Tourism, Accommodations, Food Services, and Regional GDP

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Abstract. The development of the airport city makes it the center of national-regional economic growth. The continuous development provides several alternative revenues to the surrounding areas and affects the price of the urban houses. The Bank of Indonesia has analyzed the development of commercial property since 2016. It covers five types of commercial property, which include offices (rent/sale), retail (rent/sale), apartments (rent/sale), hotels, industrial land, convention halls, and warehouse complexes, in Jabodetabek, Banten, Bandung, Makassar, Medan, Semarang, Surabaya, Balikpapan, Denpasar, and Palembang. The research aims to find variables that affect the contribution of accommodations and food services to the Regional GDP. Here, researchers use an approach in quantitative dynamics modeling that is often used in time series analysis, which is the Autoregressive Exogenous modeling structure input (ARX). In general, AR is the Auto-Regressive nature of a model, while X is an exogenous input. The initial population of the study is 296 airports, which consists of all those managed by PT. Angkasa Pura I, PT. Angkasa Pura II, and the UPT Air Transportation in the Region. Then, the population is filtered further to 151 airports in Indonesia. The study shows that the variable of departing aircraft, departing passengers, arriving passengers, baggage unloading, cargo unloading, and cargo loading, each had a contribution to the GDP variable. The departing passenger variable had a positive impact on the increase of the variable of accommodation and food services of the Regional GDP.

1. Introduction
The national strategic level brings the development opportunities to Zhengzhou, and all the surrounding provinces [1]. The development makes the city of Zhengzhou airport, China, become the center of national-regional economic growth [1]. As for Australia, the modern city of Tullamarine airport, Australia, makes use of the airport’s land-use plan for non-flight airline destinations, as the source of income[2]. In Japan, the airport becomes the choice for long-distance international flights, domestic aviation networks, and business passengers, which affect the non-airlines income of the city of Haneda airport [3].

The airport traffic volume also has an impact on the surrounding area of a certain airport. The effect involves the price of the urban house[4]. Tsu et al. have conducted a study on the effects of airport traffic volume on house prices in New Zealand. The data shows that the airport’s traffic volume positively and significantly affects the prices of the urban houses in Auckland, Christchurch, and Wellington in 2014.
Airports in Auckland, Canterbury/Christchurch, and Wellington economically affect housing prices [4]. Meanwhile, Deppa and Ganapathi [5] find that the prices are an essential component of the growth of the LCC aviation sector in New Delhi, India.

2. Methodology
Regional GDP is the amount of added value of goods and services produced by various industries in a region within a certain period (usually one year). The distribution of Regional GDP, based on current prices, according to the business field, shows the economic structure, or the role of each business field in an area. The business field that has a large role presents the basis of the development of a region. Regional GDP of a commercial property area in the central business district includes real estate, construction, transportation, warehousing, and information and communication. The GDP of non-commercial property area of business centers in the region covers agriculture, forestry, fisheries, mining and excavation, processing industry, procurement of electricity and gas, water supply, waste management, waste and recycling, government administration, defense, and social security is mandatory. Others are health services and social activities, other services, provision of accommodation and drinking meals, big-retail trade, motorcycle repair, education services, financial services, and company services. The National GDP growth in the first quarter of 2018 that reached 5.01%, was one of the highest in the Asia Pacific. The national GDP growth was above that of developed countries, such as Japan and Korea [6-20].

Airport performance is based on plane arrival (x1.1), airplane departs (x1.2), passenger departing (x1.3), passenger arrival (x1.4), unloading baggage (x1.5), load baggage (x1.6), unloading cargo (x1.7), and cargo load (x1.8). The Regional GDP of accommodation and food services includes the provision of short-term lodging accommodations for visitors, and other travelers, and food and beverages for immediate consumption. The number and type of additional services provided vary greatly. It excludes the provision of long-term accommodation, such as primary residence, preparation of food or beverages not for immediate consumption, or through large and retail trade activities [21-30].

The coefficient of determination is a measure of the total variation of non-independent variables that can be explained by its relationship with the independent variable. The coefficient of determination is also referred to as R2. Then, the value of R2 is between 0 and 1.0. If the linear relationship is perfect between two variables, the coefficient of determination will be 1.0, where the least-squared regression line will go through each point on the scatter plot. R2 is a measure to indicate how well a linear regression line against the data is. The closer the value of R2 to +1.0, the stronger the linear relationship. On the other hand, the closer the value of R2 to 0, the weaker the linear relationship. Besides, multiple linear regression analysis uses R2 to determine the effect of Airport Performance variable to the Accommodation and Food Services (Regional GDP) variables. The analysis uses software SPSS version 20 to find the regression coefficient [6-12].

