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THE SIGNIFICANCE OF STANDARD, PATENT AND LABOUR ON IMPORT VALUE: CASE STUDY IN INDONESIA

Abstract. *Being a never-ending debate, the direction of developing standards has to be in the opposite direction in facilitating international trade. This study investigated the relationship of standard, patent, and labor on Indonesian import. This study found some differences and very diverse correlations between the components in the second factor, both positively and negatively correlated. Those studies are generally carried out by developed countries, where the infrastructure to support innovation and standards has developed rapidly. The analysis of this research was carried out using panel data regression and the Cobb-Douglas function. Estimation was carried out using the fix effect and the random effect models. The robust model found variables that impact Indonesian import performance, both simultaneous and partial tests. In addition, a significant impact of the contribution of national standards on the growth of import value and sectors was determined. The low growth rate of patents for the same sector shows the innovation sectors that contributed less to the import value when observed more deeply. In contrast to national standards tending to be domestic, the growth standard of a sector will be inversely proportional to the growth in the value of imports in that sector, except for sectors whose conformity assessment does not support infrastructure. Besides, this study found that labor had no significant impact on import value. However, there was a significant potential from developing national standards and adopting international standards for the growth of national import performance in Indonesia. In addition to functioning as an empirical investigation of the effect of the growth of national standards, the adoption of international standards, labor, and patents on the growth of import value, it also looks at the contribution to the knowledge of developing countries' import growth factors, especially those related to standardization. The analysis shows that national standard growth and adoption growth differently contribute to Indonesian import performance. The findings show that the two factors in standard development have different functions in import performance. This paper further contributed to the knowledge of import growth factors of a developing country, particularly those related to standardization.*

Keywords: panel data regression, innovation, standardization, worker, import product.

Introduction. After the global recession, world economic activities have become very dynamic. It is shown from the increase in the value of trade among countries. In international trade, the value of export-import products has increased significantly due to the gradual elimination of non-technical barriers and quotas (Beghin, 2013) and the increase in demand. The increase in market consumption in a country is fulfilled by domestic producers and added by imported products. Although the quality of imported products is different from the quality of domestic products, it has to meet the minimum requirements in the national standard that the regulations have adopted. Imported product manufacturers generally use high technology in production (Raikes et al., 2000) and are packaged more attractively or made according to international standards (Hogan et al., 2015; Cummins, 1998; Marette and Beghin, 2017).

In the last decade, Indonesian import has significant increase. Product import continues to grow significantly in line with the increase of demand that is less supported by domestic production rise. The high volume of imports in the domestic market causes intense competition for the quality and price of products (Maskell and Malmberg, 1999). Companies use standards to increase their average product acceptance rate by implementing harmonized testing standards. Gandal (2002) interpreted standardization as a 'de facto standard'. In turn, stakeholders in the market determine it according to their

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needs. ISO defines a standard as a formal document that describes the criteria, methods, processes, and technical practices established by stakeholders on a consensus basis (Liu et al., 2016). Standards play an important role in international trade and are often used as a business strategy (Shin et al., 2015). Some literature shows that the impact of standards in international trade includes: as a form of non-price competition, helping to improve trade performance through quality information, and increasing trade potential through product compatibility and conformity assessment (Tran et al., 2013). Companies and governments have widely adopted and used international standards, including developing countries, to support international trade or competency requirements in global markets (Hogan et al., 2015). Awareness of developing international standards is increasing, as indicated by the increased participation in membership of the Technical Committee or Sub-Committees by developing countries (Maertens and Swinnen, 2009). It becomes more efficient when the government supports the domestic industries by adopting international standards. Besides increasing competitiveness, the standard also affects the transparency of technical specifications for foreign suppliers (Blind, 2004).

In the import scheme regulated by the Ministry of Trade, import documents must contain product information such as composition, quality, and safety assessment results following product registration requirements, health certificates (commercially available food products), food security guarantees (for food products), and laboratory test results (Tongeren et al., 2011). In addition, other general documents that need to be attached are Product Certification Marks – Indonesian National Standards (SPPT - SNI) for mandatory products, agricultural product phytosanitary certificates, and Genetic Modified Organism (GMO) certificates for products derived from soybeans, corn, potatoes, tomatoes, and processed products. There are also several other special provisions such as radiation-free certification for dairy products from Europe, halal certificates (if the product contains a halal label), and certificates of origin for meat, gelatin, collagen, and skin products (Nurhayati, 2009).

