
The Effect of Gig Workers Across Sector on Asean Economy: A Panel ARDL Approach

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Abstract

The gig economy has emerged as a strategic topic of study in the context of rapid digital transformation. The rise of various online work platforms has driven an increase in the number of gig workers across sectors. This study aims to analyze the impact of the number of Gig workers per sector on the national economies of ASEAN countries. The method employed is the Panel Autoregressive Distributed Lag (Panel ARDL) for the period 2017-2024 using quarterly data, focusing on five ASEAN countries, namely Indonesia, Malaysia, Singapore, Thailand, and Vietnam. The data used in this study are secondary data obtained from CEIC and the Online Labour Observatory. The independent variables include the sectors of clerical and data entry, sales and marketing support, as well as software development and technology. Meanwhile, the dependent variable is Real Gross Domestic Product (GDP). This study yields four main findings. First, in the long run, all sectors—clerical data entry, sales and marketing support, as well as software and development technology—exhibit a significant positive effect on GDP. Second, in the short run, the clerical data entry sector has a significant negative impact on GDP in Vietnam. Third, the sales and marketing support sector shows a significant positive effect on GDP in Singapore, whereas it has a significant negative effect in Vietnam in the short run. Fourth, the software and development technology sector demonstrates a significant positive impact on GDP in Malaysia and Singapore.

Keywords: ASEAN, ARDL, Gig Workers, Sector

1. Introduction

The transformation of labour market structures has accelerated rapidly over the past decade. This shift has been driven by the Fourth Industrial Revolution, which emphasizes digitalization and artificial intelligence, thereby significantly advancing digital and technological transformation (Ungureanu, 2019). Platform-based economies have emerged as a consequence of this acceleration, marked by the rise of major companies introducing various digital innovations, such as Airbnb and Uber (S Vallas, 2020; Schwellnus C, Geva Assaf, Pak Mathilde, 2019).

Currently, companies of various sizes have adopted digital platforms to rapidly and efficiently access workers with diverse skills (Lehdonvirta, 2018). This development has led to the emergence

of a new work ecosystem (Wood, 2017) in which digital platforms function as intermediaries connecting workers with parties requiring goods or services (Heeks, 2017; Freudenstein, D., & Duane, 2020). This phenomenon is known as the gig economy, a work system characterized by flexibility and the predominance of short-term employment contracts (Banik, 2019). The growth of the gig economy can be observed through the increase in the global Online Labour Index (see Figure 1).

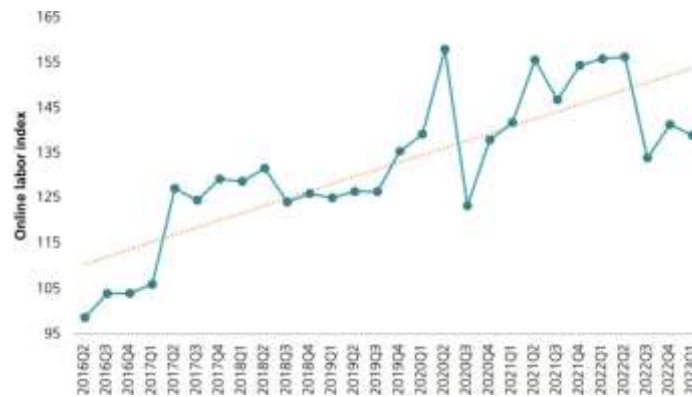


Figure 1. Global Online Labour Index

Source: World Bank Report (2023)

The Online Labour Index (OLI) shows a consistent increase from the second quarter of 2016 to the third quarter of 2023, reflecting the growing demand for and supply of online labour across countries. This index measures, in real time, the volume of projects posted on various platforms, thereby capturing the global dynamics of the gig economy (Online Labour Observatory, 2020). Consequently, the rise in the OLI indicates an expanding number of remote freelance workers engaged in technical and administrative tasks.

