0.07 (0.26)
Both	0.03 (0.18)	0.06 (0.24)

Table 4 shows the results of estimating the model in regional subsamples. Columns (1) through (3) show results for European establishments. A statistically significant relationship is established only between export and labor productivity, whereby engaging in export allows European firms an increase in labor productivity by 0.12%. As can be inferred from columns (4) through (6), no relationship has been established between innovation, export, or their joint effect within establishments headquartered within the Central Asia region. Finally, for the MENA subsample, we found a positive effect of innovation (although marginally at the 10% significance level), allowing an increase in labor productivity by 0.12%. Furthermore, at a 5% level of significance, we establish a positive relationship between export and labor productivity, suggesting the first one increases the latter by 0.47%.

Table 4. Empirical results in subsamples depending on their geographical location.

Treatment Variables	(1) Europe	(2) Europe	(3) Europe	(4) Central Asia	(5) Central Asia	(6) Central Asia	(7) MENA	(8) MENA	(9) MENA
Innovation	0.026 (0.032)			0.065 (0.072)			0.120 * (0.082)		
Export		0.115 ** (0.067)			0.122 (0.385)			0.471 ** (0.248)	
Joint/both			−0.042 (0.087)			0.096 (0.538)			0.311 (0.276)
No of obs.	10,289	7216	7206	2748	1695	1701	4353	4097	4034

Robust standard errors in parentheses; ** $p < 0.05$, * $p < 0.1$.

Comparing the summary statistics of our subsamples in Table 5, we see that, apart from a lower share of innovative firms, the MENA subsample is rather comparable to the full sample. However, in this subsample we find that the innovation effect is significant for a firm's productivity in Table 4. These findings correspond to studies showing that for MENA firms, innovation and trade play significant roles in increasing labor productivity [103]. Firms located in Central Asia have significantly higher labor productivity than firms in Europe and MENA, while leading in the share of firms that innovate and falling behind in terms of the share of firms that export (see Table 5). Surprisingly, in this subsample, we find no significant effects of either innovation or exports on labor productivity (Table 4). This, however, aligns with other empirical findings suggesting the effect of innovation on a firm's performance is more complex in Central Asia, while their export decisions are intertwined with economic, political, and various institutional characteristics [104]. These results are discussed in detail in the Discussion section below. Interestingly, the results for Europe are slightly different than the results for the EU subsample. We see that there is no longer an innovation effect, while the export effect is still positive and significant (at the 5% level of significance).

Next, we create subsamples accounting for differences across firms associated with their countries' wealth. Table 6, columns (1) through (3), show the results of testing the model within the subsample made by establishments headquartered in a high-income country. A positive relationship is established at the 1% significance level for innovation and labor productivity, indicating a firm engaging in innovation leads to their labor productivity increasing by 0.08%. Similarly, engaging in export allows for a 0.15% increase in labor productivity (at the 5% level). As can be inferred from columns (4) through (6), there is no evidence of a relationship between the variables of interest within the subsample of firms headquartered in an upper-middle-income country. Finally, for the subsample of firms from lower-middle-income economies, the estimated effect shows a positive relationship between export and labor productivity at a 5% significance level, suggesting that engaging in export allows for an increase in labor productivity of 0.33%.

Table 5. Summary statistics for regional subsamples.

Variables	Mean (Standard Deviation)			
	Full Sample	**Europe**	**Central Asia**	**MENA**
Outcome variable				
ln_labor_prod	15.64 (4.80)	14.23 (3.61)	21.50 (5.12)	15.22 (3.93)
Treatment variables				
Innovation	0.30 (0.46)	0.33 (0.47)	0.37 (0.48)	0.09 (0.29)
Export	0.05 (0.22)	0.06 (0.23)	0.01 (0.10)	0.03 (0.16)
Both	0.03 (0.18)	0.05 (0.22)	0.01 (0.11)	0.01 (0.10)

Table 6. Empirical results in subsamples depending on their country's level of development.

Treatment Variables	**(1)** **HIC**	**(2)** **HIC**	**(3)** **HIC**	**(4)** **UP-MIC**	**(5)** **UP-MIC**	**(6)** **UP-MIC**	**(7)** **LOW-MIC**	**(8)** **LOW-MIC**	**(9)** **LOW-MIC**
Innovation	0.079 *** (0.035)			0.009 (0.042)			0.021 (0.059)		
Export		0.151 ** (0.084)			0.048 (0.125)			0.331 ** (0.205)	
Joint/both			0.087 (0.101)			−0.170 (0.134)			−0.06 8(0.220)
No of obs.	5024	3374	3348	6555	4828	4818	6010	4861	4829

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$.

