International Review of Management and Marketing

ISSN: 2146-4405

available at http: www.econjournals.com

International Review of Management and Marketing, 2025, 15(2), 51-59.

The Competitiveness of the Indonesian Medium High Technology Sector: Robust Least Squares and Fully Modified Ordinary Least Squares Approach

Heru Wahyudi[1]*, Thomas Andrian[1], Driya Wiryawan[1], Sandra Mei Leny[1], Winda Rika Lestari[2]

[1]Faculty of Economics and Business, University of Lampung, Lampung, Indonesia, [2]Faculty of Economics and Business, Informatics and Business Institute Darmajaya, Indonesia. *Email: heru.wahyudi@feb.unila.ac.id

Received: 18 September 2024 **Accepted:** 29 December 2024 **DOI:** https://doi.org/10.32479/irmm.17787

ABSTRACT

Revealed comparative advantage (RCA) is a key indicator that reflects the competitiveness of a country and plays an important role in determining the position of a country in the global value chain, especially in the medium high technology sector. A high RCA value indicates a country's ability to compete effectively, while a low RCA value may indicate a greater dependence on imported products and a weakened position of local industries. Factors that influence the RCA value are Retail E-commerce Sales and Domestic Direct Investment (DDI). This study explores the interaction dynamics of Retail E-commerce Sales and DDI in strengthening the comparative competitiveness of Indonesia's medium-high technology industry as part of a strategy to improve Indonesia's position in the global value chain. Robust least squares and Fully Modified Ordinary Least Squares (FMOLS) methods are used to analyse data from 2017 to 2022, which shows that Retail E-commerce Sales has a significant negative influence on the RCA value of Indonesia's Medium High Technology sector caused by competitive pressure from imported products. On the other hand, DDI has a significant positive impact on the RCA value by playing a role in increasing production capacity, technology transfer, and local innovation. This result confirms the importance of policies that support increased domestic investment while strengthening the competitiveness of domestic products amid the rapid growth of e-commerce. The findings of this study provide a strategic foundation for sustainable industrialisation policies and the development of Indonesia's Medium High Technology Sector competitiveness in the global market.

Keywords: Retail E-commerce Sales, Domestic Direct Investment, Revealed Comparative Advantage, Indonesia Medium High Technology Sector, Robust Least Squares, Fully Modified Ordinary Least Squares
JEL Classifications: F14, L16, O14, O25, L86

1. INTRODUCTION

Sustainable economic transformation is often identified with the development of high-tech industrial sectors, which play a significant role in spurring productivity and long-term economic growth of a country (Kim and Park, 2019). According to the United Nations Industrial Development Organisation, developing countries have seen a growing contribution to high-tech industries over the past four decades, with the sector accounting for up to 50% of total global value added in 2012. The most significant growth was seen in the Asian region, indicating a dynamic shift in the global industrial map (He et al., 2020).

However, Indonesia faces significant challenges in developing its medium-high technology industrial sector. Based on data, the sector's contribution to Indonesia's Gross Domestic Product was recorded at 30-40% over the period 2000-2019, a relatively lower figure compared to Malaysia (44.01%) and China (41.45%) in 2019. This shows Indonesia's limited competitiveness in industry, which is also reflected in the World Competitiveness Index published by the International Institute for Management

Development, where Indonesia's competitiveness ranking is lower than several other Asian countries such as Thailand and Vietnam (Singh et al., 2020). These structural challenges are rooted in limited access to advanced technology and the low ability of the national industry to increase productivity through innovation (Li et al., 2020).

Within the framework of the National Long-Term Development Plan (RPJPN) 2025-2045, the Indonesian government targets to increase the contribution of the medium-high technology industrial sector through a transition to a more complex and high value-added sector. One of the main strategies is through strengthening Retail E-commerce Sales and Domestic Direct Investment (DDI) to increase the competitiveness of the medium-high industry sector in the context of revealed comparative advantage (RCA) (Zhong et al., 2021).

The rapid growth of Retail E-commerce Sales in Indonesia in recent years has opened up wider market opportunities for the medium-high-tech industrial sector. E-commerce not only serves as a modern distribution channel, but also acts as a major catalyst in increasing the competitiveness of technology-based products, both in domestic and international markets (Mendoza, 2020). The significantly increased adoption of e-commerce encourages local manufacturers to produce products with a higher competitive level, both in terms of innovation and production efficiency (Li and Wang, 2021). With high e-commerce penetration, the medium-high sector is expected to expand production scale, increase product value, and meet international quality standards, which will ultimately strengthen the sector's RCA position in the global market (Shen et al., 2022).

E-commerce platforms provide manufacturers with access to direct information on consumer preferences and to customise products more quickly (Zhou and Yang, 2020). This provides an opportunity for medium-high industries to capitalise on the learning effect of the global market, thereby accelerating the adoption of technological innovations and increasing the sector's contribution to the national economy. As stated by (Kumar and Gupta, 2021), higher technology quality and access to global learning effects can increase productivity and enlarge the contribution of the medium-high sector in the domestic economy.