The application of LARTAS (Larangan Terbatas or Restricted Ban) in Indonesia for specific import products is conducted both by manual and computerized system, known as the Indonesian National Single Window (INSW). It is regulated under the Regulation of the Minister of Trade No. 12 of 2018 about the provisions on certain products' import. In this system, customs officers could check the suitability of imported documents online through the Electronic Data Exchange (PDE) media, and the product inspection is carried out by the authorized agency (Mclinden, 2011). General provision on the import, distribution and supervision of products in the domestic market is regulated in the Regulation of Minister of Trade No. 48/M-DAG/PER/7/2015 on General Provision of Import. Risk assessment procedures are applied in the supervision process. Besides, food additives could endanger health. Thus, it must meet Article 21 of Law No. 23 of 1992 and the Regulation of the Minister of Health No. 722/Menkes/Per/IX/1988. The supervision of imported products in the market requires a large budget and comprehensive support infrastructure. Besides, EU members have done it with the Blue Guide, market surveillance since 2016. It is focused on high-risk and frequently traded products in the market. Beyond standards, companies need innovation and reliable labor to meet market or consumer requirements (Fujiwara, 2012). Companies must also consider the right time to standardize their innovations (Friedrich, 2019). For SMEs, standardization activities could eliminate flexibility and creativity. However, standardization is inevitable when demand increases, including imported products. Product standardization must be based on market needs supported by regulations to reduce the effects of many innovations.

Literature Review. In some references, international standards have a positive and significant impact on import performance, and it all applies in developed countries (Blind, 2004; Blind and Jungmitagg, 2001; Grajek, 2004; Moenius, 2004; Moenius, 2006; Swann et al., 1996; Clougherty and Grajek, 2008). Whether it also applies to developing countries through adoption programs is often questioned. Blind's study found that innovation explains half of the observed microeconomic growth and standards contribution through technology diffusion. Hence, the standard is essential in the national innovation system (Blind and Grupp,

2000). There is also some literature dealing with the effect of innovation on economic growth both individually and nationally. This trade situation creates technological competition (Pack and Saggi, 1997) and market failures (Beghin, 2013) between domestic products and imported products (Blind and Mangelsdorf, 2016; Fischer and Serra, 2000; Marette and Beghin, 2017). Regarding import performance, Swann (2010) has identified many references and found two studies with a negative and significant effect from national standards on import performance. In addition, there are also three research references showing that there is a positive and significant influence from national standards on the value of imports. Furthermore, there are also references related to import regulations and standards (Swann, 2010).

However, stakeholders raised many issues on standardization, expressing doubts about developing the national standards. The adoption of international standards had a significant effect on causing flooding of imported products in the country. In this case, the question raised is whether the policy of national and sectoral standards development through the adoption program of international standards is appropriate in supporting international trade facilitation, especially imported products. A previous study was limited to two independent variables and found a significant correlation between the development of national standards and the adoption of international standards on import values. The analysis found that the two variables interact with each other. For the partial analysis, this study positive and significant correlation between the adoption of international standards on import performance for the agricultural, mining, and minerals sectors. Considering that only two independent variables were involved in the previous study, adding two new variables that affect import performance in this study is necessary. These variables are patent and labor. In some countries, labor is one of the determining factors for economic development success. The region's rapid development is influenced by the number of workers, especially those with more expertise since the industrial growth is influenced by the number and expertise of the workers. Productive workers are people between the age of 15-64 years old or those who can produce goods and services and increase production activities. Thus, the demand for labor would increase (Sayifullah and Emmalian, 2018). Many workers are an important resource in increasing economic growth and a determining factor for productivity (Mankiw, 2014). Lindbom (2009) has investigated the effect of imported goods and labor productivity at the municipal level, confirming a relationship between the import of goods and labor productivity. Another study was conducted by identifying the relationship between the number of labor and import. The result showed that import competition tends to raise casual employment among workers with education above primary (Goldar and Aggarwal, 2010).

The role of labor is also explained by research conducted by Artuso and McLarney (2015), showing that skills and wages affect the shift in productivity in trade, which will affect import activities. If a country decides to lower its labor quality, unskilled labor will increase, wages will decrease, and production shifts will likely decrease. Furthermore, the analysis method applied in the previous study is only Pearson correlation analysis (Tampubolon and Isharyadi, 2017). For this challenge, this study was conducted by adding patents and labor as the control variables in the analysis. Related to this, Maskus (2002) has predicted that stronger patents could induce changes in imports of high-tech goods, but it also depends on the size of the market and the extent of patent revisions. Estimation of the trade effect would differ in each country, and the effect of patents on imports in Indonesia would be investigated. Like China's economic growth, the patents produced continue to increase and affect its economic growth (Liu and Qiu, 2016). Policies in a developing country, such as Indonesia, show that regulators tend to protect the domestic market by adopting standards into regulations (Fischer and Serra, 2000; Marette and Beghin, 2017). In addition, for the most part, standards adopted in the regulations are national standards due to the adoption of international standards. This program is an effort to prevent sub-standard products from reaching the market through international standardization. In this case, this study analyzed the relationship of national and international standards, patents, and labor to the import rise.

