INTER-SECTORAL RELATIONSHIP OF EMPLOYMENT AND OUTPUT IN THE DIFFERENT SECTORS OF THE PHILIPPINES USING SEEMINGLY UNRELATED REGRESSION ESTIMATION

by

Mariel L. Pepino and Purisima Bayacag, PhD

Abstract

This paper explored the inter-sectoral relationship of employment and output in the Philippines. The sectors include Agriculture, Industry and Service Sectors. The study used Seemingly Unrelated Regression Estimation (SURE) and employed a test for contemporaneous correlation to examine if the use of SURE is appropriate.

The empirical results confirm that there are inter-sectoral linkages among the sectors in terms of employment and output. The employment of the three sectors is affected by employment and not of output of other sectors. However, the employment of service sector is found to be affected also by its own output. Meanwhile, the output of one sector is affected by other sectors' output and not by employment except in the industry sector.

The study concluded that among the three major sectors, the industrial sector exhibits the highest employment linkage to the other sectors while the service sector is observed to have the highest output inter-sectoral linkage. Moreover, the services' growth is found to be highly associated with the growth of the agricultural sector. The study confirmed that output growth in the Philippines did not trickle down into creation of employment.

Keywords: Inter-sectoral, employment, output, Philippines, SURE.
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INTRODUCTION

A measure of an economy’s size is its output. The most widely-used measure of economic output is the Gross Domestic Product or GDP (www.quickmba.com). The GDP is the total market value of all final goods and services produced in an economy for a given period (Bello et al., 2009).

The percentage increase in Gross Domestic Product is conventionally used in measuring economic growth (www.worldbank.org). Economic growth is a positive change in the level of production of goods and services by a country over a certain period of time (www.investorwords.com). It is also defined as an upward trend in real GDP, reflecting an expansion of the economy over time (Bello et al., 2009). Hence, real GDP gives us the information about the size of the economy and how an economy is performing. Meanwhile, the growth rate of real GDP is often used as an indicator of the general health of the economy.

Output is known to have a strong relationship with employment (www.wami-imao.org). When real GDP is growing, employment is likely to be increasing as companies or producers come up with increase in output (www.imf.org).

Increases in Real GDP and employment rate in a country is a result of contributions of different sectors namely; agriculture, industry and services. In the Philippines, the agricultural sector comprises of agricultural crops, livestock and poultry, forestry and fishery, while the industrial sector includes mining and quarrying industry, manufacturing industry, electricity, gas and water supply, and construction sectors. Meanwhile, the service sector consists of wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; hotel and restaurant services; transport, storage and communications; financial intermediation; real estate, renting and business activities; public administration, defense, compulsory social security; education; health and social work; social and personal service activities; private households with employed persons; and extra-territorial organization and bodies (www.nscb.gov.ph). As expected, the contribution of each sector may not be the same over time. A sector could be fast growing while others are sluggish in expanding its output and employment.

Over the ten-year period 2001-2010, the Philippine economy had experienced a modest growth rate of 4.7% per annum. Over the same period, employment grew but at a slower pace of 2.9% annually (Department of Labor and Employment, 2011). Table 1 presents the sectoral shares of Gross Domestic Product and employment in 2001 and 2010. In a span of one decade, the shares of the agricultural and industrial sectors of the Gross Domestic Product declined. In 2001, agriculture contributed 20.2% and this trimmed down to 16.8% in 2010. Meanwhile, industry’s share slightly decreased from 34% to 33.6%. It is important to note that as the shares of the two sectors in output decreased, their shares in employment as well declined. On the other hand,

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both output and employment shares of the service sector increased. The said sector’s output and employment increased from 45.9% to 49.7% and from 46.6% to 51.8%, respectively. It could be noticed that as the shares of agricultural and industrial sectors decreased in the national employment and output, the share of service sector increased. This suggests that employment and output of a sector is affected by other sectors of the economy. In such case, it is interesting to test empirically if employment and output have inter-sectoral relationships in the country.

