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Seasonal Adjustment of Quarterly National Accounts Series

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1.0 Introduction

The System of National Accounts (SNA) provides the central framework within which the transactions of the economy as a whole is summarized. The Philippines started compiling annual national accounts way back in 1946. These accounts provide analysts and planners with the basic information needed for economic analysis and policy formulation. In response to the need for more timely data from which relevant economic policies are to be based, the Philippine Statistical System (PSS) started compiling quarterly national accounts in 1984, covering the period 1981 onwards. However , since most of the quarterly data are characterized by seasonal variation, the PSS is aiming to produce seasonally adjusted data to facilitate earlier detection of turning points of important economic variables. The major aggregates for which quarterly national accounts estimates are maintained and for which seasonal adjustment will be made include the gross domestic product and expenditure accounts.

Gross Domestic Product (GDP) is the sum of final goods and services produced by resident producer units in the country. On the supply side, GDP is broken down into the Gross Value Added (GVA), or gross output less intermediate inputs, of the three major sectors: agriculture, industry and services. The agriculture sector includes agricultural crops, livestock and poultry, fishery, and forestry. Industry sector includes mining and quarrying, manufacturing, construction, and electricity, gas and water. The services sector is comprised of trade, transport, finance, real estate and ownership of dwellings, private services, and government services. The agriculture sector contributes around 22.43% to total GDP, while the industry and services sector have a 34.73% and 42.84% shares, respectively.

On the expenditure side, the components of GDP include Personal Consumption Expenditure (PCE), General Government Consumption Expenditure (GGCE), Gross Domestic Capital Formation (GDCF), Exports and Imports. PCE records the value of final expenditures by households and private non-profit institutions on current goods and services. GGCE on goods and services include compensation of employees and net purchases of goods and services such as those for military, civil

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administrative or governing purposes. GDCF, that is, gross addition to fixed assets and changes in stocks during an accounting period, is made up of the outlays of producers on commodities which are not intermediate consumption of the period, or those which are considered to be used as part of future production. Exports are part of the domestic production that are sold to the rest of the world, while imports represent that part of local demand that are supplied by other countries.

2.0 Seasonal Adjustment Using X-11 ARIMA

Seasonal adjustment procedure using X-11 ARIMA was applied to GNP, to each of the major industrial sectors of GDP and to each of the major expenditure items. Data at constant 1985 prices were used. In summary, the following are the variables considered:

- GROSS NATIONAL PRODUCT (GNP)
- GROSS DOMESTIC PRODUCT (GDP)
- GVA IN AGRICULTURE (including fishery and forestry)*
- GVA IN INDUSTRY SECTOR*
- GVA IN SERVICE SECTOR*
- PERSONAL CONSUMPTION EXPENDITURE (PCE)**
- GENERAL GOVERNMENT CONSUMPTION EXPENDITURE (GGCE)**
- GROSS DOMESTIC CAPITAL FORMATION (GDCF)**
- EXPORTS**
- IMPORTS**

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* - major industrial sectors of GDP
** - major expenditure items

In the initial run made during the first quarter of 1993, the complete data series from first quarter 1981 to fourth quarter 1992 were considered. The automatic option of the X-11 ARIMA software was used in determining the model which suits the data series. The program chose the (0,1,1) (0,1,1) model,either additive or multiplicative, for all the variables except for GDCF, exports and imports which did not exhibit any seasonality. GDCF does not exhibit seasonality because one of its components, the changes in stocks, has a very irregular behavior. The total exports and total imports also did not show any seasonal pattern because they are composed of heteregeneous components that have opposite seasonal patterns that tend to cancel out as a whole.

In almost all cases where there are seasonality, however, some of the summary measures which are used to assess the quality of seasonal adjustment failed. The measures indicated that the series are highly irregular or that the seasonality is moving too fast.

The graphs of the series show that the irregularity in the behavior of the data is more prominent in the early and mid-eighties - the period marked by political uncertainties in the country brought on by the Aquino assassination and the people power revolution and the ouster of Marcos as national leader.