Patents are exclusive rights granted by the state to inventors for their inventions in the technology sector for a certain period (Law No.13/2016). Patent licensing is part of a nation's technological independence to reduce the possibility of a technology monopoly (Utama, 2012). Patents could be divided into two types, namely ordinary patents and simple patents (Ramli and Putri, 2018). Ordinary patents are patents that have gone through in-depth research or development with more than one claim. Simple patents do not require in-depth research or development and contain only one claim (Ramli and Putri, 2018). The patent system could protect innovative inventions from developed countries. However, on the other hand, the patent system could not protect inventions in developing countries (Utami et al., 2014). The current study data cover these two types of patents and do not separate them.

Furthermore, information in the patent could be useful for monitoring competitors and identifying sources of technological knowledge and human resource management (Ernst, 2003). Especially for developing countries, the economy is still focused on increasing innovation. Besides, it is measured through patents (Ernst et al., 2014). An intellectual property right is an essential indicator for measuring a country's innovation level, especially patents.

Methodology and research methods. This study used quantitative data with a ratio scale. Data from several objects in the labor sector, national standards, patents, and imported goods, obtained from annual records, are cross-section data. Besides, this study used various data sources such as national standard data (sta) and international standard adoption (ado) from 1987 to 2017, which were obtained from the Center for Documentation and Information – National Standardization Agency of Indonesia (BSN). Furthermore, international Classification for Standards (ICS) was also used to classify national and international standards. This classification applies to documents such as standards, standard profiles, technical specifications, technology assessments, technical reports, technical regulations, guidelines, codes of practice, and others. By definition, this classification is compiled to classify national, regional, international, and other normative documents in databases, libraries, and others. In addition, ICS classification was also used to adopt international standards.

Patent data (pat) from 1998 to 2017 were obtained from the Directorate General Intellectual Property Rights of the Ministry of Law and Human Rights. The patent data result from an annual patent recapitulation registered at the authorized agency. According to the World Intellectual Property Organization (WIPO), the International Patent Classification (IPC) provides a hierarchical system of independent language symbols for classifying patents and utility models according to the different areas of technology to which they pertain. IPC classification structure has a derivative up to the fifth level, namely Section-Class-Subclass-Group-Subgroup. The subgroup has a different variation of digit formats, which are between 7 digits to 11 digits. Hence, raw patent data are grouped by class and correlated with other variables. Import data (imp) and data on the number of labor (lab) from 1999 to 2017 were further received from the Statistics Indonesia (BPS). In this case, the Harmonized System (HS) classification would classify the import commodity sector in trade transactions. In general, import product transactions use dollars. This export product sector uses two-digit or more codes. Based on the data on the distribution of Indonesia's imports, the development of several prominent commodity sectors can be seen. In the last 18 years, the average import rate is around 15 - 20 percent per year per product group such as nuclear reactors, boilers, machinery and mechanical equipment, computers (HS 84); inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes (HS 28); organic chemicals (HS 29); tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks (HS 32); essential oils and resinoids; perfumery, cosmetic or toilet preparations (HS 33); soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, «dental waxes» and dental preparations with a basis of plaster (HS 34); albuminoidal substances; modified starches; glues; enzymes (HS 35); and base

metals and articles of base metal (HS 72-76, HS 78-83). Therefore, the data concordance used results from a compilation study of several published conversions, namely the concordance between the ISIC revision 4, ICS, HS, and IPC V8 classifications. This concordance includes standard, patent, and labor classification and sector classification of imported commodities in trade. The correlation of SNI and HS also provides various benefits, namely as a means of identifying products with high import values for SNI reinforcement, identifying SNI product scope gap compared to product variations in HS through the preparation of PNPS, as well as identifying opportunities, threats, and strengths through incoming notifications (Purwanto фтв Tampubolon, 2014).

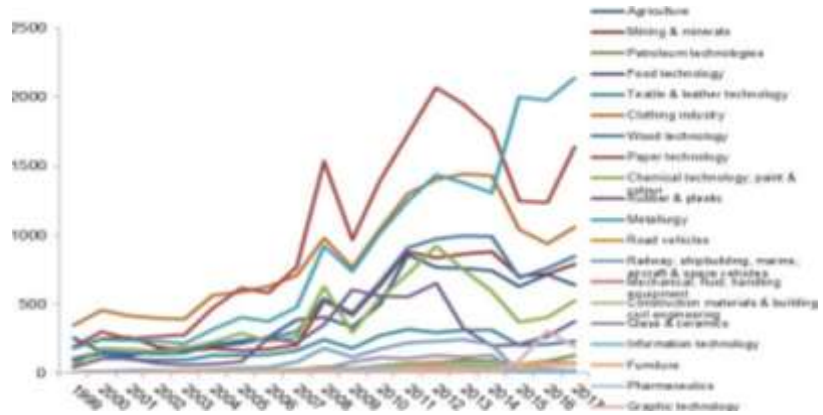

Figure 1. Distribution of Indonesian import by commodity sector in million USD

Sources: developed by the author based on (BPS, 2017).