Table 1. Sectoral shares (%) of real gross domestic product (RGDP) and employment, Philippines, 2001 and 2010.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Gross Domestic Product</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2001</td>
<td>2010</td>
</tr>
<tr>
<td>Agriculture, Forestry</td>
<td>20.2</td>
<td>16.8</td>
</tr>
<tr>
<td>and Fishing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>34.0</td>
<td>33.6</td>
</tr>
<tr>
<td>Services</td>
<td>45.9</td>
<td>49.7</td>
</tr>
</tbody>
</table>

Source: Department of Labor and Employment, 2011

Objectives of the Study

The general objective of the study is to investigate the interdependence of employment and output growth in the three major sectors of the Philippines using the Seemingly Unrelated Regression Estimation (SURE). Specifically; this study sought to:

1. present the trend of employment and output in the three major sectors of the Philippines from 1980-2010;
2. provide an empirical evidence on the relationship among agricultural, industrial and service sectors’ employment and output; and
3. compute the elasticities of employment and output in the three major sectors of the Philippines.

METHODOLOGY

Conceptual Framework

Figure 1 represents the conceptual framework of the study. It is believed that the agriculture, industry and service sectors are linked in terms of employment and output. In such case, the employment and output of a certain sector may affect the employment and ultimately, the output of other sectors of the economy. This is represented by the arrows pointing to each sector. These linkages are well supported by the Lewis two-sector theory of development, Clark-Fisher Theory, Input-Output model and Business Cycle.

Data Source

The study relied on the secondary data published by the National Statistics Office (NSO) and National Statistical Coordination Board (NSCB). The data are time series data of employment and real Gross Domestic Product (GDP) of the major sectors of the Philippines, namely; agriculture (including fishery and forestry), industry and service sectors for the period of 1980-2010.
Figure 1. Inter-sectoral linkage among the three major sectors in terms of output and employment.

**Statistical Method**

This study employs Seemingly Unrelated Regression Estimation (SURE) to attain its objectives. This is a system of regression equations of which each contains different explanatory variables and satisfies the classical assumptions of the standard regression model (Zellner, 1962).

The SUR model holds the assumption of a standard regression model where disturbances in different time periods, whether they are in the same equation or not are uncorrelated (no autocorrelation). That is:

$$\text{cov}(u_{it}, u_{js}) = \text{E}(u_{it}u_{js}) = 0$$

(1)

However, the SUR model permits non-zero covariance between the error terms in different equations but corresponding to the same time period. It assumes that there is contemporaneous correlation at the same point of time. This assumption is denoted as:

$$\text{cov}(u_{it}u_{jt}) = \text{E}(u_{it}u_{jt}) = \sigma_{ij}$$

(2)

Hence, the Seemingly Unrelated Regressions allows the estimation of multiple models simultaneously while accounting for the correlated errors (Alaba *et al*., 2010).

Contemporaneous correlation among equations is often a reasonable assumption. It is often unrealistic to expect that the equation errors measured at the same time are uncorrelated. This is because in a given time period, any omitted factor or any disturbances will have related effects on all equations. For an instance, if the economy slows down in a given year or time, it is likely to have related effects on the different sectors of the economy. Fluctuations in the sectoral output and employment could happen simultaneously. Other disturbances like the price increase of petroleum products and other common inputs of production, climatic conditions and political
instability could result to related effects on the sectors of the economy in terms of employment and output at same point of time.

A classical linear SUR model is a system of $M$ linear regression equations that can be compactly written in matrix notation as:

$$\begin{align*}
Y_1 &= X_1 + u_1 \\
Y_2 &= X_2 + u_2 \\
& \quad \vdots \\
Y_M &= X_M + u_M \\
\end{align*}$$

$i = 1, 2, \ldots, M$ equations (3)

The vectors and matrices can be stacked together into one equation as:

$$\begin{bmatrix}
Y_1 \\
Y_2 \\
\vdots \\
Y_M
\end{bmatrix} = 
\begin{bmatrix}
X_1 & 0 & \cdots & 0 \\
0 & X_2 & \cdots & 0 \\
\vdots & \vdots & \ddots & \vdots \\
0 & 0 & \cdots & X_M
\end{bmatrix} 
\begin{bmatrix}
\beta_1 \\
\beta_2 \\
\vdots \\
\beta_M
\end{bmatrix} + 
\begin{bmatrix}
u_1 \\
u_2 \\
\vdots \\
u_M
\end{bmatrix} \quad (4)$$

or simply:

$$Y = X\beta + U \quad (5)$$

where:

- $Y$ = vector of the response variables
- $X$ = matrix of the explanatory variables
- $\beta$ = coefficient vector
- $U$ = vector of error terms

**Empirical Model**

Using the concepts of SUR, the simultaneous equations are being utilized to attain the objectives of the study. The response variables in the system are jointly (or simultaneously) determined by the equations in the system (Barreto and Howland, 2005).
For the ease of presentation and interpretation, the model was divided into two sets. The first set is the equations of employment function of the sectors while the second set bears the equations for the output function.

**First set:**

\[
\begin{align*}
\ln \text{EAg}_{At} &= \beta_{10} + \beta_{12} \ln \text{EIn}_{It} + \beta_{13} \ln \text{ESe}_{St} + \beta_{14} \ln \text{GAg}_{At} + \beta_{15} \ln \text{GIn}_{It} + \beta_{16} \ln \text{GSe}_{St} + \epsilon_{1t} \\
\ln \text{EIn}_{It} &= \beta_{20} + \beta_{21} \ln \text{EAg}_{At} + \beta_{23} \ln \text{ESe}_{St} + \beta_{24} \ln \text{GAg}_{At} + \beta_{25} \ln \text{GIn}_{It} + \beta_{26} \ln \text{GSe}_{St} + \epsilon_{2t} \\
\ln \text{ESe}_{St} &= \beta_{30} + \beta_{31} \ln \text{EAg}_{At} + \beta_{32} \ln \text{EIn}_{It} + \beta_{34} \ln \text{GAg}_{At} + \beta_{35} \ln \text{GIn}_{It} + \beta_{36} \ln \text{GSe}_{St} + \epsilon_{3t}
\end{align*}
\]

where:

- \(\text{EAg}_{At}\) = employment in agricultural sector during the time \(t\)
- \(\text{EIn}_{It}\) = employment in industrial sector during the time \(t\)
- \(\text{ESe}_{St}\) = employment in service sector during the time \(t\)
- \(\text{GAg}_{At}\) = real GDP in agricultural sector during the time \(t\)
- \(\text{GIn}_{It}\) = real GDP in industrial sector during the time \(t\)
- \(\text{GSe}_{St}\) = real GDP in service sector during the time \(t\)
- \(\epsilon_{it}\) = error term

Equations (6), (7) and (8) show that the employment of a sector depends on its own output, and output and employment of other sectors.

**Second set:**

\[
\begin{align*}
\ln \text{GAg}_{At} &= \beta_{10} + \beta_{11} \ln \text{EAg}_{At} + \beta_{12} \ln \text{EIn}_{It} + \beta_{13} \ln \text{ESe}_{St} + \beta_{14} \ln \text{GIn}_{It} + \beta_{16} \ln \text{GSe}_{St} + \epsilon_{1t} \\
\ln \text{GIn}_{It} &= \beta_{20} + \beta_{21} \ln \text{EAg}_{At} + \beta_{22} \ln \text{EIn}_{It} + \beta_{23} \ln \text{ESe}_{St} + \beta_{24} \ln \text{GAg}_{At} + \beta_{26} \ln \text{GSe}_{St} + \epsilon_{2t} \\
\ln \text{GSe}_{St} &= \beta_{30} + \beta_{31} \ln \text{EAg}_{At} + \beta_{32} \ln \text{EIn}_{It} + \beta_{33} \ln \text{ESe}_{St} + \beta_{34} \ln \text{GAg}_{At} + \beta_{35} \ln \text{GIn}_{It} + \epsilon_{3t}
\end{align*}
\]

Similarly, in equations 9, 10 and 11, the output of a sector is function of its own employment, and employment and output of the other sectors.

Natural log of the variables was used in both systems for the following reasons; First, to improve the model fit. For instance, if the residuals are not normally distributed then taking the logarithm of a skewed variable distribution may improve the fit by altering the scale and making the variable more "normally" distributed hence, smoothing the data to improve model fit. The second reason for logging variables is for the ease of interpretation. If the response (Y) and explanatory (X) variables are both in natural log form, the regression coefficients (\(\beta\)) will be automatically the elasticities (stats.stackexchange.com).