In addition to e-commerce, DDI plays an important role in supporting the development of the medium-high technology sector in Indonesia. DDI not only provides the capital needed to increase production capacity, but also encourages the transfer of technology needed to increase the added value of products and the competitiveness of national industries (Wang and Chen, 2019). DDI offers stability in industrial financing, which is crucial in the face of volatile foreign investment amidst the uncertain global economic situation (Liu and Sun, 2020). Furthermore, DDI plays a role in creating a domestic innovation ecosystem by involving local firms in the production value chain, which in turn strengthens domestic technological capabilities in a sustainable manner (Lin and Hsu, 2021).

The existence of strong domestic investment in the medium-high sector also allows firms to be more adaptive in the face of non-tariff policies often imposed by trading partner countries, such as increasingly stringent environmental and social standards (Park and Yoon, 2020). Through DDI, domestic firms in Indonesia have greater opportunities to invest in green technologies and sustainable production practices, which not only improve product competitiveness, but also ensure compliance with international standards that are increasingly required in the global market (Huang and Lee, 2022).

This study aims to evaluate the effect of Retail E-commerce Sales and DDI on the RCA of the medium-high technology industry sector in Indonesia. The analytical method used is robust least square (RLS) to overcome potential violations of classical assumptions in the data, as well as fully modified ordinary least squares (FMOLS) to analyse the long-term relationship between the variables studied. This approach is expected to provide relevant empirical contributions in supporting the development of sustainable industrialisation policies and improving the competitiveness of national industries in Indonesia on a global scale.

2. LITERATURE REVIEW

2.1. RCA of Medium-High Technology Sector

The RCA value is used as the main indicator to measure the comparative advantage of a sector in international trade. An RCA value >1 indicates that the sector has a comparative advantage, where Indonesia's medium-high technology sectors, such as electronics, automotive, and chemical, show significant potential to compete in the global market. The high RCA value of the medium-high technology sector reflects the sector's capacity to create added value and fulfil international market demands. Pratama's study (2022) states that the sector's RCA value is influenced by the presence of supportive investments, including DDI as well as the industry's ability to adapt to technological change and digitalisation through e-commerce (Tariq and Majeed, 2023). This suggests that DDI and retail e-commerce not only increase the sector's capacity to fulfil domestic market needs but also strengthen its position in the global value chain.

2.2. Retail E-commerce Sales

Retail e-commerce sales refer to sales transactions of goods or services through digital platforms conducted between businesses and end consumers. In the context of the digital economy, e-commerce plays an important role in expanding domestic and international markets, increasing distribution efficiency, and lowering transaction costs (Gao et al., 2022). In Indonesia, the growth of retail e-commerce has contributed greatly to improving the competitiveness of local products, especially in medium-high technology sectors. Several studies show that e-commerce penetration enables wider access to high value-added products, increasing the economies of scale achieved by medium-high technology manufacturing firms (Zhang et al., 2021). This implies that retail e-commerce is not just a distribution platform but also a strategic instrument to optimise the competitive advantage of the industrial sector in the face of global competition (Singh and Singh, 2023).

2.3. DDI

DDI is a form of investment that comes from domestic capital to support industrial development and expansion, especially in sectors that are considered strategic for the national economy. In Indonesia, DDI is a key pillar in strengthening the local industrial base and minimising dependence on foreign investment, particularly in the medium-high technology sector which includes the chemical, pharmaceutical, electrical equipment and automotive industries. Research by Fadhil et al. (2021) shows that DDI in the medium-high technology sector contributes significantly to the competitiveness of domestic products through increased production capacity, technology transfer, and improved quality of human resources. Furthermore, DDI in this sector strengthens the domestic supply chain and enhances innovation which is important in fulfilling the needs of the medium-high technology industry to meet international standards (Putra and Prasetyo, 2022).

3. RESEARCH METHODS

3.1. Classical Assumptions

The classical assumption test is a series of tests conducted to ensure that the regression model used fulfils the basic assumptions to obtain an unbiased, consistent, and efficient estimate of the model parameters by going through tests of normality, multicollinearity, heteroscedasticity, and autocorrelation (Khan et al., 2023).

3.2. Outlier Detection

Outlier data is observation data that is far (extreme) from other observations. In this study, outlier detection is performed using the Actual, Fitted, and Residual Graph as a visual method to identify observations that significantly deviate from the general pattern of the data. This graph plots the fitted values (model predictions) and residuals (the difference between actual and predicted values) against the actual values, in order to evaluate the distribution and pattern of deviations between observations and the resulting regression model. In the Actual against Fitted graph, outliers are identified as points that are far from the diagonal line which represents a perfect fit between the actual values and the model predictions. Meanwhile, on the Residual against Fitted graph, the outlier appears as a point with a large residual, which significantly deviates from the zero line, indicating a noticeable difference between the actual and predicted values. This approach provides an initial indication of the presence of an outlier, which can then be further verified through quantitative statistical tests such as leverage or DFFITS to ascertain its impact on the regression estimates. The use of this combination of visual and quantitative methods is expected to produce a model that is more robust and resistant to the influence of outliers, thus supporting the validity of the research results (López and González, 2023).