Looking at the summary statistics of these subsamples in Table 7, we see that the higher the income, the lower the average labor productivity. Conversely, the higher the income, the larger the share of firms that innovate, export, and both innovate and export. Differences in the significance of innovation and export on labor productivity depending upon the level of a country's development are also suggested in other empirical studies [17,45,49].

Table 7. Summary statistics for different income level subsamples.

Variables	Mean (Standard Deviation)			
	Full Sample	**HIC**	**UP-MIC**	**LOW-MIC**
Outcome variable				
ln_labor_prod	15.64 (4.80)	13.25 (3.81)	16.32 (4.69)	17.23 (4.87)
Treatment variables				
Innovation	0.30 (0.46)	0.36 (0.48)	0.29 (0.46)	0.22 (0.42)
Export	0.05 (0.22)	0.07 (0.25)	0.04 (0.19)	0.03 (0.16)
Both	0.03 (0.18)	0.06 (0.23)	0.03 (0.18)	0.02 (0.13)

After dividing the full sample into subsamples, we found that engaging in innovation positively correlates with productivity, thus providing support for hypothesis *H1*. Technological (product and process) innovations have a positive effect on labor productivity

and are found within the subsample of the European Union (increase in labor productivity by 0.06%, at the 5% significance level), MENA (increase in labor productivity by 0.12%, at the 10% significance level), and high-income economies (increase in labor productivity by 0.08%, at the 1% significance level).

Furthermore, we find support for *H2*, that exporting positively affects labor productivity. Significant proof of a positive correlation between export and labor productivity growth emerges from testing the model in the full sample (increase in labor productivity by 0.17%, at the 1% significance level), as well as in the following subsamples: European Union (increase in labor productivity by 0.16%, at the 1% significance level), Europe (increase in labor productivity by 0.12%, at the 5% significance level), MENA (increase in labor productivity by 0.47%, at the 5% significance level), high-income economies (increase in labor productivity by 0.15%, at the 5% significance level), and lower-middle-income economies (increase in labor productivity by 0.33%, at the 5% significance level).

Finally, after breaking the sample into subsamples, we found no evidence of complementary effects of innovation and exports on a firm's productivity. Thus, we found no evidence for hypothesis *H3*, that innovation and exports jointly have a positive effect on labor productivity. The following section discusses the main findings and compares them to previous empirical evidence. We also provide possible explanations for heterogeneous results across regions and countries at different levels of economic development. Table 8, below, gives an overview of hypotheses validation.

Table 8. Overview of hypotheses validation.

Sample Used	Hypothesis Supported/Not Supported		
	H1: ***Technological (product and process) innovations have a positive effect on labor productivity.***	**H2:** ***Exports has a positive effect on labor productivity.***	**H3:** ***Innovation and exports jointly have a positive effect on labor productivity.***
Full sample		✓	
Subsamples			
EU	✓	✓	
Europe		✓	
Central Asia			
MENA	✓	✓	
HIC	✓	✓	
UP-MIC			
LOW-MIC		✓	

A tick symbol (✓) suggests validation of hypothesis within a corresponding sample.

5. Discussion

Our results clearly show that innovation positively affects labor productivity, so as the exports. Nevertheless, we cannot claim the same for the joint effect that these two have on labor productivity. It is worth mentioning that we found support for both *H1* and *H2* within the European Union, MENA, and high-income economies subsamples. Our evidence of a positive influence of innovation on labor productivity is in line with findings from other studies. Morris [20] conducts the largest cross-country assessment of this relationship by using data on firms in 43 countries from the WBES. His findings comprehensively reinforce the traditional patterns in the innovation literature, whereby innovation effort, capital intensity of firms, and human capital are important for product and process innovations, which, in turn, significantly and economically improve productivity.

In relation to the impact of export on productivity, empirical results show uniformly positive effects. These results are overall aligned with the long-standing literature on trade arguing in favor of openness to trade by proving it allows for an increase in productivity (including labor productivity). Finding more evidence in support of our claims that export benefits labor productivity is in accordance with other studies. For example, Pietrucha and

Zelazny [105] explored trade (import and export) and foreign direct investment (FDI) as channels of international total factor productivity (TFP) spillovers in 41 countries (members of the EU and OECD) during the period 1995−2014, and concluded that each of the spillover channels of TFP is significant for TFP when studied separately, while a joint examination of all channels allows for concluding that the export channel is the dominant one. Bravo-Ortega et al. [52] find that firms that invest in R&D are considerably more likely to export, but the reverse effect does not hold. Thus, finding more evidence for export compared to innovation increasing labor productivity could make a case for itself, leading to a conclusion that innovation might also stimulate exports, whereas the opposite is less likely.