**Testing for Contemporaneous Correlation**

In the system of equations presented above, it is hypothesized that the error terms in the estimation of employment and the estimation of output of the three major sectors have contemporaneous correlation. If there is no contemporaneous correlation, there is no need to employ Seemingly Unrelated Regression (SUR) and treating equations individually is efficient. To
test for the presence of contemporaneous correlation for this study, the null and alternative hypotheses used are:

\[ H_0: \sigma_{21} = \sigma_{31} = \sigma_{32} = 0 \]

\[ H_1: \text{at least one covariance is non-zero} \]

Rejecting the null hypothesis means that there is presence of contemporaneous correlation of the error terms in the different equations at the same point in time. This means that treating the equations as a system using SUR is appropriate. In this study the above test revealed that there exist contemporaneous correlation of the error terms.

**Estimation Procedure**

Shazam Version 9 was utilized to estimate the empirical model. Shazam is a package used in econometrics and statistics for estimating, simulating and forecasting econometrics and statistical models.

**RESULTS AND DISCUSSION**

This section presents the results of Seemingly Unrelated Regression Estimation (SURE) and the result of the test for contemporaneous correlation done to test the appropriateness of SURE for this study. Before the presentation of empirical results, the profile of employment and output of the major sectors of the Philippines namely agriculture, industry and services are presented to give an overview of the said variables used in this study.

**Profile of Sectoral Employment and Real GDP**

The trends of sectoral shares of the major sectors of the Philippines in terms of employment and output for the period 1980-2010 are shown in Figure 2 and Figure 3, respectively.

![Figure 2. The annual sectoral shares (%) of employment of the three major sectors, Philippines, 1980-2010.](image-url)
Figure 2 shows that among the three major sectors, the industrial sector is the lowest contributor in terms of employment from 1980 to 2010. Its share to the national employment hardly changed and constantly recorded below 20% in a span of more than three decades.

Meanwhile, the agricultural sector had the largest share in terms of employment in 1980s but its share declined over the years. A sudden decline of agricultural employment was observed in 1985. From 49.61% in 1984, it trimmed down dramatically to 43.24% in 1985. This could be explained by the equalization of sales taxes on imports and locally produced goods during the period 1983-1985 as part of trade reform program (TRP) of the Marcos Administration. The markup applied on the value of imports (for sales tax valuation) was also reduced. Tariff reduction results to consumer substitution towards cheaper imports (Cororaton and Corong, 2005). This could be the reason for the decrease in the number of workers in the agricultural sector to cut the labor cost and maximize profit. Growth in agricultural output had to come largely from multi-cropping and increasing yields. Prior to the enactment of the TRP and on its first year of implementation, the agricultural employment was at around 52% of the total employment.

The trends also show that the share of labor released from agricultural sector has not been significantly absorbed by the industrial sector. Rather, this labor was apparently absorbed by the service sector. The service sector appears to likely benefit the most tariff reduction. The decline in combined prices for both agriculture and industry increases trading in the wholesale and retail sub-sector. While agricultural sector’s employment share was decreasing, the service sector’s percentage share was increasing over time. As a result, the shares of agriculture (41.74%) and services (41.62%) were almost equal in 1996. From being second to agriculture, services became the largest provider of jobs since 1997. The decline in imported agriculture products’ prices induces consumers to substitute towards it. With this, the service sector’s output expands through wholesaling and retailing, encouraging resource reallocation from agricultural sector to the service sector (Cororaton and Corong, 2005).

Figure 3. The annual sectoral shares (%) of real domestic product (RGDP) in 1985 constant prices of the three major sectors, 1980-2010.
As stated earlier, employment share of agricultural sector is declining. Figure 3 shows that agricultural sector’s share to real GDP is declining as well. Furthermore, the trends show that the agricultural sector has been the lowest contributor to the national output from 1980 to 2010 though it is the second largest contributor in terms of employment.