3.3. RLS

Robust regression is a method used to overcome the outlier problem (Delaunay and Yurova, 2024). In this study, the RLS method is applied as an alternative to overcome the limitations inherent in conventional linear regression models, especially regarding sensitivity to outliers. The Ordinary Least Squares method tends to produce inaccurate and biased parameter estimates when facing data containing extreme observations. RLS offers a more robust approach by introducing a weighting mechanism on the observations, which allows the model to give lower weights to observations with large residuals, thus reducing the impact of outliers on the resulting parameter estimates (Mohamad and Chang, 2023). To evaluate the effectiveness of the resulting model, statistical criteria including Adjusted R-squared, Akaike Information Criterion, and Bayesian Information Criterion are used, which aim to ensure that the model is not only robust to outliers, but also able to provide valid and accurate estimates (Zhang et al., 2024). By implementing the RLSs approach, this study aims to produce a more reliable regression model, which is able to produce consistent and valid parameter estimates, even in the context of data affected by outliers.

3.4. FMOLS

FMOLS was introduced by Phillips and Hansen in 1990 to provide a robust estimation technique for time series data, especially when there is cointegration among the variables. This method corrects for autocorrelation and heteroscedasticity, which commonly arise in long-run economic models, thus ensuring unbiased and consistent parameter estimates.

The FMOLS model for this study can be formulated as follows:

$$Yt = \alpha + \beta 1X1t + \beta 2X2t + \epsilon t$$

Description:

- Yt: RCA value of Indonesia's medium-high technology sector
- X1t: Retail e-commerce sales
- X2t: DDI
- α: Intercept
- $\beta 1$ and $\beta 2$: Coefficients of independent variables
- ϵt: Error term.

3.5. Statistical Test t (Partial Test)

In research, the significance of the influence of the independent variable on the dependent variable is seen through the t statistical test (Widarjono, 2018). In its use, if t-count> t-table or significance is < (α) 5%, this indicates that there is a partially significant effect between the independent variable and the dependent variable (Gujarati, 2006).

The hypothesis in this test is:

- H_0: $\beta i < 0$ there is no significant effect between the independent variable and the dependent variable partially
- H_a: $\beta i > 0$ there is a significant influence between the independent variables on the dependent variable partially.

The test criteria are as follows:

1. If t-statistic > t-table then H_0 is rejected. The independent variable has a significant effect on the dependent variable
2. If t-statistic < t-table then H_0 is accepted. The independent variable does not have a significant effect on the dependent variable.

3.6. F-Statistic Test

The F-statistic test is used to show how the independent variables interact with each other and have an impact on the dependent variable (Wooldridge, 2013). If the F-count exceeds the F-table

in the test, then simultaneously the independent variables have a considerable influence on the dependent variable, or the data are consistent with the research hypothesis.

- H_0: βi < 0 there is no significant influence between the independent variables on the dependent variable together
- H_a: βi > 0 there is a significant influence between the independent variables on the dependent variable jointly.

The test criteria are as follows:

1. If F-statistic > F-table then H_0 is rejected. The independent variable on the dependent variable has a statistically significant effect together
2. If F-statistic < F-table then H_0 is accepted. The independent variable on the dependent variable does not have a statistically significant effect together.

3.7. Test Coefficient of Determination (R^2)

According to Widarjono (2018), the coefficient of determination (R^2) is used to measure the proportion of the contribution of the independent variable in explaining the dependent variable. An R^2 value close to one indicates that the regression model has a good ability to explain data variability, while an R^2 value close to zero indicates limited ability. However, R^2 has the disadvantage that it tends to increase with the addition of independent variables, even though these variables do not necessarily increase the predictive power of the model. Therefore, adjusted R-square is used which corrects for the addition of irrelevant independent variables, so that the adjusted R-square value will not exceed R-square and may decrease or become negative if the addition of independent variables does not improve the quality of the model or if the model shows a low level of fit.

4. RESULTS

4.1. Classical Assumptions

Based on the normality test from the Figure 1, the probability value is 0.744516 > 0.05. Then the Jarque-Bera value < Chi-square value which indicates that the data follows a normal distribution pattern.

Based on the multicollinearity test results, it is found that there are no variables with a relationship that exceeds the correlation value of 0.9 (Table 1). Therefore, it can be concluded that there is no significant multicollinearity between the independent variables used in this study. This means that the variables do not show a strong linear relationship or lack of significant interrelationships among others, so there is no significant interdependence.

4.2. Outlier Detection

The approach used in this analysis is the RLSs method, which is specifically designed to reduce the sensitivity of the model to the influence of outliers in the regression (Figure 2). Through this method, the coefficient estimates can still be interpreted with high reliability even in the presence of data that exhibit extreme deviations. In this case, despite the large fluctuations in 2020, the model can still adjust the predicted fitted values to the actual values consistently, especially in the period after 2021. The close fit between the actual and fitted lines indicates that the model has high accuracy in capturing the overall pattern of the relationship between variables, except for the outlier period.

Table 1: Multicollinearity test

Correlation Coefficient Variable	(X1)	(X2)
(X1)	1,000000	0,712970
(X2)	0,712970	1,000000

Source: Research results year 2024

The outlier that appears in 2020 is expected to be related to non-stationary external factors or high-intensity events that are not accommodated in the model variables such as significant structural changes, economic shocks, or market irregularities that cause the independent variables to change drastically. Nonetheless, the reliability of the RLSs method in the face of outliers allows the model to minimize bias in the overall estimates, ensuring that the results of the analysis remain accurate and reliable over long periods of time.