The picture above shows sectors that have grown over the last two decades, including mechanical, fluid for general use, the materials handling equipment sector; metallurgy sector; chemical technology; paint and color sector, and textile and leather technology sector. However, sectors that decreased in the last two decades include food technology, rubber and plastic; road vehicles; and paper technology.

The International Standard Industrial Classification of all Economic Activities (ISIC) revision 4 or the Indonesian Standard Classification of Business Fields (KBLI) classifies the labor. It follows the classification of the industry as a place of employment and is determined based on its main production, namely the type of commodity produced with the greatest value. The number of labour affects the level of production in a company, both paid and unpaid labor. Large and medium industrial workers are workers who directly or indirectly work in the production process or are related to it, including those who supervise the production process, record raw materials and products, head of personnel, security, company drivers, and others. In this case, this study would not include home industries (less than four workers) and small industries (less than 19 workers). The reason is that both types of industries have limited capital and are unlikely to apply standards. In addition, it is almost certain that the characteristics of companies in Indonesia that could import products from abroad are only medium and large industries. Medium-scale companies have 20 to 99 labors, while large-scale companies have more than 100 workers (BPS, 2017). This classification does not consider either the use of power machines or not and the amount of company capital. However, the number of labours describes the size of a company or the amount of production capacity. The company's main product with the largest value or quantity determines the standard code for the business field. In this study, labour data are the number of workers who work in the middle-high manufacturing industry. Meanwhile, workers in small and micro industries are not included. Apart from the difficulty in obtaining data, a few small and micro industrial entrepreneurs are still involved in

standardization activities and apply standards in their products or services. This assumption is also under the results of previous research and field surveys. The scope of this study focuses on the process of manufacturing and services companies. This manufacturing covers the economic activity of changing basic goods by mechanical, chemical, or hand into finished/ semi-finished goods or goods of higher value. Industrial services and assembling work are activities to serve the needs of other industries, for example, processes with manufacturing fees. Data in each classification is further linked by Concordance between NACE Rev.2/ISIC Rev.4, IPC V8, ICS 6 Ed. and HS 2012 in the previous study (Tampubolon, 2016).

The calculation of the contribution of standards to import performance was carried out using the econometric model, where several factors influence import value as a function of performance in the regression model. In this case, this study referred to Wooldridge (2010) by determining the cumulative distribution function of the normal distribution. Thus, the logarithmic regression model coefficients were estimated using the maximum likelihood estimator. In this case, the reported standard errors are strong for heteroscedasticity. In this research, the commonly used function is the Cobb-Douglas function (Cheng and Han, 2014), which empirically describes the relationship between economic output and the factors of patent, standards, labor, and the adoption of international standards in the form of a general equation:

$$Y = f(X_1, X_2, \ldots\ldots X_m) \quad (1)$$

$$Y = AX_1^{\beta 1} X_2^{\beta 2} \ldots AX_m^{\beta m} \quad (2)$$

where Y is the value of import; β is the elasticity value of factor X (which affects the import), including patent (X1), SNI (X2), labor (X3), and adoption (X4).

Then, the equation is formed as follows:

$$imp_{it} = A.pat_{it}^{\beta 1} sta_{it}^{\beta 2} lab_{it}^{\beta 3} ado_{it}^{\beta 4} \quad (3)$$

where *pat* is paten, *sta* is standard, *lab* is labour, and *ado* is adoption.

Import value is the total value of the transaction process of imported goods or commodities which legally enter the country during *a* period *t* or annually. *A* is a measure of technical progress as a function of technological knowledge as represented by the productivity of the number of workers (lab_{it}). At the same time, the adoption of international standards (ado_{it}) was used as a reference and product quality assurance in trade transactions. In addition, sta_{it} is the number of Indonesian National Standards (*SNI*) during period *t*, and pat_{it} is the number of patents during period *t*. Both parts of the equation further take the logarithm.

The hypothesis in this study is whether patent, standard (Blind and Jungmittag, 2008), and labour contribute to Indonesian import performance. Based on the source of diffusion of technological knowledge on standards through the employees, there are two types of diffusion source, i.e., domestic, and external. Local technology knowledge dominates the specifications in national standards development. However, their source is mostly from international organizations for the adoption of international standards.

Result. Descriptive statistics**.** Table 1 above shows the value of observations or the amount of data (N) in this study. Thus, the number of observations is 380, consisting of twenty sectors (n). The sector title follows the International Classification for Standard (ICS). The result shows that the average import value is USD 270.47 million. The maximum import value was USD 2,134.65 million in 2017 in the Metallurgy sector, while the minimum import value was USD 0.20 million in 1999 in the Pharmaceutics sector. The maximum increase and decrease in import variables are at the average of 408.71 million US dollars, indicated by the standard deviation value. The current study covered twenty sectors, where there was no national standard for Graphic technology until 2016. Food technology had the highest number of national standards of 886 documents in 2017. The average number of national standards for each sector each year is 196 documents. Table 1 presents other variables. Furthermore, the instrumental variables are included in this model to explain the potential endogeneity problem concerning the dependent variables

of our primary interest (standards and adoption). The instrumental variables are expected to fit as they correlate with the intended potentially endogenous regressors and are less correlated with the regression model error term to be estimated (Wooldridge, 2010).

