A STUDY ON THE FEASIBILITY OF REGIONAL INPUT OUTPUT MULTIPLIER USING MULTI STAGE LOCATION QUOTIENT METHOD (INDIRECT ESTIMATION FOR INTERREGIONAL MULTIPLIER BASED ON NESTED STAGE LQ METHODS)

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The Philippine economy has experienced sustained and high growth in 2017. However, amidst economic growth, there are still people who are not able to feel the economic gains. As poverty headcount ratio remains high, the Philippines need to pursue inclusive growth and implement the new medium-term development plan that aims to transform the country into an upper-middle income economy through rapid poverty reduction.

The pursuit regional economic development analysis requires detailed information about dynamics of regional economies. This paper proposes a method of constructing the intra-regional and multi-regional input- output (IO) models from the national IO table using Location Quotient (LQ) Approach. This paper also discusses the problems faced in estimating intra- and inter-regional IO multipliers using LQs and examines methods for estimating the IO multipliers among multiple regions. The research contributes to several kinds of literature, particularly to an emerging area of study- estimating the IO multiplier among regions using the LQ indicator group and its issues for application.

***Key Words**: location quotient, non- survey method, regional IO, Philippines*

I. INTRODUCTION

The national IO table depicts economic structure of the country. It is an extension of the information contained in the national accounts as it presents details on the process of production and the use of goods and services, as well as the income generated from production. It is a matrix representation of a nation's economy for a particular period through inter-industry relations, showing how the output of one industry is used by other industries and final consumers.

This 2006 IO is the tenth (10th) inter-industry studies of the Philippine economy since 1961. It integrates some of the 2008 System of National Accounts (SNA) recommendations and assumes new/updated standards and classification systems. It is consistent with the 2006 national accounts in terms of the gross value added by industry and total gross domestic product. Using this table, the consequence of changes on production of industries and in consumption in the economy can be measured.

There are three main tables in creating IO accounts, such as transaction, technical coefficients and inverse matrix tables. Each has different use in explaining the current economic structure of the Philippines.

a. The transactions table contains all the production flows within the economy during a specific year or period. It contains the industries based on the Philippines Industrial Classification. It shows the flow of goods of services to intermediate and final demands. The industries are listed as consuming (column) sectors and supplying sectors (rows);
b. The technical coefficients table shows the unit cost of production in the economy. It defines the coefficient value of intermediate and primary inputs essential in the production of one unit of output for each industry. Coefficients are derived by dividing each element of the intermediate transactions vector by the total inputs of each sector.
c. The inverse matrix provides the connection between production and final demand. It is used to compute the needed output levels of an assumed set of final demands. It is calculated as the inverse of the matrix (I - A), in which A is an input coefficient and I is the identity matrix.

This study will focus on technical feasibility of IO estimation based on Quotient Approach, using various Location Quotient (LQ) indices and provision of solution in further breaking down regional input coefficients to show variations in regional domestic capacities.

The paper is structured as follows: Section 2 is concerned with review of related literature in estimating regional and interregional IO multipliers. Section 3 outlines the accounting framework suggested in this paper. Section 4 discusses the methodologies employed and the salient suggestions of the paper. Finally, section 5 provides critical issues and next direction.

II. REVIEW OF RELATED LITERATURE IN ESTIMATING REGIONAL AND INTERREGIONAL IO MULTIPLIERS

The national IO table shows the degree to which various businesses and households in an economy are interrelated. It gives the quantifiable multiplier effects; the increase in the aggregate output due to initial investment in the aggregate demand. In the Philippines, the concept of multiplier has been used to justify by government in allocating spending and recommending taxation relief towards businesses.

Due to regaining focus on regional science and a possible shift to federalism, Philippines needs a tool that can expose economic differences among regions. Whereas national input-output tables are about giving better granularity to the national accounts through an application of the technology of production, regional input-output tables provide regional variation in that technology and an understanding of the role of inter-regional trade in an economy. Since Philippines publish only

national IO tables, there is limited information about the inter- industry regional relations.