Meanwhile, the industry’s share also shows a decreasing trend over the years. However, in the early 1980’s, it was the highest contributor of real GDP but was not sustained. Early middle of the 1980’s the service’s sector share surpassed that of industry and became the dominant sector in contributing to national output since 1985.

The general picture of the trends shows that while the service sector’s share in output is increasing, the agriculture and industry output shares exhibit declining trends.

Inter-sectoral Relationship of Employment

The results of employment functions using SURE are presented in Table 2. The high value of the respective R^2 of the employment functions of agriculture (0.81), industry (0.96) and service sector (0.98) denotes that the variations in employment of the sectors could be well explained by the variations in the explanatory variables. Meanwhile, the system R^2 is equal to 1.00 implying that estimating the equations simultaneously is efficient.

It could be noted in Table 2 that the agricultural sector’s employment is significantly affected by the industrial sector’s employment. In particular, a 10% increase in the employment of industry stimulates 6.23% increase in the agricultural employment.

Meanwhile, services’ employment is also found to be influenced by industrial sector’s employment. When industry’s employment increases by 10%, services’ employment also increases by 9.13%. Moreover, the sector’s output is found to be affecting its own employment as well, i.e., labor is an important input in the service sector.

The services and agriculture employment also contribute positively to the increase in employment of the industrial sector. In this case, a 10% increase in the employment of service sector, leads to 8.48% increase in industry’s employment. Meanwhile, a 10% increase in agriculture’s employment also induces additional 5.23% employment in the industrial sector.

The strong link between industrial employment and agricultural and service employment could be explained by the forward and backward linkages which are described in the Input-Output Model. The said linkages could explain the interdependency of the two sectors as supplier and user of inputs. It could be that the industrial sector supports many jobs in the agricultural and service sectors as it uses inputs from the agricultural sector for its operations while it induces creation of services from the service sector. For instance, the food processing industry needs suppliers of raw materials from the agricultural sector. The final products are shipped and sold around the world. The supply chain requires indirect jobs such as logistics and transportation workers, customer service and technical support specialists, regulatory affairs and safety professionals, distribution or warehouse employees which are provided by the service sector. Hence, as more are employed in the industrial sector, more jobs are induced from other sectors. In return, these indirect jobs ensure smooth operations in the industry hence encouraging expansion that could result into hiring more employees in the industrial sector.

The employment of a sector is found to be affecting those of others’. However, it is observed that the sectors’ employment is found to be not affected by other sectors’ output. A sector needs output of other sectors to produce its own output and therefore it is expected that when a sector expands, the output of other sectors also increases. However, the increase in output of the other sectors is not necessarily driven by increase in employment. It could be driven by higher labor
productivity and technological advancements. Moreover, it is also possible that the induced additional output of a sector from the rest of the economy is not high enough to create significant number of jobs. In a study conducted by Usui (2012), he stated that there is a weak link between growth and employment in the Philippines. Despite the recent growth episode, the economy still suffers from high unemployment which was recorded at 7.3% in 2010.

Table 2. Parameter estimates of employment of the different sectors in the Philippines, 1980-2010.