Furthermore, finding more evidence of exports enhancing labor productivity is also in line with other studies [52]. For example, Wagner [106] finds a positive relationship between export and labor productivity across German firms. In contrast to the a priori expectation that given a positive and significant relationship between innovation and labor productivity and, at the same time, export and labor productivity, the joint effect of innovation and export would also be significant and positive, this does not happen to be the case. Despite the significance that can be attached to these two variables individually increasing labor productivity, there is no evidence that an increase in labor productivity is subject to the joint effect of innovation and exports.

Interestingly, the joint effect does not seem to be relevant even in the subsamples where we found statistically significant relationships for both innovation and exports individually. Thus, we found no evidence to support hypothesis *H3*. This is in contrast to other studies arguing the existence of joint effects of innovation and exports on productivity. Dai et al. [12] suggest the existence of a complementary effect between export and innovation on the performance of Chinese manufacturing firms. The results indicate that starting to innovate for firms already engaged in export brings additional markup gains of 3.99% and productivity gains of 17.35%. Likewise, starting to export for innovating firms lead to additional increases in markup of 2.01% and productivity of 11.63%. Therefore, Dai et al. [12] conclude that there is a complementarity between export and innovation. Furthermore, Bravo-Ortega et al. [52] find that even though exporting does not stimulate investment in R&D, exports and R&D have a joint effect on improving productivity. An interesting question is whether the effects are rather modest to be captured, or the combined effect of innovation and exports on labor productivity is more complex.

Positive effects of innovation are more pronounced within subsamples or firms located in more advanced economies, particularly the EU member countries, as well as high-income countries [45,107]. Though, our finding of a positive correlation between innovation and labor productivity pronounced for MENA firms is somewhat surprising (although only marginally significant at the 10% level). The results obtained for the EU and high-income economies might be rather expected, though given the situation of MENA from 2011 on, it comes as a positive surprise that innovation is a driver of labor productivity for these firms. This, however, aligns with other empirical studies arguing that the MENA region went through positive transformations that led to the array where firms are substantially benefiting from engaging in innovation [108]. Additionally, the MENA region benefits from its geographical positioning, including access to large markets in Europe and Asia [108].

Apart from evidence of export contributing to labor productivity in our full sample, we found the same results for every subsample except Central Asia and upper-middle-income economies. Our empirical findings for Central Asia contrast findings from other studies about innovation positively affecting labor productivity [107,109]. However, they are aligned with the literature suggesting that the effects of innovation on firms' performances are more complex in Central Asia. At the same time, their export decisions are intertwined with economic, political, and various institutional characteristics [104]. Furthermore, some studies suggest that firms located in Central Asia are still going through a transition process reflected in different paths to increasing productivity [110].

Moreover, Cirera and Muzi [111] note that firms located in developing economies are more likely to engage in incremental than in radical innovation due to the lack of firms' innovation capabilities, in particular managerial capabilities [112]. Although in our empirical models we do not make a distinction between radical and incremental innovation, limited financial, physical, and human capital in less developed economies could suggest that firms in these countries mostly introduce incremental innovations that do not fully reap the returns to innovation investments [112], in particular with respect to productivity. Furthermore, Gkypali et al. [36] note that innovation might not have an expected positive effect on productivity because positive innovation effects that lead to economies of scale in the distribution of goods might be offset by a crowding out effect, whereby sales of existing products are reduced, and thus their profitability and productivity are also reduced.

In Central Asian countries, export participation may not increase firms' adoption of new knowledge, expertise, and technology, if exporting firms are mostly from labor-intensive, low-tech industries [113,114]. This, in turn, would suggest that export participation does not have an expected positive effect on productivity, as exporting firms have limited capacity for productivity enhancements. In our subsample of firms located in Central Asia, 91.64% firms are from former Soviet republics. According to Coulibaly [115], the economic structures of these countries are still shaped by their history of integration in the Soviet economy. Similarly, a majority of firms in the subsample of upper-middle-income are located in either former Soviet or former Yugoslavian republics. Given their history of communism and socialism, a transition to capitalism is certainly slowing down their adoption of innovations and integration in international trade.

Finding no evidence that either innovation or export affect a firm's productivity for upper-middle-income economies is, to some extent, justified by other studies showing that upper-middle-income countries are facing unprecedented and continuously high levels of competition in markets [116]. Consequentially, they are fighting to improve their productivity in the exceptionally turbulent environment, making their engagement in innovation more challenging and uncertain [117]. Despite the mainstream views of trade openness, market liberalization, and free access to foreign technology [118], empirical results for upper-middle-income economies suggest that these processes are not fully implemented [117].