There are several non- survey approaches in estimating regional and interregional IO multipliers. First is the quotient approach that adjusts national coefficient using LQ approach. It is measuring how concentrated a particular industry is in a region as compared to the nation as it reveals what makes a particular region "unique" in comparison to the national average. Second is the RAS method which is originally developed for the estimation of the input output coefficients, for which only the peripheral information of the column sums and the row-sums is known, in the iterative way. The study conducted by Dewhurst (1990) supported claim that the accuracy of tables can be improved significantly by the use of this method, however, there's a need for more sophisticated information, which may not be available in the local statistical system. The third approach is the Commodity Balance or Supply- Demand Approach which estimates the net exports, making it an incomplete IO table due to the unavailability of sophisticated trade figures.

With regards to creating a multi- regional table, there are various studies presented. Miller and Blair (2009) introduced various compiling methods such as Isard-type and Chenery Moses-type. These two methods differ in the assumption of interregional trade coefficient. The Isard type needs a comprehensive set of intra- and interregional data, while it is tough to get such interregional trade coefficients for each sector in each region. On the other hand, the Chenery- Moses presents advantages because of the practical application of the common interregional trade coefficient for each sector in each region. Since the interregional trade data are still hard to get many researchers were able to modify their studies to some kind of non-survey method in the estimation of the interregional trade coefficients such as LQ techniques, gravity model, and RAS methods.

In 1994, Secretario (2001) created the first and the only inter- regional IO table for the Philippines in his study entitled "Construction of Inter- Regional Input- Output Table for the Philippines 1994 under the JSPS- Manila Research Project Final Report." He used hybrid approach in creating intra and inter regional IO tables by utilizing surveys such as Family Income and Expenditures Survey, Commodity Flow Statistics, Gross Regional Domestic Product (GRDP), Gross Domestic Regional Expenditures (GRDE), and Input Output Survey of Establishments (IOSE).

Taking into consideration the mentioned approaches, it can be inferred that LQ approach is the most suitable as it requires the fewest data. However, the domestic capacity and the relative size of a region is not taken into consideration in this method, hence underestimates regional trade.

The propensity of this study comes from the credit that the multi-regional IO analysis becomes more important, because the regional economies are strongly connected domestically and international.

III. METHODOLOGY

1. Conversion of the National Input-Output (IO) Table to Input Coefficient Form

Convert National IO table into coefficient form. This paper assumes that national and regional technology coefficients are the same.

Whereas supply-demand balance equation (balancing of total supply and total demand) is equal to:

$A = [A^N] = [X_{11}/X_1]$; i,j= 1,2,…n [1]

Where

A^N is the input coefficient of sector i in order to produce 1 (one unit of output sector j (i,j= 1, 2,…n)

X_{11} is the intermediate input sector I by sector j (i,j= 1,2,…n)

X_1 is the gross output of sector j

2. Regionalization of the national IO table

According to Greenstreet (1989), there are three main techniques in regionalization methodology such as survey, non- survey and hybrid methods. Due to data and funding limitations and non- consensus about the most efficient procedure, the author will only utilize the non- survey method based on LQ. The basic source

of this method is the national IO table and the employment data per region. In regional modeling, employment always serves as a proxy for output because output data are not normally available and its strong resemblance.

This paper will utilize the quotient approach. It is to regionalize the representative industry (or commodity) technology matrix of national level by using quotient, which include the national information.

A. Computation of LQ Using the regional employment data.

According to Kowalewski (2012), employment data is usually used as a proxy for output because it is usually collected in the regional level at a highly disaggregated level. It is also expected that output and employment are in a close relationship.

Location Quotient LQ_i^R is equal to:

$$\frac{Q_r/T_r}{Q_n/T_n} \quad [2]$$

Q_r: Employment statistics for the industry i in region r

T_r: Total Employment statistics in the whole region r

Q_n: Employment statistics for the industry i in the country

T_n: Employment statistics in the whole country

B. Multiply the LQ to the National Coefficient

This paper assumes that regional technological coefficient is equal to the LQ multiplied to the national technological coefficient. In order to disaggregate the national IO table, Kowalewski (2012) used the simple formula can be used to convert national IO into regional coefficients. The regional input coefficients, the A^R, are estimated by multiplying the corresponding national input coefficients, the A^N, by a location quotient:

$$= LQ_i^R \times A^N \quad [03]$$

Where A^R is the estimated number of units of regional input *i* required to produce one unit of gross output of regional purchasing sector *j*. Hence, in this case, it is the estimted intraregional input coefficient.