One approach in quantitative dynamics modeling that is often used in time series analysis is the Autoregressive Exogenous modeling structure input (ARX). The Autoregressive Exogenous (ARX) modeling technique is a successful method for completing system identification. The ARX can map the relationship between input (u) and output data (y), which is available based on the desired order model. In general, AR is the Auto-Regressive nature of a model, while X is an exogenous input. Here, there were non-independent variables, which are: X1 = airplane arrived; X2 = airplane departed; X3 = passenger departed; X4 = passenger arrived; X5 = baggage unloaded; X6 = baggage loaded; X7 = cargo unloaded; X8 = cargo loaded. The initial population is 296 Airports, which consists of all those managed by PT. Angkasa Pura I, PT. Angkasa Pura II, and UPT Air Transportation. Then, the population is filtered further to the final number of 151 airports in Indonesia [21-30].

3. Result and Discussion
The Bank of Indonesia has analyzed the development of commercial property since 2016. It covers five types of commercial properties, which are offices, shopping centers (retail), apartments, hotels, and industrial land (Figure 1-4). In the study, industrial land data is eliminated due to the lack of data in seven cities as the data sources.
The growth of the supply of commercial property in Jabodetabek, especially for apartments and hotels, Surabaya, for offices, Makassar for hotels, and Medan for Apartments, is expected to be very positive. Meanwhile, the growth is expected to decline slightly in Semarang and Bandung for apartment, and Banten for Retail and Hotels.

Figure 1. Office supply growth in 7 major cities in Indonesia (%)

Figure 2. Retail supply growth in 7 major cities in Indonesia (%)

Figure 3. Apartment supply growth in 7 major cities in Indonesia (%)

Figure 4. Hotel supply growth in 7 major cities in Indonesia (%)

Descriptive analysis from the figure shows that the growth of the supply of commercial property in Jabodetabek, especially for apartments and hotels, Surabaya, for offices, Makassar for hotels, and
Medan for apartments, is expected to be very positive. It would have an impact on Regional GDP, accommodations, and food services.

The R² value of 48.1% explains the medium linear relationship between the variables of airport performance and the variables of accommodations and food services (regional GDP) (Figure 5-6).

Multiple linear regression equation:

\[ Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 \]  \hspace{1cm} (1)

Multiple linear regression equation of airport performance variables on accommodations and food services (Regional GDP) is shown in equation 2

\[ Y = -71.497 - 2.368 X_1 + 2.590 X_2 + 0.01 X_3 - 0.007 X_4 - 0.001 X_5 \]  \hspace{1cm} (2)

Where:

\( Y \) = Regional GDP accommodations and food services
\( X_1 \) = airplane arrived
\( X_2 \) = airplane departed
\( X_3 \) = passenger departed
\( X_4 \) = passenger arrived
\( X_5 \) = baggage unloaded

![Figure 5. Histogram of accommodations and food services (regional GDP)](image-url)
Figure 6. Normal P-P Plot of Regression Standardized Residual of accommodations and food services (regional GDP)

The ARX could map the relationship between data input (u) and output (y), which are available based on the desired order model. In general, AR was the Auto-Regressive nature of a model, while X was an exogenous input. The relationship between the input-output of this ARX models could generally be represented by equation 3:

\[ Y(t) + a_1 y(t-1) + \cdots + a_n y(t-n_a) + b_0 u(t-d) + \cdots + b_n b_u (t-d-n_b) + e(t) \]

(3)

Where \( y(t) \), \( u(t) \), and \( e(t) \) is output, the input, and error process, \( n_a \) is autoregression and \( n_b \) was exogenous regressor. The structure of the ARX model could be displayed as in equation 4:

\[ A(q) \cdot y(t) = B(q) \cdot u(t) + e(t) \]

(4)

Where:

\( A(q) = 1 + a_1 q^{-1} + a_2 q^{-2} + \cdots + a_n q^{-n_a} \)

\( y(t) \) = output

\( B(q) = b_1 + b_2 q^{-1} + b_3 q^{-2} + \cdots + b_n q^{-n_b} + 1 \)

\( u(t) \) = input

\( e(t) \) = error

While predicting the output of the ARX model (Figure 7-8) at time \( t \) is found in equation 5

\[ y(t) = F(x(t)) \]

(5)

where:

\( y(t) \) = prediction

\( x(t) \) = regressor

\( F \) = nonlinear function

The second output sought is Accommodations and Food Services (Regional GDP). By doing the similar process as above, the inputs that influence the Supply of Accommodations and Food Services
(Regional GDP) are airplane arrival (X1), airplane depart (X2), passengers arrival (X3), and passengers depart (X4), which are more influential than the other four inputs.

The graph of ARX estimated the data held. \(N_a, n_b,\) and \(n_k\) values that produce optimum fits of 8, 2, and 1, respectively. It provides a fit of 75.32%, and fit validation of 75.08%. Furthermore, FPE is 0.9998, and MSE is 0.9997. Of the 90 data used for estimation, 67 data, or 75.08% of ARX has similarities with the existing data. The value could be said to be quite good because of the fitness produced is > 50%. The ARX generates several input-output relations, as illustrated in equation 6 to equation 16.