A growing body of literature on the gig economy has given rise to two contrasting perspectives, the exploitative work system and the empowering work system (Idowu & Elbanna, 2022). The exploitative perspective is grounded in a top-down approach that emphasizes job design, digital management, and workers' rights (Graham et al., 2017). This approach views digital platforms as mechanisms that manipulate and control online workers, as work processes are fully governed by the platform's predetermined design (Kittur A, Jeffrey V, Michael S, Bernstein, Gerber E. M, Zimmerman J, Lease M, 2013). Fourie (2023) explicitly argues that the gig economy represents an extension of the informal sector that, often unintentionally, exploits workers, leaving them without power or job security. Similarly, Celestin et al. (2021) note that gig workers' earnings are highly volatile and that they lack access to social security, pensions, and insurance, reflecting a high level of financial insecurity.

Conversely, the empowering work system perspective adopts a bottom-up approach, focusing on workers' freedom and autonomy, which enables them to better balance their personal and professional lives (Keith Chen et al., 2019). The flexibility inherent in the gig economy provides opportunities to optimize the use of human capital, thereby enhancing productivity (Najiha & Herman, 2023). Imbalances within the gig economy—such as extensive platform control and limited job security—

can be addressed through the formation of collective agencies, gig worker communities, and regulatory frameworks (Pilatti et al., 2024).

The two work system patterns that emerge in the gig economy play a crucial role in determining worker productivity, which in turn affects a key economic indicator—economic growth (Malik, 2025). Endogenous growth theory emphasizes that long-term economic growth is driven by technological progress and improvements in human capital. In the era of the gig economy, the endogenous growth model becomes highly relevant, as it integrates human capital and physical capital through the adoption of the Cobb–Douglas production function, as follows (Romer, 2016; Şaptefraţi, 2025):

$$Y(t) = K(t)^\alpha [A(t)]^{1-\alpha}$$

where Y represents total output, K denotes physical capital, and A reflects labour productivity. Endogenous growth theory explains that labour efficiency is driven by technological advancements (Parker, 2019).

Empirically, previous studies have reported diverse findings regarding the relationship between the gig economy and economic growth. Several studies have identified a positive influence of gig workers on economic growth (Ahmad, 2021; Iortyom et al., 2024; Muhyi et al., 2023; Shyamala K, L Priya, 2024; Hidayah et al., 2025). This relationship arises because the gig economy operates under a flexible work system that is not constrained by age, location, or time, thereby providing equal opportunities for individuals across all segments of society to participate in the labour market (De Stefano et al., 2021)

This flexibility is important because it can serve as either a primary or supplementary source of income for workers. The additional income generated through gig work supports the fulfillment of basic needs—such as household consumption, healthcare services, and housing—which, in aggregate, contributes to the national economy (Iortyom et al., 2024). Thus, the gig economy has the potential to promote economic empowerment by creating new economic activities, thereby reducing disguised unemployment and enhancing household welfare through the utilization of digital technologies.

Conversely, several studies have identified a negative relationship between the gig economy and economic growth or economic development (Lisi & Malo, 2017; Cetrulo et al., 2018; Malik, 2025). This condition arises because the gig economy generates instability across several welfare indicators, such as life satisfaction, health, financial stability, and job satisfaction (Pande, 2024). The predominance of short-term contracts within the gig economy may reduce workers' incentives to innovate (Lisi & Malo, 2017) and contribute to financial instability and declining well-being, which collectively may hinder the sector's ability to support sustainable economic growth.

In addition, several studies have found that the impact of the gig economy on economic growth is weak or highly limited (Abraham et al., 2018). This sector has not yet been able to produce a significant effect on reducing unemployment or increasing productivity due to fluctuating wage levels and the precarious nature of gig employment (Codagnone et al., 2016; Piketty, 2014). In general, the effects of the gig economy on labour market dynamics and economic resilience are highly complex, as they

are not universal and do not generate uniform outcomes across all economic sectors (Sankararaman, Rengaraju, Rengarajan, Vembu, Indhumathi, 2024).

The divergence in perspectives and the variety of findings regarding the relationship between the gig economy and macroeconomic conditions reflect several limitations in previous literature. Most earlier studies projected the number of gig workers in aggregate, which has not adequately captured variations across sectors within the gig economy. Each sector in the gig economy possesses distinct contributions and dynamics that influence a country's economy differently. The variation in research results may also stem from differences in countries' economic characteristics, as prior studies have tended to focus on single-country contexts. This implies that examining the impact of the gig economy at the country-specific level is essential for obtaining a more comprehensive understanding of its contribution to each nation's economy.

