Analysis of time series for postal shipments in Regional VII East Java Indonesia

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Abstract. The change of number delivery goods through PT. Pos Regional VII East Java Indonesia indicates that the trend of increasing and decreasing the delivery of documents and non-documents in PT. Pos Regional VII East Java Indonesia is strongly influenced by conditions outside of PT. Pos Regional VII East Java Indonesia so that the prediction the number of document and non-documents requires a model that can accommodate it. Based on the time series plot monthly data fluctuations occur from 2013-2016 then the model is done using ARIMA or seasonal ARIMA and selected the best model based on the smallest AIC value. The results of data analysis about the number of shipments on each product sent through the Sub-Regional Postal Office VII East Java indicates that there are 5 post offices of 26 post offices entering the territory. The largest number of shipments is available on the PPB (Paket Pos Biasa is regular package shipment/non-document) and SKH (Surat Kilat Khusus is Special Express Mail/document) products. The time series model generated is largely a Random walk model meaning that the number of shipment in the future is influenced by random effects that are difficult to predict. Some are AR and MA models, except for Express shipment products with Malang post office destination which has seasonal ARIMA model on lag 6 and 12. This means that the number of items in the following month is affected by the number of items in the previous 6 months.

Keywords: ARIMA, documents, non-documents, shipments, post office.

1. Introduction
The average increase of internet user households in Indonesia is 3.5% per year as cellular phone users in Indonesia grow by 2% per year (Statistics Indonesia, 2016) encourages shifting the way Indonesians shop from the direct transaction system (in the market/shop) to indirect transaction online, it encourages PT. Pos Indonesia to cooperate with some online shopping service providers such as Matahari mall, Ali Express, etc. (PT. Pos Indonesia Annual Report, 2015). These conditions affect the magnitude of the types of documents and non-documents through the Post, which based on the annual report of PT. Pos Indonesia (2015) delivery of goods through packages has increased since 2010 from 14,944,000 units to 25,241,000 packages in 2014, while standard letter delivery actually decreased from 64,267,000 units in 2010 to 60,472,000 units in the Year 2014. This change indicates that the
trend of increasing and decreasing the delivery of documents and documents in PT. Pos Indonesia is
strongly influenced by conditions outside of PT. Pos Indonesia so that the prediction the number of
document submissions and non-documents requires a model that can accommodate it.
ARIMA models are, in theory, the most general class of models for forecasting a time series which
can be made to be “stationary” by differencing (if necessary), perhaps in conjunction with nonlinear
transformations such as logging or deflating (if necessary). A random variable that is a time series is
stationary if its statistical properties are all constant over time. A stationary series has no trend, its
variations around its mean have a constant amplitude, and it wiggles in a consistent fashion, i.e., its
short-term random time patterns always look the same in a statistical sense. The latter condition
means that its autocorrelations (correlations with its own prior deviations from the mean) remain
constant over time, or equivalently, that its power spectrum remains constant over time. A random
variable of this form can be viewed (as usual) as a combination of signal and noise, and the signal (if
one is apparent) could be a pattern of fast or slow mean reversion, or sinusoidal oscillation, or rapid
alternation in sign, and it could also have a seasonal component. An ARIMA model can be viewed as
a “filter” that tries to separate the signal from the noise, and the signal is then extrapolated into the
future to obtain forecasts.

Based on the above background, the purpose of this research are to obtain and analyze the best time
series model of document delivery and non-document and review the forecasting of documents and
non-documents based on the ARIMA model obtained in the next period.

2. Materials and Methods

2.1. ARIMA Model

The acronym ARIMA stands for Auto-Regressive Integrated Moving Average. Lags of the stationeries
series in the forecasting equation are called "autoregressive" terms, lags of the forecast errors are
called "moving average" terms, and a time series which needs to be differenced to be made stationary
is said to be an "integrated" version of a stationary series. Random-walk and random-trend models,
autoregressive models, and exponential smoothing models are all special cases of ARIMA models.