<table>
<thead>
<tr>
<th>Response Variable</th>
<th>Explanatory Variable</th>
<th>Estimated Coefficient</th>
<th>Standard Error</th>
<th>P-value</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture’s Employment</td>
<td>Industry’s Output</td>
<td>0.4054^ns</td>
<td>0.3733</td>
<td>0.277</td>
<td></td>
</tr>
<tr>
<td>Agriculture’s Employment</td>
<td>Services’ Output</td>
<td>0.0209^ns</td>
<td>0.1528</td>
<td>0.891</td>
<td>0.8064</td>
</tr>
<tr>
<td>Industry’s Employment</td>
<td>Services’ Employment</td>
<td>-0.1880^ns</td>
<td>0.2707</td>
<td>0.487</td>
<td></td>
</tr>
<tr>
<td>Services’ Employment</td>
<td>Industry’s Employment</td>
<td>0.6230^*</td>
<td>0.1604</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Services’ Employment</td>
<td>-0.1652^ns</td>
<td>0.1775</td>
<td>0.352</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry’s Employment</td>
<td>Industry’s Output</td>
<td>0.1120^ns</td>
<td>0.1358</td>
<td>0.377</td>
<td></td>
</tr>
<tr>
<td>Agriculture’s Employment</td>
<td>Services’ Output</td>
<td>-0.3629^ns</td>
<td>0.3336</td>
<td>0.277</td>
<td>0.9597</td>
</tr>
<tr>
<td>Services’ Employment</td>
<td>Services’ Output</td>
<td>-0.2085^ns</td>
<td>0.2279</td>
<td>0.360</td>
<td></td>
</tr>
<tr>
<td>Agriculture’s Employment</td>
<td>Services’ Employment</td>
<td>0.5233^*</td>
<td>0.1348</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Services’ Employment</td>
<td>Industry’s Employment</td>
<td>0.8483^*</td>
<td>0.0965</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Services’ Employment</td>
<td>Services’ Output</td>
<td>0.4262^*</td>
<td>0.2194</td>
<td>0.052</td>
<td></td>
</tr>
<tr>
<td>Industry’s Output</td>
<td>Agriculture’s Output</td>
<td>0.2096^ns</td>
<td>0.3536</td>
<td>0.553</td>
<td></td>
</tr>
<tr>
<td>Agriculture’s Employment</td>
<td>Industry’s Employment</td>
<td>-0.1847^ns</td>
<td>0.1364</td>
<td>0.176</td>
<td>0.9818</td>
</tr>
<tr>
<td>Industry’s Employment</td>
<td>Services’ Employment</td>
<td>-0.1493^ns</td>
<td>0.1605</td>
<td>0.352</td>
<td></td>
</tr>
<tr>
<td>Services’ Employment</td>
<td>Industry’s Employment</td>
<td>0.9132^*</td>
<td>0.1039</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

* - significant at 10% level of significance  
ns - not significant at 10% level of significance  
System R² = 1.0000

Inter-sectoral Relationship of Output

The results of the second set of equations bearing the output functions estimated using SURE are presented in Table 3. The results show some similar results to the first set of equations. The respective R² exhibits high values from 0.95 to 0.99 while the system R² is equal to 1.00. These imply that most of the variations in the respective output of the major sectors could be explained by the changes in the values of the explanatory variables and estimating the equations simultaneously is efficient.
The results also show that agricultural sector’s output is influenced by the service sector’s growth. A 10% increase of service sector’s output leads to a 5.83% increase in agriculture’s output. The service sector’s contribution to agricultural sector could be due to presence of transport facilities which allows agricultural sector to have more access to the market for its inputs and outputs. As a result, these will lead to commercialization of the agricultural sector and encourage increase in output. Moreover, availability of financial services in the service sector provides credit and facilitates financial transactions that enhance expansion in the agricultural sector.

Table 3. Parameter estimates of output of the different sectors in the Philippines, 1980-2010.

<table>
<thead>
<tr>
<th>Response Variable</th>
<th>Explanatory Variable</th>
<th>Estimated Coefficient</th>
<th>Standard Error</th>
<th>P-value</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture’s Output</td>
<td>Agriculture’s Employment</td>
<td>0.0727*</td>
<td>0.0839</td>
<td>0.386</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industry’s Employment</td>
<td>-0.1143*</td>
<td>0.0892</td>
<td>0.200</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services’ Employment</td>
<td>-0.0309*</td>
<td>0.0810</td>
<td>0.703</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industry’s Output</td>
<td>0.0244*</td>
<td>0.0598</td>
<td>0.683</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services’ Output</td>
<td>0.5833*</td>
<td>0.0651</td>
<td>0.000</td>
<td>0.9859</td>
</tr>
<tr>
<td>Industry’s Output</td>
<td>Industry’s Employment</td>
<td>0.0154*</td>
<td>0.2296</td>
<td>0.947</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agriculture’s Employment</td>
<td>0.0416*</td>
<td>0.2102</td>
<td>0.843</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services’ Employment</td>
<td>-0.4232*</td>
<td>0.2088</td>
<td>0.043</td>
<td>0.9479</td>
</tr>
<tr>
<td></td>
<td>Industry’s Output</td>
<td>0.1507*</td>
<td>0.3687</td>
<td>0.683</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Services’ Output</td>
<td>0.9453*</td>
<td>0.2282</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>Services’ Output</td>
<td>Services’ Employment</td>
<td>0.1809*</td>
<td>0.1062</td>
<td>0.089</td>
<td>0.9921</td>
</tr>
<tr>
<td></td>
<td>Agriculture’s Employment</td>
<td>-0.0988*</td>
<td>0.1171</td>
<td>0.399</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industry’s Employment</td>
<td>0.1267*</td>
<td>0.1266</td>
<td>0.317</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Agriculture’s Output</td>
<td>1.1297*</td>
<td>0.1262</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industry’s Output</td>
<td>0.29670*</td>
<td>0.0717</td>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