In addition, previous studies have tended to employ literature reviews, multiple regression, Structural Equation Modeling, and Instrumental Variable Regression (Ahmad, 2021; Idowu & Elbanna, 2022; Muhyi et al., 2023; Najiha & Herman, 2023; Pilatti et al., 2024; Santoso, 2024). This study employs the Panel Autoregressive Distributed Lag (Panel ARDL) method using quarterly sectoral data from five ASEAN countries. The data projections and methodological approach adopted in this study are expected to address the research gap identified in prior literature. Therefore, this study aims to examine the impact of the number of gig economy workers across sectors on the economic conditions of ASEAN countries.

This study produces four main findings. First, in the long run, all sectors—clerical data entry, sales and marketing support, and software and development technology—have a significant positive effect on GDP. Second, in the short run, the clerical data entry sector has a significant negative effect on GDP in Vietnam. Third, the sales and marketing support sector has a significant positive effect on GDP in Singapore, while exerting a significant negative effect in Vietnam in the short run. Fourth, the software and development technology sector significantly and positively affects GDP in Malaysia and Singapore.

The structure of this study consists of several sections. Section II describes the analytical methods employed in the research. Section III presents the results and discussion. Section IV provides the conclusion, which includes a summary of the research findings and recommendations derived from the results.

2. Research method

2.1 Data

This study employs quarterly secondary data from five ASEAN countries—Indonesia, Malaysia, Singapore, Thailand, and Vietnam—covering the period 2017–2024. The data were obtained from the China Economic Information Center (CEIC) and the Online Labour Observatory, consisting of Real Gross Domestic Product, as well as the number of gig workers in the clerical data entry, sales and marketing support, and software development technology sectors. The dependent variable in this study

is Real GDP, which serves as a proxy for economic growth. The selection of this variable follows Wang, Beard, Hawkins dan Chandra (2024) who argue that GDP is the most widely used macroeconomic indicator for measuring economic output and reflecting overall economic growth. The number of workers in selected gig sectors functions as the independent variables to examine how gig employment across these sectors influences economic growth.

Table 1 presents the descriptive statistics for the overall sample as well as for each individual country. The Real GDP data, measured at constant 2014 prices, represent the total income generated from the production of goods and services within an economic region, expressed in thousand USD. Meanwhile, the gig economy sector data refer to the number of workers in each sector, derived from project-based activities across several online platforms, namely Freelancer.com, Guru.com, PeoplePerHour.com, Fiverr.com, and Workana.es (Furrer et al., 2025).

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Real GDP	160	140,6 (juta USD)	78,2 (juta USD)	65,8 (juta USD)	343 (juta USD)
Clerical Data Entry	160	527889	1620542	0	9238502
Sales and Marketing Support	160	719803	4843979	58	5,71e+0 7
Software Development Technology	160	6965592	1,64 (juta orang)	37	7,35 (juta orang)
By Countries					
Indonesia					
Real GDP	32	2.92,6 (juta USD)	25601056. 972	247,3 (juta USD)	342,8 (juta USD)
Clerical Data Entry	32	1781859. 1	2973171.1 45	396	9238502
Sales and Marketing Support	32	2937542. 4	10649594. 810	336	5710475 1
Software Development Technology	32	1008993 4	16162696. 336	1126	4372252 2
Malaysia					
Real GDP	32	109,0	9891637.4	8771968	129,9

Variable	Obs	Mean	Std. Dev	Min	Max
		(juta USD)	60	3	(juta USD)
Clerical Data Entry	32	22733.56 3	45746.417	357	203826
Sales and Marketing Support	32	187412.3 4	324521.45 1	58	1298854
Software Development Technology	32	4156493	6226090,7 05	340	1693479 6
Singapore					
Real GDP	32	9606080 0	7420473.1 51	8105554 7	121,1 9juta USD)
Clerical Data Entry	32	101789.5	493655.00 4	0	2799120
Sales and Marketing Support	32	196123.3 1	333766.92 7	226	1497890
Software Development Technology	32	655850.7 8	1181514.7 87	480	5097531
Thailand					
Real GDP	32	117,7 (juta USD)	6362602.1 45	103,5 (juta USD)	128,9 (juta USD)
Clerical Data Entry	32	33987.40 6	119716.08 3	222	617983
Sales and Marketing Support	32	149114.2 8	290391.73 6	275	1109831
Software Development Technology	32	881380.6 3	1680775.6 11	37	5201580
Vietnam					
Real GDP	32	8751647 8	12775969. 120	6577436 2	119,8 (juta USD)
Clerical Data Entry	32	699075.5	1419054.1	101	5203383