Table 1. Descriptive statistics

Variable	Obs	Group	Mean	Std. Dev.	Min	Max
Import	380	20	270,456,986	408,705,550	199,647	2,134,653,777
Patent	380	20	2,107	5,029	1	41,511
Standard	380	20	196	180	0	886
Labour	380	20	212,913	243,266	3,448	1,217,007
Adoption	380	20	15	33	0	218

Sources: developed by the author.

Table 2 shows that the correlation between the independent and dependent variables (import performance) is quite strong except for the variable of international standards adoption. Meanwhile, the correlation between independent variables is less than 0.5 (good enough), except for the relationship between national standards and patents. Hence, based on the values in this table, these variables are sufficient to be analysed in this study.

Table 2. Correlation value between variables

	lnimport	lnpatent	lnstandard	lnlabour	lnadoption
lnimport	1.0000				
lnpatent	0.7196	1.0000			
lnstandard	0.6721	0.5353	1.0000		
lnlabour	0.5463	0.3286	0.4872	1.0000	
lnadoption	0.2910	0.2023	0.2495	0.2328	1.0000

Sources: developed by the author.

Panel model results. To see the effect of developing standards (sta), patents (pat), labor (lab), and adoption of international standards (ado), it is necessary to arrange a panel regression model of the dependent variable Y (import - imp) and four independent variables X. Data analysis has obtained panel regression models as formed in this study, namely Fix Effect Model and Random Effect Model. After the models were formed, the model selection was carried out. Then the Robustness checks were further conducted and eventually followed by the last step, forming a Robust model.

In this model, the fixed model approach is often organized by including dummy variables to allow differences in the value of different parameters in individual units. The number of dummy variables must correspond to the number of objects or individuals. This fixed effect model is the Least Square Dummy Variable (LSDV). The advantage of the LSDV approach is that it can produce an efficient and unbiased β_LSDV parameter.

Table 3. Estimation of fixed effect model

Lnimport	Coef.	Std. Err.	T	P>|t|	[95% Conf.	Interval]
Lnpatent	.4651287	.0636041	7.31	0.000	.3400416	.5902157
Lnstandard	1.7170560	.1521987	11.28	0.000	1.4177350	2.0163780
Lnlabour	.4005502	.2046675	1.96	0.051	-.0019592	.8030596
Lnadoption	-.3267294	.0442347	-7.39	0.000	-.4137235	-.2397353
_cons	4.2770060	2.3034280	1.86	0.064	-.2530302	8.8070420

Sources: developed by the author.

Based on the program, the panel regression data of FEM model for this case is as follows:

$$lnimp_{it} = 4.2770 + 0.4651lnpat_{it} + 1.7170lnsta_{it} + 0.4005lnlab_{it} - 0.3267lnado_{it} \quad (4)$$

This model has a simultaneous/statistical F test value of 31.72 and a probability value of 0.00000 <alpha (0.05), meaning that the imported variable simultaneously influenced the independent variable. The partial test found that the patent and national standard variables had a positive and significant effect on the growth of import values with an alpha level of 0.05. The international standard adoption variable is the only variable with a negative and significant impact on import performance, with an alpha level of 0.05. However, labour does not significantly affect the growth of import value. Estimation of random effect model. Incorporating dummy variables in the model creates a decrease in the efficiency of parameter estimation and has a consequence (trade-off) in reducing the number of degrees of freedom. There is a correlation between error terms and time changes in the panel data model. Observation errors could be overcome by approaching the component error model, which is also called the random-effects model. This model can also overcome the weakness of the fixed effect method using dummy variables (Winarno, 2007). Individual errors are assumed to be uncorrelated with each other, as are combination errors. This Swamy-Arora transformation approach often uses the Generalized Least Square (GLS) model.

Table 4. Estimation for random effect model

Lnimport	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]	
Lnpatent	.4935404	.0541122	9.12	0.000	.3874824	.5995984
Lnstandard	.8878272	.1090853	8.14	0.000	.6740240	1.1016300
Lnlabour	.1988808	.1390743	1.43	0.153	-.0736998	.4714614
Lnadoption	-.1252111	.0346665	-3.61	0.000	-.1931562	-.0572660
_cons	9.3705490	1.5063250	6.22	0.000	6.4182060	12.3228900

Sources: developed by the author.