A non seasonal ARIMA model is classified as an "ARIMA(p,d,q)" model, where:

- p is the number of autoregressive terms,
- d is the number of no seasonal differences needed for stationery, and
- q is the number of lagged forecast errors in the prediction equation.

The forecasting equation is constructed as follows. First, let y denote the dth difference of Y, which
means:
If d=0:  y_t = Y_t
If d=1:  y_t = Y_t - Y_{t-1}
If d=2:  y_t = (Y_t - Y_{t-1}) - (Y_{t-1} - Y_{t-2}) = Y_t - 2Y_{t-1} + Y_{t-2}

Note that the second difference of Y (the d=2 case) is not the difference from 2 periods ago. Rather, it
is the first-difference-of-the-first difference, which is the discrete analog of a second derivative, i.e.,
the local acceleration of the series rather than its local trend.

In terms of y, the general forecasting equation is:

\[
\hat{y}_t = \mu + \phi_1 y_{t-1} + \ldots + \phi_p y_{t-p} - \theta_1 e_{t-1} - \ldots - \theta_q e_{t-q}
\] (1)

Here the moving average parameters (θ’s) are defined so that their signs are negative in the equation,
following the convention introduced by Box and Jenkins. Some authors define them so that they have
plus signs instead. When actual numbers are plugged into the equation, there is no ambiguity, but it’s
important to know which convention your software uses when you are reading the output. Often the parameters are denoted there by AR(1), AR(2), …, and MA(1), MA(2), … etc..

To identify the appropriate ARIMA model for \( y_t \), we begin by determining the order of differencing (d) needing to stationarize the series and remove the gross features of seasonality, perhaps in conjunction with a variance-stabilizing transformation such as logging or deflating. If we stop at this point and predict that the differenced series is constant, we have merely fitted a random walk or random trend model. However, the stationeries series may still have auto correlated errors, suggesting that some number of AR terms (\( p \geq 1 \)) and/or some number MA terms (\( q \geq 1 \)) are also needed in the forecasting equation.

2.2. PT.Pos Products

PT. Pos Indonesia (Persero) has an extensive network of 4,800 online post offices (http://www.posindonesia.co.id). The number of service points reached 58,700 points in the form of post office, postal agency, Mobile Postal Service, and others. Innovation continues to be carried out by Pos Indonesia, among others, Post shop development which is a retail business development implemented to change the image of conventional office into a modern post office with one stop shopping service pattern, namely Postal services in the form of mail delivery service, package, financial services, stamps, philately products and others. Online Shopping services Pos Indonesia also provides e-commerce services and other services through myPos and m-pospay applications.

In general, PT.Pos Indonesia's products are divided into three categories:
1. Letters and Packages
   In this category there are some products such as: Admailpos, Express Mail Service (EMS), Philatelic, Paketpos, Posexpress, Special Poskilat, Ordinary Letter (Standard).
2. Financial Services
   In this category there are several products such as: Bank Channelling, Fund Distribution, Giropos, Weselpos, Post Pay.
3. Retail in cooperation with ANTAM gold
4. Logistic Integration, Customized according to customer's request which include services: Transporting, Warehousing, Freight forwarding, Distribution of goods and Supply chain management.
5. International post include: EMS, international fast Package, Export Package, International registered mail, International Pos Post, International air mail.

In this research the products used in the analysis are Admailpos product, Express Mail Service (EMS), Paketpos, Posexpress, Special Poskilat, Ordinary Letter (Standard). Preparation of products based on document category and non document can not be done directly because there are several categories of products whose data can not be differentiated whether included in the document or non document category.