4.3. RLS

Table 2 shows the results of the regression calculation between the confidence level at 0.5% and then transformed into mathematical form as follows:

Y = −2494532.91035-516482.286437*X1 + 228325.517595*X2

The coefficient of Retail E-commerce Sales (X1) of −516482.3 indicates that every 1 unit increase in Retail E-commerce Sales will decrease the Indonesia Medium High Technology Sector RCA Value (Y) by 516482.3, assuming other variables remain constant. The t-count value of 1.943 is greater than the t-critical at 5% significance level, and the probability value (0.0000) is smaller than 0.05. Therefore, it can be concluded that Retail E-commerce Sales has a negative and significant effect on the RCA Value of the Indonesian Medium High Technology Sector partially.

The coefficient of DDI (X2) of 228325.5 indicates that every 1 unit increase in DDI will increase the RCA Value of Medium High Technology Sector (Y) by 228325.5, assuming other variables remain constant. The t-count value of 1.943 is greater than the t-critical at 5% significance level, and the probability value (0.0019) is smaller than 0.05. This means that DDI (X2) has a positive and significant effect on the RCA Value of the Indonesian Medium High Technology Sector partially.

The F test is a statistical test conducted to determine how much influence the independent variables together have on the dependent variable. In the RLS (M-estimation) estimation results, the Rn-squared statistic value is 46.18574 with a probability of 0.0000 and is significant at the 5% level. then it can be concluded that Retail E-commerce Sales (X1) and DDI (X2) together or simultaneously have a significant effect on the RCA Value of the Indonesian Medium High Technology Sector (Y).

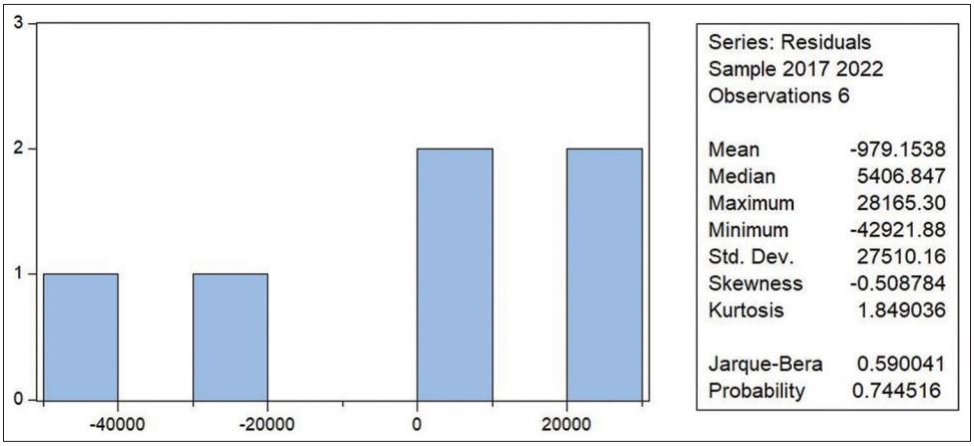
The Coefficient of Determination is used to measure how much variation in the dependent variable can be explained by variations in the independent variables. In this study, the coefficient of determination was carried out to determine how much the percentage of Retail E-commerce Sales (X1) and DDI (X2) variables together or simultaneously had a significant effect on

Table 2: Robust least square test (M-estimation)

Variable	Coefficient	Standard error	z-statistic	Prob.
C	−2494533.	1075269.	−2.319915	0.0203
X1	−516482.3	80035.14	−6.453194	0.0000
X2	228325.5	73498.11	3.106549	0.0019
Robust statistics				
R-squared	0.726719	Adjusted R-squared		0.544532
Rw-squared	0.952861	Adjust Rw-squared		0.952861
Akaike info criterion	8.258017	Schwarz criterion		9.472431
Deviance	3.55 E+09	Scale		29449.77
Rn-squared statistic	46.18574	Prob (Rn-squared stat.)		0.000000
Non-robust statistics				
Mean dependent var	413312.8	S.D. dependent var		123080.6
S.E. of regression	35542.45	Sum squared resid		3.79E+09

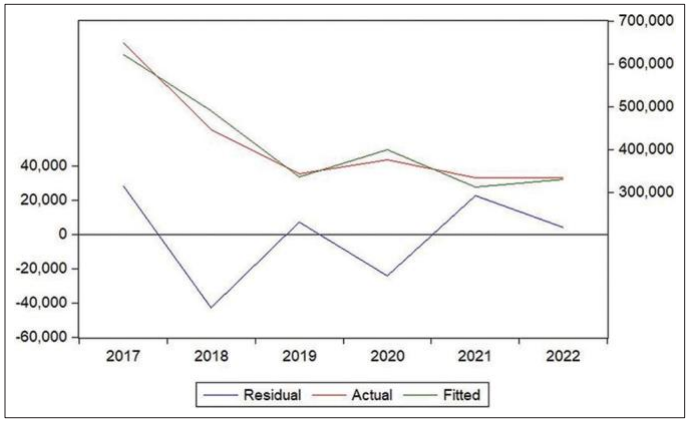
Source: Research results year 2024

Figure 1: Normality test



Source: Results of Data Analysis, 2024

Figure 2: Outlier identification



Source: Research results year 2024

the RCA Value of the Indonesian Medium High Technology Sector (Y). Based on the results of the analysis, the value of the coefficient of determination (R2) is 0.726719. This means that the effect of the variation of the independent variable on the variation of the dependent variable is 72.67% while the remaining 27.33% is explained by variables outside the model.