Based on the output of the program, panel data for the random model in this import value case are as follows:

$$lnimp_{it} = 9.3705 + 0.4935lnpat_{it} + 0.8878lnsta_{it} + 0.1989lnlab_{it} - 0.1252lnado_{it} \quad (5)$$

This model also shows the effect of the four independent variables on import variables simultaneously, using the Wald Chi-square value = 373.76 (probability value of 0.0000 <alpha 0.05). The partial test found that patent and national standard variables had a positive and significant effect on the growth of import values with an alpha level of 0.05. The variable of international standards adoption has a negative and significant effect on import performance with an alpha level of 0.05. Meanwhile, labour did not significantly impact the growth of import values. As shown above, two estimation models (Equation no. 4 and Equation no. 5) were obtained. Thus, it is necessary to conduct tests to select a model that fits the panel data. In the Hausman test, REM is selected as it is more suitable and uses the null hypothesis as the Random Effect Model. In contrast, the alternative hypothesis is the Fixed Effects Model.

Table 5. Hausman test

	---- Coefficients ----			
	(b)	(B)	(b-B)	Sqrt (diag(V_b-V_B))
	fem	rem	Difference	S.E.
lnpatent	.4651287	.4935404	-.0284117	.0334268
lnstandard	1.7170560	.8878272	.8292290	.1061359
lnlabour	.4005502	.1988808	.2016694	.1501570
lnadoption	-.3267294	-.1252111	-.2015183	.0274762

Sources: developed by the author.

The selection of the data regression model was determined between FEM and REM, with the Chi-square statistic and k as the degrees of freedom or the estimated number of variable coefficients. In this test, if the Hausman statistical value is greater than the critical value, then H_0 is rejected, and the suitable model for this data is the fixed effects model and vice versa (Gujarati, 2012). Based on the output value above, it can be seen that prob> chi2 or p-value of 0.0000 is smaller than the real level of 5 percent, so H_0 is rejected, indicating that the fixed effects model is the right model.

Variants of residual (error) data that are not constant become a concern of all observed data and cause inaccurate test results. That causes the confidence interval to be exaggerated or underestimated, and, in the end, the conclusions drawn from the resulting regression equation model could be misleading. Therefore, a heteroscedasticity test or residual diversity test is necessary. In addition, the autocorrelation test is also useful to identify whether there is a correlation between residuals that are not independent of one observation to another with a time lag (Kuncoro, 2011). These residuals could also lead to inaccurate conclusions. Linear regression with the OLS (Ordinary Least Square) method and the model parameter must be BLUE (Best Linear Un) Estimator). Hence, it is expected that the coefficient B (beta) must be consistent, unbiased, and efficient. Based on the program output for the heteroscedasticity test, the p-value (0.0000) was obtained using the modified Wald test with the syntax command xttest3 smaller than the 5 percent real level. Thus H_0 was rejected, indicating a heteroscedasticity problem in the fixed-effect estimation model. Furthermore, the autocorrelation test for panel data on STATA using the Wooldridge test with the syntax command xtserialdepvarindvar obtained a p-value (0.0000) smaller than the 5 percent real level. Therefore, H_0 is rejected, indicating an autocorrelation problem in the estimated fixed-effect estimation model. The resulting model using FEM based on observational data further shows heteroscedasticity in the model (p-value = 0.0000) and autocorrelation (p-value = 0.0000).

When the implication occurs in autocorrelation and heteroscedasticity for the Fixed Effect panel data model, it is necessary to take corrective action using the FEM ROBUST model (White, 1980). This robust method was introduced by Andrew and Hampel (2015) as a regression method used when the error distribution is abnormal and/or there is a disturbance in the model. Robust procedures aim to overcome data oddities, including outlier data (Ryan, 2008; Aunudin, 1989).

Table 6. Model FEM Robust

lnimport	Robust					
	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
lnpatent	.4651287	.1096582	4.24	0.000	.2356114	.6946460
lnstandard	1.7170560	.3603783	4.76	0.000	.9627758	2.4713370
lnlabour	.4005502	. 3855505	1.04	0.312	-.4064163	1.2075170
lnadoption	-.3267294	. 1405119	-2.33	0.031	-.6208243	-.0326345
_cons	4.2770060	4.4139410	0.97	0.345	-4.9614790	13.5154900

Sources: developed by the author.

Based on the robust output model above, it shows that coefficients of the independent variables remain the same and are only different in the probability value. The FEM ROBUST Model was obtained as the best model in this study to explain the influence of growth in the adoption of international standards, the number of labour, national standards, and the number of patents against import value. Therefore, the equation for this robust model is the same as Equation 4.

This study analysed sectors that have contributed positively and significantly to the performance of imports in Indonesia. These sectors include the mining and minerals sector; petroleum technologies sector; food technology sector; textile and leather technology sector; clothing industry sector; wood technology sector; paper technology sector; chemical technology; paint and colour sector; rubber and plastic sector; metallurgy sector; road vehicles sector; railway, shipbuilding and marine, aircraft and space

vehicles sector; mechanical; fluid for general use; materials handling equipment sector; construction materials and building sector; civil engineering sector; glass and ceramics sector; information technology sector; furniture sector; pharmaceutics sector; and graphic technology sector. It was further found that the growth of the agriculture sector did not have a significant effect on the growth of import value. This result also supports Moenius's (2006) findings that agricultural standards cannot be used as a trade barrier, and its adoption of international standards does not affect trade performance. The following table shows the significance and contribution of the growth of each sector to the value of imports.