2.3. Methodology for Data Modelling

Sources of data in this research were taken from the data delivery notes (documents and non-documents) or product services letter and package services received by PT.Pos regional VIII East Java for 5 years starting from 2013 to 2017. The types of products used for research data are:
1. PPB is Ordinary Package Shipment (non document)
2. SKH is a Special Express Mail (document)
3. PPKH is a Special Express Package Delivery (non-document)
4. XP is Express (non documents and documents)
5. EMS is Express Mail Service (document)
The datas used in this research are in the monthly data series (with bag for unit of data) per each delivery destination (26 post offices throughout East Java), so that modelling will be done at each delivery destination. After we were doing the modelling then we were forecasting for the next few months.

3. Results
The results of the research divided into three parts:
1. Descriptive analysis of the number of shipments based on the post office of destination of the products
2. Time series data modelling based on products type and post office of products destination
3. Forecasting based on the model obtained for each type of products and post office of destination of the mail.

The results can be seen in the section 3.1, 3.2 and 3.3.

3.1. Descriptive analysis of the number of shipments

According to Figure 1, there are five post offices that have a total larger product shipment than other post offices (more than 1,200,000 bags). While the other 19 post offices only get total shipments of products under 200,000 bags)

Figure 1. Bar charts the number of bags of shipment by products and post offices destination

Five post offices that get the most posts are Post Office KP Malang, Post Office KP Kediri, Post Office KP Madiun, Post Office KP Jember and Post Office KP Blitar. The largest number of mails for the five Post Offices is not only on the total products but also on all types of products, so for Post
Office Sub-Regional VII East Java can make this information to provide more space for the products delivered there than the office another destination post.

3.2. Time series data modeling

Based on the time series plot monthly data fluctuations occur from 2013-2016 and due to the cause of the fluctuation of unknown data, then the modeling is done using ARIMA or seasonal ARIMA model and selected the best model based on the smallest AIC value. Based on the ACF and PACF plots and testing the significance of the parameters and the coefficient reduction to obtain the appropriate model, the corresponding model is shown in full in Table 1.

| Post Office   | PBP         | SKH         | PPKH        | EMS         | EXPRESS     |
|---------------|-------------|-------------|-------------|-------------|-------------|
| Probolinggo   | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Pasuruan      | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Lumajang      | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Jember        | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Bondowoso     | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Situbondo     | ARIMA (0,0,1) | ARIMA (2,1,1) | ARIMA (0,0,1) | ARIMA (0,1,1) | ARIMA (0,0,1) |
| Banyuwangi    | ARIMA (0,1,0) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Malang        | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Nganjuk       | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Madiun        | ARIMA (0,0,1) | ARIMA (0,0,2) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Ponorogo      | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Magetan       | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,0,1) |
| Ngawi         | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Bangkalan     | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Sampang       | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Pamekasan     | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Sumenep       | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Gresik        | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Lamongan      | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Tuban         | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Bojonegoro    | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Mojokerto     | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Jombang       | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Kediri        | ARIMA (0,1,0) | ARIMA (0,0,1) | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (0,1,0) |
| Blitar        | ARIMA (0,0,1) | ARIMA (1,0,0) | ARIMA (0,0,1) | ARIMA (0,0,1) | ARIMA (0,0,1) |
| Tulungagung   | ARIMA (0,1,0) | ARIMA (0,1,0) | ARIMA (1,0,0) | ARIMA (0,1,0) | ARIMA (1,0,0) |

Most time series models are produced in the form of a Random walk where a random walk is defined as a process where the current value of a variable is composed of the past value plus an error term defined as a white noise (a normal variable with zero mean and variance one). The implication of a process of this type is that the best prediction of \( y \) for next period is the current value, or in other
words the process does not allow to predict the change \((y_t - y_{t-1})\). That is, the change of \(y\) is absolutely random. It can be shown that the mean of a random walk process is constant but its variance is not. Therefore a random walk process is non stationary, and its variance increases with \(t\). In practice, the presence of a random walk process makes the forecast process very simple since all the future values of \(y_{t+s}\) for \(s > 0\), is simply \(y_t\).