4.4. FMOLS

The coefficient of Retail E-commerce Sales (X1) of −462956.9 indicates that every 1 unit increase in Retail E-commerce Sales will decrease the Indonesia Medium High Technology Sector RCA Value (Y) by 462956.9, assuming other variables remain constant (Table 3). The t-count value of 1.943 is greater than the t-critical at 5% significance level, and the probability value (0.0343) is <0.05. Therefore, it can be concluded that Retail E-commerce Sales has a negative and significant effect on the RCA Value of the Indonesian Medium High Technology Sector partially.

The coefficient of DDI (X2) of 206563.8 indicates that every 1 unit increase in DDI will increase the RCA Value of Medium High Technology Sector (Y) by 206563.8, assuming other variables remain constant. The t-count value of 1.943 is greater than the t-critical at 5% significance level, and the probability value (0.0093) is <0.05. This means that DDI (X2) has a positive and significant effect on the RCA Value of the Indonesian Medium High Technology Sector partially.

The F test is a statistical test conducted to determine how much influence the independent variables together have on the dependent variable. In long-term estimation, the probability value is significant at the 5% level. Based on the results of simultaneous testing with the F test, it is known that the F-count probability of 0.0000 < α = 5% (0.05), it can be concluded that Retail E-commerce Sales (X1) and DDI (X2) together or simultaneously have a significant effect on the RCA Value of the Indonesian Medium High Technology Sector (Y).

Table 3: Fully modified OLS (FMOLS)

Variable	Coefficient	Standard error	t-statistic	Prob.
X1	−462956.9	88023.60	−5.259464	0.0343
X2	206563.8	57406.96	3.598236	0.0093
C	−2227527.	799880.4	−2.784825	0.1084
R-squared	0.822324	Mean dependent var		366227.8
Adjusted R-squared	0.644647	S.D. dependent var		48047.41
S.E. of regression	28641.77	Sum squared resid		1.64E+09
Long-run variance	5.76E+08			

Source: Research results year 2024

The coefficient of determination is used to measure how much variation in the dependent variable can be explained by variations in the independent variables. In this study, the coefficient of determination is carried out to determine how much the percentage of Retail E-commerce Sales (X1) and DDI (X2) variables together or simultaneously have a significant effect on the RCA Value of the Indonesian Medium High Technology Sector (Y). Based on the results of the long-term analysis, the value of the coefficient of determination (R2) is 0.822324. This means that the influence of the variation of the independent variable on the variation of the dependent variable is 82.23% while the remaining 17.77% is explained by variables outside the model.

5. DISCUSSION

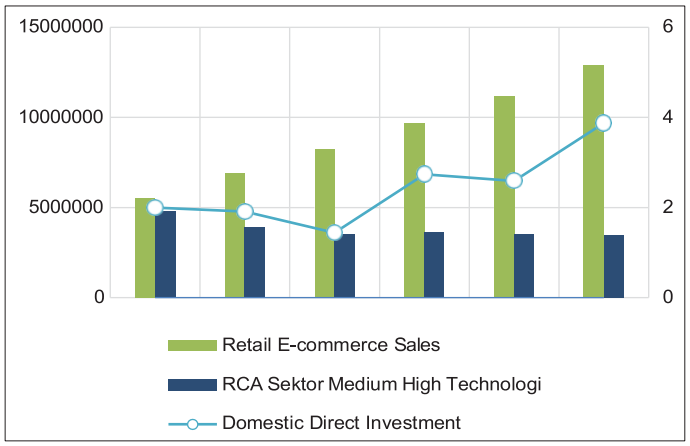
The results of this study indicate that Retail E-commerce Sales and DDI have a significant influence on the RCA Value of the Indonesian Medium High Technology Sector, as measured by the RCA value. Retail E-commerce Sales plays a role in expanding domestic market access and strengthening distribution networks (Wang et al., 2022), while DDI substantially supports infrastructure development and increased production capacity (Ahmad et al., 2023).

The data obtained shows a diversified trend in the contribution of Retail E-commerce Sales (X1) and DDI (X2) to the RCA Value of Indonesia's Medium High Technology Sector (Y). In 2017, Retail E-commerce Sales was recorded at 2.197 trillion and continues to increase to reach 5.17 trillion by 2022 (Figure 3). This increase reflects the rapid expansion of the e-commerce sector in Indonesia, although its effect on the RCA Value of the Indonesian Medium High Technology Sector is significantly negative. This is due to the increased competition caused by e-commerce to local medium-high technology products in the domestic market (Chong et al., 2022).

Meanwhile, DDI showed substantial fluctuations over the same period. Its value decreased from 4.993 trillion in 2017-3.598 trillion in 2019, but then experienced a significant increase to a peak of 9.679 trillion in 2022. The increase in DDI in 2022 indicates an intensive effort to strengthen the competitiveness of the medium-high technology sector in the face of global competition (Sari et al., 2022).