Table 7. The contribution and significance of the sector to import performance

lnimport	Coef.	Std. Err.	Z	P>|z|	[95% Conf. Interval]	
A	.068619	2.7106370	0.03	0.980	-5.244131	5.381370
B	1.911650	.2607476	7.33	0.000	1.400594	2.422706
C	2.606531	.3930371	6.63	0.000	1.836193	3.376870
D	2.341147	.3729367	6.28	0.000	1.610204	3.072089
E	3.607630	.4797370	7.52	0.000	2.667362	4.547897
F	1.077504	.4520420	2.38	0.017	.1915185	1.963490
G	9.704807	.9984620	9.72	0.000	7.747858	11.661760
H	2.919065	.3747298	7.79	0.000	2.184608	3.653522
I	2.891225	.5224469	5.53	0.000	1.867248	3.915202
J	3.981756	.5406021	7.37	0.000	2.922196	5.041317
K	2.959422	.6526492	4.53	0.000	1.680253	4.238591
L	2.170447	.4263758	5.09	0.000	1.334766	3.006129
M	5.469707	.7043387	7.77	0.000	4.089229	6.850186
N	4.112422	.5482434	7.50	0.000	3.037885	5.186959
O	6.238834	.8990924	6.94	0.000	4.476645	8.001023
P	9.547957	1.1126870	8.58	0.000	7.367130	11.728780
Q	2.963186	1.0206090	2.90	0.004	.962829	4.963544
R	7.377273	.8782494	8.40	0.000	5.655936	9.098610
S	2.602534	.9864773	2.64	0.008	.669074	4.535994
T	9.684621	1.1058850	8.76	0.000	7.517126	11.852120

Sources: developed by the author.

Contribution of national standard on import value. From 1999 to 2017, the average growth rate of Indonesia's national standards and the adoption of international standards was 4.35 percent and 124.13 percent. Meanwhile, the growth rates for the average import value were 12.57%. Based on the elasticity value of imports with national standards and the adoption of international standards, which is 1.72 and -0.33, Indonesian national standards and adoption have contributed 21.58% and -4.11% to the average annual growth of imports.

Adoption of standards could open up new markets so that the application of international standards would increase the value of imports (Swann, 2010). Standardization has a significant positive effect on long-term economic growth. When standards are distinguished between national and supranational standards, it is seen that other European and international standards drive a positive influence on economic growth. Such standards may trigger economic growth by facilitating knowledge exchange between countries (Blind et al., 2021). Positive and significant contributions from various sectors can be analysed through this approach, such as mining, minerals, textiles, clothing technology, food technology, chemical technology, paper, and various other sectors. For the agricultural sector, this study found that the development of standards and the adoption of international standards did not significantly affect import performance. Meanwhile, regulations are strong enough to control imported goods, such as the quarantine program in this sector. In the future, it is necessary to consider the variable of regulation and standard application in each sector to determine the effect of each sector on trade.

Table 8. Contribution of national standards to the growth of import value from 1999–2017 (in million USD)

Year	Contribution of sta (%)	D-*imp*	*sta*D-imp*
1999			
2000	8.12	570.9643	46.37
2001	2.61	-194.3074	-5.07
2002	7.78	-82.5171	-6.42
2003	0.63	-1.4261	-0.01
2004	2.24	672.5579	15.06
2005	4.63	392.5479	18.17
2006	10.23	201.7667	20.63
2007	0.95	669.2513	6.37
2008	6.06	2855.5186	173.11
2009	12.63	-1441.9563	-182.07
2010	13.13	2033.6114	266.91
2011	13.04	2019.3800	263.28
2012	6.33	911.1513	57.66
2013	10.36	-552.2715	-57.23
2014	8.75	-593.7451	-51.93
2015	20.42	-1439.4406	-293.98
2016	2.35	425.1562	10.00
2017	4.19	941.0431	39.45
TOTAL		6816.3204	320.34

Sources: developed by the author.

Although the adoption of international standards has a positive and significant effect on the value of imports, the correlation value between imports and adoption is small (0.147). While the standard has a strong correlation value on labour, labour does not significantly impact import performance. Based on the adjusted R-squared (0.3505), other factors besides patent and national standards affect Indonesian import performance. In this case, standardization is an instrument for the utilization and dissemination of research and innovation project results and patents. Standards facilitate innovation in developing countries through quality and enable the exploitation of economies of scale and positive external networks (Blind et al., 2021). In China, companies improve their innovation by importing technology (Liu and Buck, 2007). Other variables that might influence imports could be applied in future research. This research focuses on the significance of standards, patents, and labour on imports, but indirectly, imports will be related to exports. Feng et al. (2016) explained the import of intermediate products carried out by China from 2002 to 2006 would increase the volume of exports and increase the scope of its exports.