| Post Office (KP) | PPB | SKH | PPKH | EMS | EXPRESS |
|------------------|-----|-----|------|-----|---------|
| Situbondo        | \(Z_t = 792.75 + a_t + 0.33a_{t-1}\) | \(Z_t = 0.49Z_{t-1} + 0.11Z_{t-3} + 0.40Z_{t-2} + 0.76a_{t-1}\) | \(Z_t = 476.74 + a_t + 0.32a_{t-1}\) | \(Z_t = 160.48 + a_t + 0.36a_{t-1}\) | \(Z_t = 287.6 + a_t + 0.29a_{t-1}\) |
| Banyuwangi       | \(Z_t = 358.89 + a_t + 0.36a_{t-1}\) | \(Z_t = 4142.8 + a_t + 0.49a_{t-1}\) | \(Z_t = 6837.34 + Z_{t-1} + a_t - 0.58129a_{t-1}\) |
| Malang           | \(Z_t = 0.3999.84 + a_t + 0.39a_{t-1}\) | \(Z_t = 3750.65 + a_t + 0.34a_{t-1} + 0.36a_{t-2}\) | \(Z_t = 6837.34 + Z_{t-1} + a_t - 0.58129a_{t-1}\) |
| Magetan          | \(Z_t = 0.863.18 + a_t + 0.49a_{t-1}\) | \(Z_t = 384.99 + a_t + 0.46a_{t-1}\) | \(Z_t = 520.18 + a_t + 0.5a_{t-1} + 0.57a_{t-2} - 0.84a_{t-3}\) | \(Z_t = 311.69 + a_t + 0.5a_{t-1}\) |
| Ngawi            | \(Z_t = 793.42 + a_t + 0.36a_{t-1}\) | \(Z_t = 353.92 + a_t + 0.4a_{t-1}\) | \(Z_t = 160.98 + a_t + 0.35a_{t-1} + 0.33a_{t-2}\) | \(Z_t = 287.91 + a_t + 0.33a_{t-1}\) |
| Sampang          | \(Z_t = 486.05 + a_t + 0.31a_{t-1}\) | \(Z_t = 153.37 + a_t + 0.33a_{t-1}\) | \(Z_t = 287.91 + a_t + 0.33a_{t-1}\) |
| Sumenep          | \(Z_t = 883.99 + a_t + 0.35a_{t-1}\) | \(Z_t = 339.35 + a_t + 0.72a_{t-1}\) | \(Z_t = 287.91 + a_t + 0.33a_{t-1}\) |
| Jombang          | \(Z_t = 772.58 + a_t + 0.65a_{t-1}\) | \(Z_t = 3854.67 + a_t + 0.29a_{t-1}\) | \(Z_t = 287.91 + a_t + 0.33a_{t-1}\) |
| Kediri           | \(Z_t = 584.47 + a_t + 0.47a_{t-1}\) | \(Z_t = 3558 - 0.38Z_{t-1} + a_t\) | \(Z_t = 4797.11 + a_t + 0.45a_{t-1} + 0.5a_{t-2}\) | \(Z_t = 1618.78 + a_t + 0.5a_{t-1}\) | \(Z_t = 287.91 + a_t + 0.49a_{t-1}\) |
| Blitar           | \(Z_t = 7948.82 + a_t + 0.47a_{t-1}\) | \(Z_t = 5858 - 0.38Z_{t-1} + a_t\) | \(Z_t = 4797.11 + a_t + 0.45a_{t-1} + 0.5a_{t-2}\) | \(Z_t = 1618.78 + a_t + 0.5a_{t-1}\) | \(Z_t = 287.91 + a_t + 0.49a_{t-1}\) |
| Tulung-agung      | \(Z_t = 504.73 + 0.31Z_{t-1}\) | \(Z_t = 504 + a_t + 0.31Z_{t-1}\) | \(Z_t = 299.81 + 0.25Z_{t-1}\) | \(Z_t = 299.81 + 0.25Z_{t-1}\) |

Based on Table 2 it can be concluded that only express shipment products with the destination of Malang post office have a seasonal ARIMA model in which the number of deliveries in the future is affected by shipment in the previous 6 months. The rest are AR and MA models in addition to the previously described random walk model.