Finally, looking more closely into the structure of our subsamples for Central Asia and upper-middle-income countries, 78.94% and 54.00% of subsamples, respectively, refer to firms from countries that the IMF classifies as transition economies. These economies undergo structural transformation processes, suggesting that they are moving resources from lower to higher productivity and to skill-intensive sectors, facilitating catching-up effects [29]. However, this process is notoriously slow. Capital investments and R&D are some of the prerequisites for technological innovation. Lacking these prerequisites impedes innovation, as firms face underperformance or dissolution [30,31]. Furthermore, macroeconomic environments in transition economies (going through liberalization, stabilization, privatization, along with legal and institutional reforms) are rather challenging for trade, including exports [119].

Our results do not offer a conclusive answer on the impact of innovation and exports on labor productivity. Notwithstanding, our results shed some light on the ambiguity of the relationship between innovation, export, and labor productivity. This contrasts the established views of the straightforwardness of the relationships between each of the two—innovation and export, and productivity. Most previous findings suggest that innovation and export activities are associated with an increase in labor productivity. Surprisingly, our results show that even when there is a positive relationship between innovation and labor productivity, and at the same time, a positive relationship between export and labor productivity, there does not seem to be evidence of the effect that the joint effect of innovation and export produces on labor productivity. This might imply that either innovation or export do not simply 'add up' to each other to increase labor productivity,

or that they do, but in a way that they 'overlap' or 'congest', making their joint effects economically insignificant.

6. Practical and Policy Implications

Our results offer some policy recommendations regarding productivity enhancements of firms' innovation and exporting activities. The first recommendation is associated with the innovation effect on productivity or a lack thereof in countries whose macroeconomic environment should be more conducive to innovation. More precisely, policymakers in less developed economies outside of the EU and high-income countries should provide more support for innovation, either directly through, e.g., R&D subsidies, tax credits, etc., or through improving macroeconomic conditions, thus enabling firms to be more innovative. Once these conditions are met, our empirical findings from the EU and high-income countries indicate that firms in other emerging economies would reap productivity benefits from innovation activities. The second policy recommendation focuses on the absence of synergistic effects of innovation and exports on productivity, a pattern found in all less developed economies included in the analysis. As for policy design and implementation, it is a common practice that public support for innovation and exports is provided by distinct policy agencies (or their departments). However, government agencies should coordinate their efforts if a policy goal is achieving synergistic productivity gains from innovation and exports. To be more precise, public agencies in charge of designing and implementing R&D and innovation policies should coordinate their policy goals and instruments with public agencies that provide support to exporting firms.

Limitations and Suggestions for Future Research

Our study has some limitations that can serve as suggestions for future research. The first limitation is associated with the cross-sectional nature of the data. Namely, the lack of panel, longitudinal data prevents us from fully taking into account the endogeneity of innovation and exports and distinguishing between short and long-run innovation and export effects [120]. The second limitation is related to how micro effects translate on a macro level. Our paper provides micro-level evidence that firms engaging in R&D and exports exhibit an increase in productivity. We found particularly intriguing results where both innovation and exports had a significant and same direction effect on a firm's productivity, and yet there was no significant joint effect of innovation and exports on productivity. Albeit we did not find strong support for the relationship between the interaction of innovation and exports on productivity at a firm level, this does not preclude the possibility of the interaction of innovation and exporting at the industry or country level affecting the country's productivity growth. We believe our findings laid solid grounds for further research on whether developing economies could aggregate over a large number of such smaller firms that are producing ideas and exporting and hence achieve an increase in output growth. Finally, to gain more understanding of the influence of innovation and exports on productivity, future studies should conduct a qualitative analysis (such as interviews and case studies) that would complement the current empirical findings. This mixed-method approach would provide more fine-grained insights into the effectiveness of innovation and exports in stimulating labor productivity in less developed economies.

7. Conclusions

This paper estimates the individual and joint effects of innovation and exports on labor productivity in less developed economies. We apply the propensity score matching approach combined with entropy balancing on a large sample of firms in less developed economies using the BEEPS VI data. Apart from a full sample analysis, we report results from subsamples of countries depending upon their membership in the EU, their regional positioning, and their income level. While export and innovation decisions are highly interdependent, we explicitly account for firms' endogenous exports and innovation decisions. Our empirical strategy takes into account the endogeneity of both exports and

innovation [12]. The overall results suggest that exporting firms are more productive than non-exporters. The impact of innovation is rather more heterogeneous. While the EU and high-income countries reap the productivity benefits of innovation, this effect is absent in other regions and countries at medium and low levels of income. Finally, our results indicate the absence of a joint, complementary effect of innovation and exports on labor productivity. This finding is confirmed across regions and countries at different income levels.

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