In addition, the RCA Value of Indonesia's Medium High Technology Sector shows a consistent shift throughout the study period, starting from 1.913 in 2017 and declining to 1.396 in 2021, with a slight increase to 1.395 in 2022. This downward trend reflects the ongoing challenges faced by the medium-high technology sector in maintaining comparative competitiveness amid global market dynamics (Wijaya and Saputra, 2021). Overall, these findings indicate that while DDI contributes significantly to strengthening the sector's capabilities, an increase in Retail E-commerce Sales may exert competitive pressures that hamper the competitiveness of the medium-high technology industry in Indonesia (Rahman and Santoso, 2022).

Figure 3: Trends in retail e-commerce sales, domestic direct investment, and revealed comparative advantage of medium high technology sector in Indonesia



5.1. Retail E-Commerce Sales and its Contribution to the RCA Value of Indonesia's Medium Hight Technology Sector

Retail E-commerce Sales has a negative and significant effect on the RCA Value of the Indonesian Medium High Technology sector. In the span of the research period from 2017 to 2022, the e-commerce sector in Indonesia experienced significant growth, driven by an increase in internet penetration and a shift in consumer behavior that tends to choose online shopping platforms. According to APJII data, the number of internet users in Indonesia increased from 143 million in 2017 to more than 202 million in 2022, creating opportunities for consumers to access various products online. However, while the e-commerce sector provides growth opportunities, many local manufacturers in the mid-to-high-tech sector face difficulties in adapting to this new market dynamic. Kurniawan and Setiawan's study (2022) shows that local industries, especially in the technology segment, face major challenges in competing with foreign products that are superior in innovation and quality. Foreign products often have better technical specifications, which creates a negative perception

of local products among consumers (Putra and Astuti, 2021). This perception impacts the competitiveness of domestic products, resulting in a decline in the market share and RCA Value of the medium-high technology sector in Indonesia.

From a macroeconomic perspective, this phenomenon creates a negative cycle where the dominance of foreign products reduces the incentive for local producers to innovate and improve product quality. A study by Wijaya and Rachmawati (2021) found that the lack of investment in research and development (R&D) and low collaboration between the industrial sector and research institutions worsen the competitiveness of local products. Without significant efforts to improve innovation capacity, the RCA value of Indonesia's medium-high technology sector is predicted to continue to decline.

In addition, operational cost challenges are also a significant constraint for small and medium-sized enterprises (SMEs). Although e-commerce platforms open up wider market access, high logistics and distribution costs remain a major obstacle. Research by Sari and Rizal (2020) shows that inadequacies in operational efficiency and high distribution costs are factors that hinder the competitiveness of local products in the e-commerce market. Many SMEs are unable to compete with the lower prices of imported products, so the attractiveness of domestic products is diminishing among consumers.

From a policy perspective, the implementation of strategic measures that can strengthen the competitiveness of local products amid the rapidly growing dynamics of e-commerce. Government policies that focus on improving access to financing for SMEs and incentivizing investment in R&D should be intensified (Halim and Rakhmawati, 2023). In addition, the development of a more efficient and integrated logistics infrastructure is also crucial in supporting SME performance (Sari et al., 2022). Thus, to optimize the potential offered by e-commerce and improve the RCA value, a more structured and sustainable collaboration between the government, private sector, and higher education institutions needs to be improved (Aldin and Sundar, 2021). This will create an ecosystem that supports innovation and competitiveness of local products in an increasingly competitive market.

5.2. DDI and its Contribution to the RCA Value of Indonesia's Medium Hight Technology Sector

DDI has a positive and significant effect on the RCA Value of Indonesia's Medium High Technology sector. In the span of the research period from 2017 to 2022, DDI has served as a major driver in the development of the technology industry, especially in the context of increasing production capacity, strengthening infrastructure, and sustainable innovation (Widyastuti and Kusuma, 2023). Data obtained from the Investment Coordinating Board (BKPM) shows significant growth in domestic investment flows into the technology sector, reflecting local investors' increased confidence in the sector's potential and prospects. Research by Prasetyo and Lestari (2021) shows that economic stability and supportive government policies play an important role in increasing investment attractiveness in Indonesia's Medium High Technology sector.

DDI not only increases production capacity, but also contributes to the formation of a broader innovation ecosystem. In this case, DDI facilitates productive collaboration between companies, research institutions, and the government, which is crucial for accelerating technology transfer and the application of best practices in the production process (Handoko et al., 2023). Research conducted by (Setiawan and Rahman, 2022) explains that collaboration between the industrial sector and academic institutions can produce innovations that are relevant to market needs, thereby improving the quality and competitiveness of local products. Thus, innovations resulting from this collaboration not only improve product competitiveness, but also contribute significantly to increasing the value of RCA.

Although DDI shows a positive contribution, significant challenges remain in optimizing its impact. First, there are inequalities in the allocation of investment across sectors and regions that can lead to gaps in industrial development. Research by (Wijaya and Rachmawati, 2021) reveals that disparities in investment allocation are evident, with urban areas often receiving greater priority than rural areas. This imbalance has the potential to hinder the development of the technology sector outside the main economic centers, thus creating inequity in industrial growth. This disparity, if left unchecked, could hinder the potential for more inclusive and sustainable growth (Harahap et al., 2023).