### 3.3. Forecasting

The model already obtained in the previous section is used to predict the number of items by type of postal product and post office. Forecasting is done by using outsample data to forecast data up to 3 months ahead. The forecasting results are shown in Table 3.

Forecasting results obtained are expected to provide information to the Regional Postal Coordinator VII East Java to make the preparation of a more adequate place and workforce.
Table 3. Forecasting number of bags for every products and post office destination for three months in 2017

| Post Office (KP) | Month   | PPB | SKH | PPKH | EMS | EXPRESS |
|-----------------|---------|-----|-----|------|-----|---------|
| Probolinggo     | October | 853 | 374 | 515  | 173 | 310     |
|                 | November| 853 | 374 | 515  | 173 | 310     |
|                 | December| 853 | 374 | 515  | 173 | 310     |
| Pasuruan        | October | 881 | 395 | 527  | 177 | 316     |
|                 | November| 881 | 395 | 527  | 177 | 316     |
|                 | December| 881 | 395 | 527  | 177 | 316     |
| Lumajang        | October | 814 | 354 | 496  | 166 | 296     |
|                 | November| 814 | 354 | 496  | 166 | 296     |
|                 | December| 814 | 354 | 496  | 166 | 296     |
| Jember          | October | 8,363| 3,729| 5,041| 1,699|3,032     |
|                 | November| 8,363| 3,729| 5,041| 1,699|3,032     |
|                 | December| 8,363| 3,729| 5,041| 1,699|3,032     |
| Bondowoso       | October | 820 | 359 | 499  | 167 | 297     |
|                 | November| 820 | 359 | 499  | 167 | 297     |
|                 | December| 820 | 359 | 499  | 167 | 297     |
| Situbondo       | October | 793 | 412 | 477  | 160 | 288     |
|                 | November| 793 | 409 | 477  | 160 | 288     |
|                 | December| 793 | 411 | 477  | 160 | 288     |
| Banyuwangi      | October | 814 | 359 | 491  | 165 | 295     |
|                 | November| 814 | 359 | 491  | 165 | 295     |
|                 | December| 814 | 359 | 491  | 165 | 295     |
| Malang          | October | 9,400| 4,143| 5,718| 1,922|2,832     |
|                 | November| 9,400| 4,143| 5,718| 1,922|1,964     |
|                 | December| 9,400| 4,143| 5,718| 1,922|5,540     |
| Nganjuk         | October | 729 | 325 | 439  | 148 | 264     |
|                 | November| 729 | 325 | 439  | 148 | 264     |
|                 | December| 729 | 325 | 439  | 148 | 264     |
| Madiun          | October | 8,441| 3,751| 5,162| 1,732|3,068     |
|                 | November| 8,441| 3,751| 5,162| 1,732|3,068     |
|                 | December| 8,441| 3,751| 5,162| 1,732|3,068     |
| Ponorogo        | October | 683 | 309 | 413  | 138.54|245     |
|                 | November| 683 | 309 | 413  | 138.54|245     |
|                 | December| 683 | 309 | 413  | 138.54|245     |
| Magetan         | October | 863 | 385 | 520  | 197 | 312     |
|                 | November| 863 | 385 | 520  | 163 | 312     |
|                 | December| 863 | 385 | 520  | 156 | 312     |
| Ngawi           | October | 793 | 354 | 481  | 161 | 289     |
|                 | November| 793 | 354 | 481  | 161 | 289     |
|                 | December| 793 | 354 | 481  | 161 | 289     |
| Post Office (KP)  | Month | PPB | SKH | PPKH | EMS | EXPRESS |
|------------------|-------|-----|-----|------|-----|---------|
| Bangkalan        | October | 757 | 338 | 456  | 153 | 274     |
|                  | November | 757 | 338 | 456  | 153 | 274     |
|                  | December | 757 | 338 | 456  | 153 | 274     |
| Sampang          | October | 787 | 344 | 486  | 161 | 287     |