Variable	Obs	Mean	Std. Dev	Min	Max
			64		
Sales and Marketing Support	32	128823.0	532899.83	295	3023057
		6	8		
Software Development Technology	32	1904429	28884487.	1062	7345827
		9	232		4

Sources: CEIC (GDP) & Online Labour Observatory (Gig Workers by Sector)

Author's calculation using STATA

2.2. Analytical Methods

This study employs a dynamic panel estimation approach because static panel methods are unable to adequately capture the structural characteristics of panel data, as they assume coefficient homogeneity for the dependent variable (Loayza & Rancière, 2006; Holly & Raissi, 2009). In this regard, the Panel Autoregressive Distributed Lag (Panel ARDL) method developed by Hashem Pesaran & Smith (1995) is applied to estimate both the short-run and long-run relationships between the number of gig workers and economic growth. The Panel ARDL model used in this study is specified as follows:

$$\Delta RGDP_{it} = \beta_{0it} + \beta_1 CDE_{it} + \beta_2 SMS_{it} + \beta_3 SDT_{it} + \sum_{j=1}^{r-1} \alpha_{it} \Delta RGDP_{i,t-j} + \sum_{j=0}^{p-1} \alpha_{2it} \Delta CDE_{i,t-j} + \sum_{j=1}^{q-1} \alpha_{3it} \Delta SMS_{i,t-j} + \sum_{j=0}^{s-1} \Delta SDT_{i,t-j} \quad (2.1)$$

where RGDP denotes Real Gross Domestic Product, CDE represents clerical data entry, SMS refers to Sales and Marketing Support, and SDT indicates Software and Development Technology.

The Panel ARDL method can be estimated using two alternative approaches to obtain the most suitable model, namely the Pooled Mean Group (PMG) and the Dynamic Fixed Effect (DFE) estimators. The PMG approach can be understood as a method that combines the characteristics of both the MG and PMG estimators (Basri & Kongcharoen, 2021). One advantage of the PMG estimator is its ability to allow short-run coefficients to vary across groups while constraining the long-run coefficients to be homogeneous (Munir & Iftikhar, 2021).

Unit root testing serves as the initial step in the Panel ARDL regression procedure to determine the stationarity of each variable, which indicates whether the data follow a normal distribution (Munir & Riaz, 2019). The unit root tests employed in this study include the first-generation Levin, Lin, and Chu test, as well as the second-generation Cross-Sectionally Augmented Im, Pesaran, and Shin (CIPS) test and the Cross-Sectionally Augmented Dickey–Fuller (CADF) test. The Cross-Sectionally Augmented Dickey–Fuller (CADF) and the Critical Inflationary Pressure Test (CIPS) are based on underlying models that define their respective testing procedures. The following equation represents the unit root test using the CADF approach (Mehmet, Ekrem, Gokcen, 2014):

$$\Delta Y_{it} = \alpha_i + b_i + c_i \bar{y}_{t-1} + \sum_{j=0}^p d_{ij} \Delta \bar{y}_{t-j} + \sum_{j=1}^p \delta_{ij} \Delta \bar{y}_{i,t-j} + \varepsilon_{it} \quad (2.2)$$

where α_i denotes the constant term, t represents the trend component, $\Delta \bar{y}_{t-j}$ indicates the lag of the differenced series, $\bar{y}_{t-1}$ represents the long-run lag.

The analysis then proceeds with a cointegration test, which is based on the concept that a group of variables within the model may be cointegrated or exhibit long-run integration (Pedroni, 1999). The most commonly applied cointegration tests include the Kao test and the Pedroni test. The following equation presents the general form of the cointegration regression proposed by Pedroni and Kao (Gutierrez, 2003):

$$y_{it} = \alpha_i + \beta x_{it} + u_{it}, (i = 1, \dots, N, t = 1, \dots, T) \quad (2.3)$$

$$x_{it} = x_{it-1} + \varepsilon_{it} \quad (2.4)$$

where α denotes the constant term, β represents the parameter, and u is the residual term that is assumed to be stationary.