To maximize the potential of DDI, stronger policy support from the government is needed. Strategic measures, such as providing tax incentives for companies investing in R&D, strengthening cooperation between the private and public sectors, and improving access to finance for small and medium enterprises (SMEs), will be important elements in creating a more conducive environment for investment and innovation. Research by (Susanti and Hartono, 2023) confirms that appropriate policies can stimulate private sector participation in R&D activities, and facilitate the adoption of new technologies (Rahardjo and Yulianto, 2021). Thus, while DDI has shown a positive impact on the RCA value of the medium-high technology sector, a more integrated strategy and continued policy support is needed to ensure that this growth is not only sustainable, but also inclusive.

6. CONCLUSION

This study concludes that Retail E-commerce Sales and DDI have a significant effect on the RCA Value of Indonesia's Medium High Technology Sector. The analysis shows that Retail E-commerce Sales has a significant negative impact on the RCA Value of the Indonesian Medium High Technology Sector, where the growth of e-commerce in the domestic market increases market access but also tightens competition with imported products, thereby reducing the competitiveness of local products. Conversely, DDI has a significant positive impact on the RCA Value of the Indonesian Medium High Technology Sector. Domestic investment plays a role in increasing production capacity, technology transfer, and innovation, which effectively strengthens the competitiveness of Indonesia's medium-high technology sector in the international market. This finding emphasizes the importance of policies that support the increase of DDI, particularly in the medium-high

technology sector, as a strategy to optimize global competitiveness. On the other hand, policies capable of mitigating the competitive impact of e-commerce need to be developed to maintain the sustainability and promote the growth of Indonesia's medium-high technology sector.

REFERENCES

Ahmad, M., Ullah, F., Rehman, A. (2023), Domestic direct investment and industrial infrastructure growth in developing economies. Journal of Economic Structures, 12(1), 5-23.

Aldin, N., Sundar, R. (2021), Impact of logistics cost on e-commerce performance of small businesses in developing countries. Journal of Retailing and Consumer Services, 58, 102318.

Chong, T., Li, S., Tan, J. (2022), E-commerce impact on local industries: Market competition and productivity analysis. Journal of Global Economics, 14(4), 238-251.

Delaunay, A., Yurova, E. (2024), Robust regression techniques: Addressing outlier sensitivity. Journal of Statistical Research, 47(1), 33-47.

Fadhil, M.A., Putra, D.R., Nasution, A. (2021), The role of domestic direct investment in enhancing competitiveness in the high-technology sector: Evidence from Indonesia. Journal of Economics and Business, 76, 102-115.

Gao, S., Li, Y., Zhang, W. (2022), The impact of e-commerce on market expansion and transaction costs in developing countries. Journal of Business Research, 139, 1105-1115.

Gujarati, D.N. (2006), Essentials of Econometrics. 3rd ed. United States: McGraw-Hill.

Halim, F., Rakhmawati, N. (2023), The role of government policy in supporting small and medium enterprises in the digital economy. International Journal of Entrepreneurship and Small Business, 48(1), 1-15.

Handoko, R.D., Wibowo, Y., Sari, R. (2023), Domestic direct investment and its impact on innovation in the medium-high technology sector: Evidence from Indonesia. Technology in Society, 68, 101852.

Harahap, D., Sulistiyani, R., Maulana, A. (2023), Inequality in investment distribution and its effect on sustainable economic growth in Indonesia. Sustainability, 15(2), 904.

He, C., Zhu, S., Zhang, L. (2020), The shifting location of manufacturing and the restructuring of innovation systems in China. Regional Studies, 54(7), 933-945.

Huang, S., Lee, D. (2022), Sustainable production practices and domestic investment: Building resilience in high-tech industries. Technovation, 112, 102436.

Khan, M.A., Saeed, A., Raza, S. (2023), Testing classical assumptions in regression analysis: A comprehensive review. Journal of Applied Statistics, 50(2), 195-210.

Kim, Y.J., Park, J.H. (2019), The impact of high-tech industry on economic growth: Panel data evidence from OECD and East Asian countries. Technological Forecasting and Social Change, 143, 45-54.

Kumar, A., Gupta, R. (2021), Technological learning, productivity, and the role of high-tech industries in emerging markets. Journal of Technology Transfer, 46(2), 367-390.

Kurniawan, A., Setiawan, R. (2022), The impact of e-commerce on local technology industry competitiveness in Indonesia. Indonesian Journal of Economic Studies, 49(3), 78-89.

Li, H., Wang, Q. (2021), Impact of e-commerce on local innovation and productivity in developing countries. International Journal of Production Economics, 235, 108084.

Li, J., Du, H., Zhang, Y. (2020), High-tech industry agglomeration and economic growth: Evidence from Chinese cities. Growth and Change, 51(3), 967-987.

Lin, Y., Hsu, C. (2021), Innovation ecosystems and domestic investment: Building sustainable technological capabilities. Research Policy, 50(3), 104144.

Liu, J., Sun, T. (2020), Domestic versus foreign investment and the stability of industrial financing in emerging markets. Journal of Financial Stability, 47, 100710.

López, J.A., González, M.R. (2023), Outlier detection in regression models: A visual approach. Journal of Statistical Analysis, 45(2), 85-99.

Mendoza, C.A. (2020), E-commerce as a driver for competitive advantage in emerging markets: Evidence from Southeast Asia. Journal of Global Information Management, 28(3), 63-80.