As the graphs exhibited stability after the year 1988, it was decided that the series be cut and that the procedure be repeated for the shorter series beginning 1988 and ending with the fourth quarter of 1992. For this phase, it was particularly difficult to perform seasonal adjustment on the agriculture sector as even the shorter series is marred by irregularities. As a remedy, temporary prior adjustment was applied to some data points in the original series in order to get better estimates of the seasonal factors. Another variable where the temporary prior adjustment was done is the GGCE.

During the presentation of results, Dr. Dagum noticed the use of a combination of additive and multiplicative models for the different variables. Noting that the additive models and the multiplicative models are both acceptable to each variable, she suggested the use of multiplicative models for all variables for easier comparison and understanding of results. Another problem that was identified was the fact that the sum of the seasonally adjusted figures for the quarters comprising each year is not the same as the sum of the original figures for the same period. For such a situation, the X-11 ARIMA program has an option that adjusts the results of seasonal adjustment so that the quarterly (or monthly) totals are made to equal to the annual total in the original series.

The seasonal adjustment procedure using the models derived in the earlier round of adjustment along with the modifications/improvements suggested by the consultant were futher applied when the data for the first quarter of 1993 became available. This time however, one measure failed for the model for the services sector. This indicated that the irregular is too strong compared to seasonality. However, the value of the summary measure indicating irregularity was 1.069 - very near the acceptable value of 1.000. Thus, the seasonal adjustment options were not changed.

The data for second quarter 1993 became available in August 1993. Seasonal adjustment was made in September. The same models that were used in the previous exercises were forced into the new data. The models were still acceptable, but agriculture and GGCE still needed some prior adjustment. One data point for agriculture (Q1 1988) was adjusted with a 0.90 weight. For GGCE, there are now two observations that need to be adjusted: that for Q4 1990 and Q1 1993, both with 0.95 weight. Summary measures for GNP and Industry indicated some irregularity but their values are just around the acceptable value of 1.000. Thus, the models were not changed. It has been observed that as more additional data come in, there arises the need for more adjustment of previous observations. Furthermore, the results begin to fail to meet some of the criteria for good seasonal adjustment.

A summary of the options chosen is presented below:

Variable	Options Chosen
GNP	Multiplicative Log (0,1,1)(0,1,1) 3x5 SMA, 5-term TC
GDP	Indirect Method

Variable	Option Chosen
AGRICULTURE	Multiplicative Log (0,1,1)(0,1,1) 3x5 SMA, 5-term TC
INDUSTRY	Multiplicative Log (0,1,1)(0,1,1) 3x3 SMA, 5-term TC
SERVICES	Multiplicative Log (0,1,1)(0,1,1) 3x3 SMA, 5-term TC
PCE	Multiplicative Log (0,1,1)(0,1,1) 3x3 SMA, 5-term TC
GGCE	Multiplicative Log (0,1,1)(0,1,1) 3x5 SMA, 5-term TC

In the final run, the quarter-to-quarter changes in the seasonally adjusted data were compared to what was derived during the previous run covering one less observation. The idea is to test whether the model generates consistent results. For instance if we said one quarter ago that a certain variable is growing positively, the new set of results where there is an additional data point must also indicate a positive growth during that particular previous period. In general, the results were consistent.

3.0 Analysis of Seasonally Adjusted Series Until Second Quarter 1993

The National Accounts series exhibits strong seasonality, with peaks prominently showing during fourth quarters. This indicates that majority of the activities in the economy is concentrated during this period. Implicitly, this means that more equipment, raw materials and labor are required during this period than during the other quarters.

Looking at the quarter-to-quarter growths in GDP, we see that the country has sustained its growth in 1988 and 1989. During this period, the country continued to ride on the confidence of private investors.

The year 1990 also marked the slowdown of the economy following the coup attempt staged in the last quarter of 1989. Other constraining factors to the growth of the economy were the high interest rates, depreciation of local currency and substantial hike in fuel prices brought about by the Middle East crisis.

The economy found it hard to bounce back after that year. It was almost at a standstill throughout 1991. The chain of natural calamities, the political uncertainties

and the worldwide recession made it impossible for the economy to achieve any notable gains.