3. Results and Discussion

3.1. Unit Root Test

The estimation process using the Panel ARDL method begins with testing the stationarity of the data. The stationarity analysis includes the first-generation unit root test introduced by Levin, Lin, Chu (2002) commonly known as the LLC test, as well as the second-generation unit root tests developed by Pesaran (2007), namely the Cross-Sectionally Augmented Im, Pesaran, and Shin (CIPS) test and the Cross-Sectionally Augmented Dickey–Fuller (CADF) test.

Tabel 2. Unit Root Test Result

	Stasionary at	LLC	CIPS	CADF
RGDP	1(0)	-3,68***	-5,87***	-3,31***
CDE	1(0)	-3,81***	-5,55***	-5,55***
SMS	1(0)	-4,71***	-5,00***	-5,00***
SDT	1(0)	-2,03***	-5,49***	-5,50***

*, **, and *** statistical significance at the 10%, 5%, dan 1% levels, respectively.

Source: STATA

The results indicate that the data are stationary at level $I(0)$ across all testing methods—LLC, CIPS, and CADF—at the 1% significance level. This implies that no unit root is present in the panel data, allowing all variables to be directly estimated using the Panel ARDL model.

3.2. Cointegration Test Result

The cointegration test is conducted to examine the long-run relationships among the variables. This test serves as a continuation of the stationarity analysis to determine whether the model in this study can be estimated using the Panel ARDL method. The cointegration analysis employs the Pedroni test (see Table 3).

Tabel 3. Pedroni Cointegration Test Results

Test Statistic	Trend		Without Trend	
	Statistic	P-Value	Statistic	P-Value
Modified Phillips-Perron t	-3,93***	0,000	-2,68***	0,0037
Phillips-Perron t	-8, 90***	0,000	-8,64***	0,000
Augmented Dickey-Fuller t	-9,18***	0,000	-8,70***	0,000

*, **, and *** statistical significance at the 10%, 5%, dan 1% levels, respectively.

Source: STATA

Based on the cointegration analysis using the Pedroni test, the results indicate that the null hypothesis is rejected for all estimated models, implying that all variables are cointegrated at level I(0). This confirms that the variables in this study exhibit a long-run cointegrated relationship.

3.3. ARDL Estimation Result

This study employs both the DFE and PMG estimators to examine the effect of gig worker participation on economic conditions in five ASEAN countries, namely Indonesia, Malaysia, Singapore, Thailand, and Vietnam. The Hausman test is conducted to determine the most appropriate model for capturing the influence of gig employment on economic conditions. The Hausman test results, presented in Table 4, indicate that the PMG estimator is the most suitable model for this analysis.

Tabel 4. Long Run Estimation Result

Variable	DFE		PMG	
	Coefficient	Prob	Coefficient	Prob
Long-run Estimation				
CDE	5.7188***	0,000	5.1534***	0.000
SMS	0.6962***	0,006	0.7487*	0.073
SDT	0.1940**	0.034	0.1871***	0.000
Short-run Estimation				
ECT	-0.9851***	0.000	0.9547***	0,000
D.CDE	-0.7041	0.600	-0.2840	0,929
D.SMS	-0.2955	0.120	1.5757	0.449
D.SDT	0.0241	0.701	0.7458	0.224
Hausman				
Chi square Test	0.00			
P-value	1.00			

*, **, and *** statistical significance at the 10%, 5%, dan 1% levels, respectively.

Source: STATA

Based on the long-run PMG estimation, the number of workers in the clerical data entry, Sales and Marketing Support, and Software and Development Technology sectors exhibits a significant positive effect on GDP. These results are consistent across both the PMG and DFE models. The panel elasticity for the clerical data entry sector indicates that an increase of one worker in this sector can raise GDP by 5.1534 thousand USD. In the Sales and Marketing Support sector, adding one worker increases GDP by 0.7487 thousand USD, while the Software and Development Technology sector contributes an increase of 0.1871 thousand USD to GDP.