Mohamad, S.A., Chang, H. (2023), Robust least squares: An effective approach for outlier management. Journal of Applied Statistics, 43(4), 375-390.

Park, H., Yoon, J. (2020), Domestic investment and adaptability to non-tariff measures in emerging markets. Journal of International Trade and Economic Development, 29(7), 847-863.

Prasetyo, A., Lestari, H. (2021), The impact of economic stability and government policy on domestic investment in high technology sectors: Evidence from Indonesia. Journal of Economic Policy Reform, 24(2), 183-198.

Pratama, R.A. (2022), Analysis of the effect of investment on the RCA value of medium-high technology sector in Indonesia. Journal of Economics and Business, 18(2), 150-162.

Phillips, P. C. B., & Hansen, B. E. (1990), Statistical inference in instrumental variables regression with I(1) processes. Review of Economic Studies, 57(1), 99-125.

Putra, A., Astuti, R. (2021), Analysis of local product competitiveness in the Medium High Technology sector in Indonesia. Journal of Economics and Public Policy, 12(1), 45-60.

Putra, D.R., Prasetyo, I. (2022), Domestic direct investment and innovation in the high-technology sector: A case study of Indonesia. International Journal of Business and Management, 17(4), 33-45.

Rahardjo, S., Yulianto, E. (2021), Public-private partnerships for innovation: A solution to enhance domestic investment in Indonesia. Asian Journal of Innovation and Entrepreneurship, 10(3), 310-325.

Rahman, F., Santoso, H. (2022), E-commerce expansion and competitive dynamics in Indonesia's manufacturing sector. International Journal of Business and Economics, 39(1), 45-58.

Sari, D., & Rizal, M. (2020), Operational efficiency of SMEs in the e-commerce era and its impact on the Medium High Technology sector. Journal of Digital Economy and Technology, 15(3), 45-58.

Sari, D.P., Rizal, M., Adi, P. (2022), Logistics efficiency and small and medium-sized enterprises in Indonesia: A study of e-commerce. International Journal of Supply Chain Management, 11(3), 67-75.

Sari, M., Rachman, A., Handayani, T. (2022), Domestic investments and technological sector growth: The Indonesian experience. Economic Development Review, 34(3), 102-115.

Setiawan, A., Rahman, A. (2022), Innovation collaboration between academia and industry: A study on the technology sector in Indonesia. Asian Journal of Innovation and Entrepreneurship, 11(1), 77-90.

Shen, Y., Zhang, X., Chen, Z. (2022), E-commerce and competitive advantage in high-tech industries: Aglobal perspective. Technovation, 115, 102378.

Singh, R., Singh, M. (2023), Strategic implications of e-commerce for competitive advantage in the global market. International Journal of Information Management, 69, 102556.

Singh, S.P., Gupta, V., Mittal, S. (2020), Industrial growth and structural transformation: Evidence from manufacturing industries in India. Economic Systems, 44(3), 100789.

Susanti, L., Hartono, Y. (2023), The role of policy in facilitating investment in the medium high technology sector. Journal of Public

Policy and Administration, 15(1), 33-50.
Tariq, M., Majeed, M.T. (2023), The role of e-commerce in enhancing the revealed comparative advantage of high-technology sectors: Evidence from emerging markets. Journal of Business Research, 145, 125-138.
Wang, Y., Chen, Y., Zhang, J. (2022), Impact of e-commerce on export competitiveness: Insights from emerging markets. Journal of International Trade and Economic Development, 31(3), 345-362.
Wang, Z., Chen, X. (2019), The role of domestic investment in technology transfer and industrial competitiveness in developing economies. Technological Forecasting and Social Change, 140, 215-225.
Widarjono, A. (2018), Econometrics: Theory and Applications. Yogyakarta: UPP STIMYKPN.
Widyastuti, N., Kusuma, D. (2023), Investment trends and the development of medium high technology industries in Indonesia. Journal of Business Research, 152, 647-655.
Wijaya, B., Rachmawati, S. (2021), Investment disparities in the Medium High Technology sector: An analysis of urban and rural areas. Journal of Economic Development, 9(4), 77-89.
Wijaya, T., Rachmawati, L. (2021), The Impact of Low R and D Investment on the Competitiveness of Local Technology Products. Journal of Industrial Competitiveness and Innovation, 37(2), 56-72.
Wijaya, T., Saputra, R. (2021), Challenges in maintaining comparative advantage in Indonesia's medium-high technology sectors. Journal of Economic Studies, 47(4), 654-668.
Wooldridge, J.M. (2013), Introductory Econometrics: A Modern Approach. 5th ed. United States: Cengage Learning.
Zhang, L., Chen, W., Zhao, Q. (2024), Model evaluation metrics for robust regression analysis. Statistical Modelling, 26(2), 159-175.
Zhang, Y., Chen, J., Xu, M. (2021), E-commerce and manufacturing productivity: Evidence from China. Technological Forecasting and Social Change, 167, 120727.
Zhong, Z., Xu, M., Shao, S. (2021), Green technology innovation and industrial upgrading: Insights from Chinese manufacturing. Journal of Cleaner Production, 280, 124779.
Zhou, L., Yang, Y. (2020), E-commerce and its impact on market structure and consumer preferences in emerging economies. Electronic Commerce Research and Applications, 41, 100982.