Despite the debilitating factors, however, the economy continued to be resilient as it still managed a 0.41% growth in the first quarter of 1992 compared to the fourth quarter of 1991. However, in the second quarter of 1992, the economy suffered another setback. The country was caught unprepared as a severe power shortage was experienced as a result of the breakdown in the Luzon grid and the low output capacity of hydroelectric plants caused by drought. In the third quarter of 1992, the economy made a strong showing compared to the previous quarter as it posted a 1.06% growth after the 1.44% decline it suffered a quarter earlier. This period corresponds to the assumption to presidency of Fidel V. Ramos. The economy moved up as full supply of electricity was restored during the first 100 days of the Ramos administration encouraging higher productivity, particularly in the manufacturing sector. With the power problem back in the fourth quarter of 1992, the growth of GDP was stifled.

The power problem continued to worsen in the first quarter of 1993, with outages peaking at eight to ten hours per day. Thus, the bid for an economic take-off became more elusive. Again, the economy was barely moving , but at least, it was not sliding down. The pump priming efforts of the government in the form of increased expenses on infrastructure and projects helped cushion the adverse effects of the instability of power supply.

With the growing resilience of the Philippine economy, GDP in the second quarter of 1993 managed to achieve a seasonally adjusted level of 179.6 billion pesos at constant 1985 prices, growing by 0.60% over the previous quarter. The higher net inflow of factor incomes from the rest of the world further boosted the economy as Gross National Product (GNP) grew by 1.1% during the quarter compared to the first quarter of 1993.

Among the major sectors of GDP, agriculture exhibits the most unpredictable behavior, possibly because of the many irregular shocks that plague the sector. It is also quite interesting to note that the seasonality of the sector is increasing, as evidenced by the larger differences in the peaks and troughs beginning in 1991.

Like the other sectors, the agriculture sector's peaks happen during the fourth quarters. The troughs are in the third quarters. The growth of seasonally adjusted gross value added in agriculture has been on the swing moving in alternately upward and downward manner. In the first quarter of 1993, agriculture sector's growth flattened following a large increase in the fourth quarter of 1992 of 4.0%. In the second quarter of 1993, a small 0.60% decline was noted for the sector.

The industry sector has a seasonality that is also prominent in the fourth quarter. The seasonally adjusted industry gross valued added has suffered from successive declines in 1990 up to the first quarter of 1991 and was barely moving throughout the rest of 1991. The power shock in the second quarter of 1993 proved to be devastating to the sector as it led to a 2.4% decline in value added. In the third quarter of 1992,

including the first 100 brown-out free days of the Ramos administration, the sector bounced back to register a 2.67% growth compared to the previous quarter. The acceleration was however short-lived as the sector's GVA dropped by 3.3% in the fourth quarter of 1992 compared to its third quarter level. It was the biggest drop recorded in the 1988-1992 period. The industry sector continued to decline, although at a slower pace of 0.6% in the first quarter of 1993. Things were brighter in the second quarter of 1993 for the sector as it registered a 2.0% growth.

Like the other two major sectors, the service sector has a peak in the fourth quarter due to Christmas season, and another small peak in the second quarter as a result of summer vacation and the opening of school classes in June. Among the major sectors, the services sector proved to be the most resilient of all. The sector has almost consistently shown positive quarter-to-quarter growth rates.

On the expenditure side, PCE likewise exhibits seasonality with peaks during fourth quarter, when bonuses are given to employees. The seasonally adjusted PCE has consistently shown positive quarter-to-quarter growth rates, although a setback was experienced in the first quarter of 1991. This was a possible after-effect of the poor economic conditions that prevailed in 1990.

GGCE's seasonality pattern follows that of the other sectors though the seasonality is weaker. The graphs of the seasonally adjusted and the unadjusted GGCE are not significantly different from each other. In terms of quarter-to-quarter growths, it can be clearly seen that since the second quarter of 1992, GGCE has decreased as government continued to enforce economy measures by limiting its operating expenses to the barest essentials in order to contain the deficit. In the second quarter of 1993, government loosened up on its rein on expenditures. GGCE increased by 3.7% in this quarter compared to first quarter of 1993, in a government effort to pump-prime the economy.