The national industrial performance is a standard user and greatly influences the competitiveness of its products with imported products in the domestic market. Although data on the number of labour for each sector are available, it is not sufficient to describe the number of industries for each sector. The unavailable data on the number of industries per sector in this study reduces the comprehensive picture of the role of innovation and standards on import performance. It also makes it difficult to estimate the relationship between innovation and standardization in the industries. The level of industrial growth for each sector can describe the competitiveness of its products as a result of production. In addition, the growth rate of national industries can show that the competitiveness of products is high in the domestic and international markets. It further is also correlated with a decrease in the value of imports. Zoo et al. (2017) have proven that standards facilitate innovation in three ways: innovation by scaling, proving, and coordination, where multiple stakeholders are involved in the relationship. In terms of making policies in developing countries, international standards also need to be considered.

Conclusions. Based on this study, several conclusions were drawn. The development of the national standard has a positive and significant impact on import performance and patents. Meanwhile, the adoption of national standards has a negative and significant impact on the value of imports. However, labour in the medium-large industry does not significantly affect the import value.

However, applying the elasticity of Indonesian import performance to the adoption of international standards (-0.33) means that the rise of standards adoption reduces the import value by 4.11 percent from the average growth of Indonesian imports (12.57 percent). Meanwhile, the elasticity of Indonesian import performance against the development of national standards is 1.72, which means that the growth in the total number of national standards increases the import value by 21.58 percent from the average growth in import value. Therefore, the variables between the development of national standards and the adoption of international standards are contradictory in their contribution.

The findings based on the FEM ROBUST model confirmed that a 1 percent growth of the total number of national standards, patents, adoptions, and workers simultaneously increased 12.57 percent average growth in import values from 1999 to 2017. Statistically, this effect has been proved significant. This study also proved that standardization and innovation have the same direction of their effect on Indonesian import performance, both in terms of positive and significant impact. It shows that these two components play a good role in disseminating technological knowledge to support the import product performance. One of the objectives of applying standards in international trade transactions is to discourage the sub-standard imported products more effectively through the adoption of the international standard program than the development of national standards. It is also calculated that the total contribution value of the Indonesian national standards development to the growth of import value (6,816.32 million USD) from 1999 to 2017 has reached USD 320.34 million (IDR 4.64 trillion).

There is significant potential from developing national standards and the adoption of international standards for the growth of national import performance, especially in developing countries such as Indonesia. This paper serves as an empirical investigation of the effect of the growth of national standards, adoption of international standards, labour, and patents on the growth of Indonesian import value. It contributes to the knowledge of import growth factors of a developing country, particularly those related to standardization. The analysis showed that the contribution of both national standard growth and adoption growth has a different direction to Indonesian import performance. The findings identified that the two factors in standard development have different functions in import performance.

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Вплив стандартів, патентів та трудових ресурсів на вартість імпорту: на прикладі Індонезії

У наукових колах постійно точаться дискусії щодо необхідності впровадження національних та міжнародних стандартів на противагу до розвитку міжнародної торгівлі. Метою статті є аналіз впливу кількості зареєстрованих стандартів, патентів та якості трудових ресурсів на вартість імпорту в Індонезії. У ході дослідження виявлено низку відмінностей, а також позитивні і негативні кореляції між складовими визначених факторів. Дослідження проводилось у країнах з розвиненою інфраструктурною підтримкою інновацій та стандартів. Методологічною основою дослідження є регресійний аналіз панельних даних, функція Кобба-Дугласа, моделі з фіксованими та випадковими ефектами. Побудована модель дозволила виявити змінні, які впливають на показники імпорту в Індонезії. При цьому виявлено значний вплив національних стандартів на зростання вартості імпорту. У статті зазначено, що низький темп росту кількості зареєстрованих патентів в одній галузі свідчить про менший вклад у вартість імпорту. На відміну від національних стандартів, зростання кількості стандартів в економічній галузі буде обернено пропорційним росту вартості імпорту в даній галузі. У ході дослідження встановлено, що трудові ресурси не мають суттєвого статистично значущого впливу на вартість імпорту. Існує значний потенціал розроблення національних стандартів та прийняття міжнародних стандартів для підвищення національних показників вартості імпорту в Індонезії. За результатами дослідження встановлено, що розповсюдження національних стандартів має диференційований вплив на вартість імпорту в Індонезії. При цьому фактори стандартизації мають різний вплив на вартість імпорту. Отримані результати мають теоретичну та практичну цінність у контексті дослідження факторів, зокрема стандартизації, які впливають на зростання вартості імпорту, у країнах, що розвиваються.

Ключові слова: регресійний аналіз панельних даних, інновації, стандартизація, працівник, імпортована продукція.