* - significant at 10% level of significance  
ns - not significant at 10% level of significance  
System R² = 1.0000

Similar observation is also found in the industrial sector. The increase in services’ output would also lead to increase in the industrial output. A 10% growth in services would induce 9.45% growth in industrial sector. This could be due to the fact that establishments and business in the service sector utilizes electricity, water and gas to operate. Moreover, the service sector’s wholesale and retail trade encourages increase in output of the manufacturing sector. In addition, access to financial services allows more expansion in industrial output. Another variable which is found to be affecting the industrial output is the service sector’s employment. The service sector’s employment is found to have a negative influence on the industrial output. This means that as the employment of services increases, industry’s output declines. This relationship is possible if the
increase in employment in the service sector emanates from the transfer of labor from the industrial sector that result to a reduction of output in the sector. However, this contradicts the earlier findings (Table 2) that employment in the service sector is positively related to employment in the industrial sector. Thus, this observation needs to be confirmed and explored in future studies.

Moreover, the growth of agriculture and industry contributes to the growth of services. This is consistent with the Clark-Fisher theory which underscores that the rise of service sector is due to the increases in output of the two sectors. This is because as the income from the agriculture and industry increases, the demand for services also increases. This is because as incomes continue to rise, people’s needs become less "material" and they begin to demand more services—in health and education and entertainment (Soubbotina, 2004). These services may also include leisure, tourism and financial services.

The above-mentioned relationship could also be explained by other reasons. It is interesting to note that the growth of services is found to have a strong association with the growth of agricultural output. A 10% increase in agricultural sector’s growth leads to 11.3% increase in service sector’s output. It could be due to the fact that increases in the agricultural sector’s output will encourage service sector activities. The marketing and commercialization of agricultural production require services from the service sector. To mention some of these services are; transportation services, storage services, wholesaling, retailing and financing. Moreover, when there is an expansion of agricultural output, financial services are also needed by the agricultural sector for credit as source of capital and to facilitate financial transactions. Hence, the agricultural sector’s contribution to service’s sector and vice-versa could be due to the bi-directional effect of wholesale and retail trade, transport facilities, communication and financial services by the service sector. The presence of these facilities and services will induce the expansion and development in agricultural sector in which it return expands the service sector. This may also include the hotel, restaurants and other food servicing and tourism. These sub-sectors need fresh food materials from the agriculture and fisheries sector so that any expansion in these sectors will also expand the output in agricultural sector.

Meanwhile, the industrial sector’s output also contributes to service sector’s output. However, its contribution is lower compared to that of agricultural sector. A 10% increase in industrial output leads to 2.97% increase in services’ output. This could be so because though the industrial sector also involves the service sector in its operation and commercialization, some activities in the industrial sector utilize output of sub-sectors within the industrial sector. An example of this is the automotive and electronics industries. The inputs of the said industries are mainly from mining and quarrying and electricity, gas and water supply industries that belong also to the industrial sector.

Summary and Conclusion

This paper examines the inter-sectoral relationship of employment and output in agriculture, industry and service sectors of the Philippines for the period 1980 to 2010 using Seemingly Unrelated Regression Estimation (SURE). A test for contemporaneous correlation is done using the Breusch-Pagan test to know if using SURE is appropriate for the study. The results show that both sets of the employment and output functions of the major sectors have errors that are contemporaneously correlated at same point of time. Therefore, the use of SURE is found more appropriate for this study than treating the equations separately.