|                  | November | 787 | 344 | 486  | 161 | 287     |
|                  | December | 787 | 344 | 486  | 161 | 287     |
| Pamekasan        | October | 761 | 343 | 458  | 153 | 275     |
|                  | November | 761 | 343 | 458  | 153 | 275     |
|                  | December | 761 | 343 | 458  | 153 | 275     |
| Sumenep          | October | 884 | 392 | 537  | 180 | 320     |
|                  | November | 884 | 392 | 537  | 180 | 320     |
|                  | December | 884 | 392 | 537  | 180 | 320     |
| Gresik           | October | 840 | 369 | 510  | 171 | 305     |
|                  | November | 840 | 369 | 510  | 171 | 305     |
|                  | December | 840 | 369 | 510  | 171 | 305     |
| Lamongan         | October | 812 | 357 | 495  | 166 | 295     |
|                  | November | 812 | 357 | 495  | 166 | 295     |
|                  | December | 812 | 357 | 495  | 166 | 295     |
| Tuban            | October | 815 | 359 | 492  | 165.35 | 298 |
|                  | November | 815 | 359 | 492  | 165.35 | 298 |
|                  | December | 815 | 359 | 492  | 165.35 | 298 |
| Bojonegoro       | October | 786 | 346 | 476  | 159.90 | 286 |
|                  | November | 786 | 346 | 476  | 159.90 | 286 |
|                  | December | 786 | 346 | 476  | 159.90 | 286 |
| Mojokerto        | October | 754 | 334 | 458  | 153.63 | 273 |
|                  | November | 754 | 334 | 458  | 153.63 | 273 |
|                  | December | 754 | 334 | 458  | 153.63 | 273 |
| Jombang          | October | 773 | 339 | 475  | 159 | 282     |
|                  | November | 773 | 339 | 475  | 159 | 282     |
|                  | December | 773 | 339 | 475  | 159 | 282     |
| Kediri           | October | 8,773 | 3,855 | 5,372 | 1,800 | 3,210 |
|                  | November | 8,773 | 3,855 | 5,372 | 1,800 | 3,210 |
|                  | December | 8,773 | 3,855 | 5,372 | 1,800 | 3,210 |
| Blitar           | October | 7,949 | 3,558 | 4,797 | 1,619 | 2,879 |
|                  | November | 7,949 | 3,558 | 4,797 | 1,619 | 2,879 |
|                  | December | 7,949 | 3,558 | 4,797 | 1,619 | 2,879 |
| Tulung agung     | October | 821 | 364 | 505  | 168 | 300     |
|                  | November | 821 | 364 | 505  | 168 | 300     |
|                  | December | 821 | 364 | 505  | 168 | 300     |
| **TOTAL**        |         | 179,280 | 79,635 | 108,890 | 36,565 | 65,223 |
4. Discussion

The results of data analysis of the number of shipments on each product sent through the Sub-Regional Postal Office VII indicates that there are 5 post offices of 26 post offices entering the territory. The largest number of shipments is available on the PPB (non-document) and SKH (document) products.

The time series model generated most are random walk models. The random walk model explain that the number of shipment is influenced by random effects in the future, that are difficult to predict. Some models are AR and MA, except for Express shipment products with Malang post office destination which has seasonal ARIMA model on lag 6 and 12. This means that the number of items in the following month is affected by the number of items in the previous 6 months.

There are several things that can be suggested in this research are:

a. The data unit used is still in the form of pockets rather than the number of letters for documents or the number of units of goods for non-documents
b. Time units of data used also in monthly rather than weekly or daily units so the models are less sensitive to capture changes in data behaviour.

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