LQ_i^R is the computed location quotient of the sector of a particular region. The general procedure of adjustment for A matrix in Region r. It will be used as self- sufficient ratio, which presents the proportion of input requirements within the region, thus:

$$A^R = A^N \text{ if } LQ_i^R \geq 1 \quad [04]$$

$$A^R = A^N \text{ x } LQ_i^R \text{ if } LQ_i^R < 1 \quad [05]$$

Using the format of interregional input matrix, the image of producing interregional input coefficient is as follows:

Figure I: Process of Regionalizing the IO table using the LQ Method (Source from Reference no. 8)

$LQ_i^R \times A_{ij}^N = A_{ij}^{RR}$	$1 - LQ_i^S \times A_{ij}^N = A_{ij}^{RS}$
$1 - LQ_i^{SR} \times A_{ij}^N = A_{ij}^R$	$LQ_i^S \times A_{ij}^N = A_{ij}^{SS}$

The calculated regional coefficients should be adjusted where other data better reflects the situation. In the review of literatures, it can be thus observed that the problem of compiling inter- regional domestic trade flows becomes complicated as the number of regions increases.

The main problem is how to breakdown coefficients to show the variations in the regional domestic capacities as encircled in the figure above. In order to address the problem, this paper suggests that data regarding the IOSE and GRDP data, should be used to denote the differences in the regional capacity, hence will be the most efficient way to compute for the inter-regional IO table using a non- survey quotient approach.

By using the methodologies employed by Secretario (2001), this paper suggests to use the following formula in analyzing the structures of regional economies and breaking down the regional variations with details are as follows:

a. Derive the input coefficients of each sector using the IOSE. It is important to note that this variable was used by Secretario (2001). It served as a preliminary data for the computed input structure of each region. The IOSE is created in order to provide a more detailed indicator on the industry-level (IC_{ij}^{R}).

b. Compute for the Output Allocation Ratio: In the same study, Secretario (2001) created the 1994 Intra-regional IO MAKE matrix by multiplying the output allocation ratios to the total output of the sector/ industry in a particular region. In this paper, the output allocation ratio will be computed by deriving the percent distribution of each industry/ sector using the Gross Regional Domestic Product by Industrial Origin data available (PD_{ij}^{R}) then multiplied to the derived national coefficient (A^{N}).

3. **Trial idea on Non-Survey Method for Estimating Regional and Inter-regional IO multipliers**

This paper suggests the following formula:

$$A^{R} = LQ_{i}^{R} \text{ x } IC_{ij}^{R} \text{ x } A^{N} \text{ x } PD_{ij}^{R} \quad [06]$$

Whereas:
A^{R} = Regional Coefficient
A^{N} = National Coefficient
LQ_{i}^{R} = Location Quotient
IC_{ij}^{R} = Derived Input Coefficient from IOSE
PD_{ij}^{R} = (Output Allocation Ratio) Percent Distribution of each sector using the Gross Regional Domestic Product by Industrial Origin data

Similarly, for each final demand column sector in region:

$$F^{R} = LQ_{i}^{R} \text{ x } IC_{ij}^{R} \text{ x } F^{N} \text{ x } PD_{ij}^{R} \quad [07]$$

Whereas:
A^{R} = Regional Coefficient
F^{N} = Final Demand Coefficient
LQ_{i}^{R} = Location Quotient
IC_{ij}^{R} = Derived Input Coefficient from IOSE
PD_{ij}^{R} = (Output Allocation Ratio) Percent Distribution of each sector using the Gross Regional Domestic Product by Industrial Origin

IV. CRITICAL ISSUE AND NEXT DIRECTION

(1) Choice of indicators: Choice of Location Quotient. There are several LQ methods available such as Simple Location Quotient (SLQ), Flegg Location Quotients (FLQ), and Cross Industry Location Quotients (CILQ). The next direction is the assessment of the accuracy of various LQ methods for regionalization of input coefficients using the Philippine Case. In this study, LQ provides the simplest method of estimation. Issues cited in references (4) and (10).
(2) Treatment of errors: Different available approaches may be used in scrutinizing the methodology suggested.
(3) Provision of Mathematical solution and Empirical Tests

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