The empirical results confirm that there are inter-sectoral linkages among the sectors in terms of employment and output. The employment and output are observed to be affected by the same of other sectors. However, employment of the three sectors is affected by employment and not of output of other sectors. To note, only the employment of service sector is affected by its own output. Meanwhile, the output of one sector is affected by other sectors’ output and not by
employment except in industry where this is negatively affected by the services’ employment. In this case, sectoral outputs are generally determined by other sectors’ output and not by employment. This may explain the current scenario that while the Philippines exhibits a high growth rate, unemployment still remains to be a problem.

The results also revealed that though the service sector has the largest share of employment, it is not the major stimulant of employment among the sectors. It is the industrial sector which exhibits the strongest linkages among the sectors of the economy. A 10% increase in the employment of industry stimulates 6.23% and 9.13% employment increase in agriculture and service sector, respectively or a combined 15.36% induced employment in the rest of the economy. The strong linkage between industrial employment and agricultural and service sector’s employment signifies that job creation and reduction relies mostly on the employment of the industrial sector.

Meanwhile, the service sector is found to have the largest share terms of output. It is also found to have the highest output inter-sectoral linkage. A 10% increase of service growth leads to a combined increase of 15.28% in other sectors’ output. It leads to 5.83% growth in agriculture while a higher 9.45% in industrial output. Hence, the growing service sector is vital in promoting economic growth of the country.

Though agriculture exhibited a declining trend in terms of output share over the years, it is found to have a strong linkage to the service sector’s output which dominates the Philippine economy. A 10% increase in agricultural sector’s growth leads to 11.3% increase in service sector’s growth. This means that service sector’s output is highly responsive to the change in agricultural output. This implies that agricultural sector plays an important role and should be supported to boost its output because this will trickle down into a greater output in the service sector which will eventually result to a greater output in the industrial sector.

On the other hand, the results of study also show an unanticipated relationship. The industrial output is found to be negatively affected by increase in service sector’s employment. This relationship is found to contradict the observation that employment and output of both sectors are positively related. Such will remain to be verified.

Recommendations

Based from the results and conclusion, the following recommendations are made:

1. It was found out that there is a weak link between output and employment. To solve the high unemployment problem in the country, link between growth and employment in the Philippines should be strengthened. Labor-intensive technologies are encouraged in the three sectors so that the growth of the sectors would trickle down into creation of employment.

2. Since employment creation in the economy relies mostly on the employment of the industrial sector, the said sector needs to be boosted further. Moreover, instead of exporting primary products, it is encouraged that the said products be processed locally to produce the final output. This will create more employment in the industrial sector and will induce employment in the agricultural and service sectors.

3. The expansion of service sector over the years is found to be good for the economy since its growth trickle down to the growth of other sectors. Therefore, the government must strengthen the growth of service sector by encouraging more investments and provide necessary infrastructures for the growth of the said sector. In addition, efforts to create, review, and implement legislations that promote and protect the segments of the service sector where the country has a comparative advantage like the business process outsourcing (BPO) which makes up 15% of the world’s outsourcing market (www.economywatch.com). The continuous development and expansion of the services will be beneficial to the Philippines since any increase in this sector’s output will stimulate production in the other sectors.
4. The results of the study revealed that service sector’s output is highly responsive to the change in agricultural output. For this reason, the expansion of the agricultural sector is encouraged. Programs and projects that increase agricultural output should be implemented like farm to market roads, new farm techniques and other technologies that will enhance agricultural output.

5. Exploration of other areas for further research is also suggested. The service sector employment’s negative influence to industrial output remains to be validated. It is recommended that this should be explored in the future studies.

6. The study examined the interrelationships of the sectors of the economy in a macro level. To further investigate which segments of the sectors cause its respective linkages in terms of employment and output, it is recommended that the economic sectors would be segmented into sub-sectors.

7. A similar study in terms of demographic and geographical linkages can also be explored. Observing such sectors would give a comprehensive picture of the economy; and

8. Lastly, it is also recommended that other methods be used such as the Input-Output Model to examine inter-sectoral relationships.

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