Discrete-time ARX model: \(A(z) y(t) = B(z) u(t) + e(t)\)  

\begin{align*}
A(z) &= 1 + 0.00827 z^{-1} - 0.001375 z^{-2} - 0.1807 z^{-3} + 0.01978 z^{-4} - 0.02657 z^{-5} - 0.07941 z^{-6} - 0.07654 z^{-7} + 0.06763 z^{-8} \\
B1(z) &= 5.986e04 z^{-1} - 1.173e05 z^{-2}
\end{align*}

Fig 7. ARX Estimation in Provision of Accommodation and Food Services

Fig 8. ARX Validation on Accommodation and Food Services
The equation for the first input \( x_1 \) (plane comes) in discrete time \( z \) is:

\[
\frac{y(t)}{u_1(t)} = (5.986e04 \ z \ (-1)-1.173e05 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right)
\]

(12)

The equation on the second input \( x_2 \) (plane departs) in discrete time \( z \) is:

\[
\frac{y(t)}{u_2(t)} = (-6.247e04 \ z \ (-1)+1.13e05 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right)
\]

(13)

Equations on the third input \( x_3 \) (departing passengers) in what are discrete \( z \):

\[
\frac{y(t)}{u_3(t)} = (2.633e04 \ z \ (-1)-620.4 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right)
\]

(14)

The equation on the fourth input \( x_4 \) (passenger arrives) in discrete time \( z \) is:

\[
\frac{y(t)}{u_4(t)} = (-1.363e04 \ z \ (-1)+3148 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right)
\]

(15)

If the above equation is combined in a discrete time \( z \), it will be (in 8 stages):

\[
y(t) = (5.986e04 \ z \ (-1)-1.173e05 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right) + u_1(t) + (-6.247e04 \ z \ (-1)-1.13e05 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right) + u_2(t) + (2.633e04 \ z \ (-1)-620.4 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right) + u_3(t) + (-1.363e04 \ z \ (-1)+3148 \ z \ (-2))/\left(1+0.00827 \ z \ ^{-1}\right) + u_4(t)
\]

(16)
But if the units in the form of discrete $z$ are converted, it is going to be like equation 24.

\[
y(t) = (-1.585e08-8.495e07 s+5.689e07 s^2+7.443e07 s^3+3.545e07 s^4+1.046e07 s^5+1.604e06 s^6+2.071e05 s^7) (2019+5239 s+4598 s^2+61.72 s^3+7.958e06 s^4+3.66e07 s^5+75.32 s^6+6.001e07 s^7+1.177e08 s^8) 
\]

\[
u(t) = (-1.394e08+6.001e07 s-7.166e07 s^2-7.958e07 s^3+3.66e07 s^4-1.062e07 s^5-1.617e06 s^6-2.072e05 s^7) (2019+5239 s+4598 s^2+61.72 s^3+75.32 s^4+6.001e07 s^5+1.177e08 s^6+7.958e06 s^7+3.66e07 s^8) 
\]

\[
u(t) = (7.099e07+1.177e08 s+9.16e07 s^2+4.311e07 s^3+1.344e07 s^4+3.001e06 s^5+3.98e05 s^6+4.319e04 s^7) (2019+5239 s+4598 s^2+61.72 s^3+75.32 s^4+6.001e07 s^5+1.177e08 s^6+7.958e06 s^7+3.66e07 s^8) 
\]

\[
u(t) = (-2.895e07-5.234e07 s-4.372e07 s^2-2.174e07 s^3-7.078e06 s^4-1.642e06 s^5-2.231e05 s^6-2.501e04 s^7) (2019+5239 s+4598 s^2+61.72 s^3+75.32 s^4+6.001e07 s^5+1.177e08 s^6+7.958e06 s^7+3.66e07 s^8) 
\]

\[
u(t) = (2761+3399 s+4678 s^2+2.592 s^3+1021 s^4+260.9 s^5+61.99 s^6+6.613 s^7+8 s^8) 
\]

4. Summary
The descriptive analysis from the above figure shows that the growth of the supply of commercial property in Jabodetabek, for apartments and hotels, Surabaya, for offices, Makassar for hotels, and Medan for apartments, is expected to be very positive. It would have an impact on Regional GDP, accommodations, and food services.

The value of $R^2 = 48.1\%$ explains the strong medium linear relationship between the variables of airport performance and the variables of accommodations and food services (regional GDP). It has a strong impact on airplane arrived (X1), the airplane departed (X2), passenger departed (X3), the passenger arrived (X4), and baggage unloaded (X5) variables.

Then, the ARX model that influences accommodations and food services (regional GDP) consists of airplane arrival (X1), airplane depart (X2), passenger arrival (X3), and passengers depart (X4). It produces a fit of 75.32% and a fit validation of 75.08%. It also provides an FPE of 0.9998 and an MSE of 0.9997. Of the 90 data used for estimation, 67 data provide the best fit of 75.32% and a fit validation of 75.08%.

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