These results are consistent with previous findings (Banik, 2019; Schwellnus C, Geva Assaf, Pak Mathilde, 2019; Ahmad, 2021; Muhyi et al., 2023; Iortyom et al., 2024; Shyamala K, L Priya, 2024; Hidayah et al., 2025) which report a positive relationship between the gig economy and macroeconomic conditions. This indicates that the number of gig workers in the five ASEAN countries examined in this study has successfully enhanced labour productivity in the long run, thereby influencing key economic indicators such as GDP. These findings align with endogenous growth theory, which emphasizes that national output is determined by physical capital and labour productivity, with the latter being driven by technological advancement (Şaptefrăţi, 2025). The gig economy provides new and flexible employment opportunities and can further promote skill diversification and continuous learning through the variety of projects and industries available across different platforms (Judijanto & Andhiyan Mergining Mei, 2025; Porwal & Kumar, 2023).

The study conducted by Iortyom et al., (2024) also found similar results, indicating that the gig economy has a positive impact on income and welfare in Nigeria. This positions the gig economy as an important source of income, particularly in regions with limited formal employment opportunities. At the aggregate level, increases in income and welfare are correlated with higher consumption, which in turn can stimulate national output, namely GDP.

Flexibility is a critical factor in the gig economy. It allows both workers and employers to adjust workloads, skills, and project types according to specific needs and circumstances (Vadavi & Sharmiladevi, 2024). This environment encourages workers to become more competitive, independently explore opportunities, and rapidly build global networks. Workers benefit from greater job autonomy, while firms gain from enhanced worker capabilities without geographical constraints, leading to reduced administrative costs (Ashford et al., 2018). In the long run, these dynamics can have a positive impact on economic growth.

Table 5. Short-run PMG Estimation by Country

Negara	Koefisien ECT	Clerical Data Entry		Sales and Marketing Support		Software and Development Technology	
		Coefficient	Prob	Coefficient	Prob	Coefficient	Prob
Indonesia	- 0.6826***	1.8088	0.303	-0.1350	0.563	0.1657	0.266
Malaysia	- 0.6076***	11.2143	0.674	0.3634	0.931	0.8516***	0.001

Singapore	- 0.4612***	-2.6574	0.202	8.9669**	0.023	3.0744***	0.000
Thailand	- 1.3417***	-5.9578	0.458	2.3000	0.412	-0.3172	0.623
Vietnam	- 1.6804***	-5.8280***	0.005	-3.616**	0.045	-0.0453	0.539

*, **, and *** statistical significance at the 10%, 5%, dan 1% levels, respectively.

Source: STATA

Table 5 presents the short-run results, indicating that the clerical data entry sector has a significant negative effect in Vietnam. The Sales and Marketing Support sector exhibits a significant positive effect in Singapore and a significant negative effect in Vietnam. Meanwhile, the Software and Development Technology sector has a significant positive impact in both Malaysia and Singapore.

These findings indicate that the Software and Development Technology sector exerts a consistent impact in both the short and long run. In contrast, the clerical data entry and Sales and Marketing Support sectors exhibit different dynamics across the short- and long-term horizons. This underscores that each sector within the gig economy possesses distinct characteristics, resulting in varying effects on the overall economy. Therefore, more sector-specific controls and regulations are necessary to minimize the potential negative consequences arising from the gig economy work system.

4. Conclusion and Recommendations

The findings of this study clearly demonstrate that the number of gig workers contributes positively to the economic conditions of the five ASEAN countries in the long run. This suggests that the gig economy can serve as a source of growth potential that should be leveraged in national economic development. The short-run instability of the gig economy highlights the need for support from more stable and sustainable formal sectors.

Optimizing the gig economy work system requires strengthening regulations and adjusting policies to ensure that flexibility is maintained without compromising stability and worker protection. The discourse on gig economy regulation continues to evolve across various countries. Some examples of countries that have focused on regulating the gig economy include California, with the enactment of the California Assembly Bill 5; India, with the Social Security Code 2020; and Europe, with the Transparent and Predictable Working Conditions Directive, which emphasizes legal protection, social security for gig workers, and transparency regarding working conditions and gig workers' rights

This study has several limitations, particularly regarding the scope of gig economy sectors analyzed and the number of variables employed. Future research could address these limitations by expanding the range of sectors under analysis and incorporating a more diverse set of variables to provide a more comprehensive understanding of the gig economy's impact.

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