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**Institutionalizing Productivity Measures in the Philippine  
Statistical System**

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# **Institutionalizing Productivity Measures in the Philippine Statistical System<sup>1</sup>**

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Romulo A. Virola, Estrella V. Domingo, Raymundo J. Talento & Ava Gail D. Cas<sup>2</sup>

## **ABSTRACT**

Thru the Philippine System of National Accounts (PSNA), the National Statistical Coordination Board (NSCB) releases annual estimates of labor productivity, defined as the ratio of GDP over employment (number of employed persons and total hours worked). But concerns have been raised on the appropriateness/adequacy of this indicator to assess progress in enhancing our productivity and gauge the competitiveness of the Philippine economy. To address this issue, the NSCB has started efforts towards the compilation of total factor/multi-factor productivity indicators.

This paper presents the results of the efforts of the NSCB towards the institutionalization of improved productivity indicators in the Philippine Statistical System (PSS). It includes a discussion of various productivity measures including those used in other countries, some related issues and some recommendations appropriate in the Philippine setting.

**KEYWORDS:** productivity, labor productivity, capital productivity, capital-labor productivity, multifactor productivity, total factor productivity; index numbers; input; output; volume; value-added; parametric; non-parametric; production function; translog; growth accounting

## **I. Introduction**

As the Philippines braces itself for stiffer competition engendered by globalization, and as an offshoot of the Asian financial crisis in 1997, a priority, if not overarching concern should be the improvement of economy-wide productivity. When the National Statistical Coordination Board (NSCB) announced what might have ordinarily been an impressive 2004 first semester Gross Domestic Product (GDP) growth of 6.3%, our neighbors were growing even more robustly: Malaysia at 8%, Hongkong, 12.1%, Taiwan, 7.7%, China, 9.6% and Singapore, 12.5%. And in a study of the agricultural sector in Indonesia, the Philippines and Thailand, the decline in total factor productivity (TFP) in the period from 1961-80 to 1981-98, was steepest for the Philippines and mildest for Indonesia [8]. From an economy that was second only to Japan in the 60s, the Philippines has lost so much of its lead that in the face of fierce global competition, the task of recovering our glorious past maybe even more

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<sup>2</sup> Secretary General, Assistant Secretary General, Director III and Statistical Coordination Officer II, respectively, of the National Statistical Coordination Board. The paper benefited from the views and expertise of Virginia M. Banados, who was Project Consultant on the NSCB-funded SRTC-implemented study "Development of a Methodology to Estimate the Philippine Capital Stock and a NSCB-Based Total Factor Productivity" and from the following members of the NSCB TFP Team: Brizilda S. Agustin, Amador S. Foronda, Marisol J. Ginez, Julieta S. Magallanes, Rey Angelo M. Millendez and Mark Rex S. Romaraog. The authors also acknowledge the assistance of Amando G. Patio Jr. in the preparation of this paper. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the NSCB.

daunting than the curse of Sisyphus. What has happened to the Philippines? Could the Philippines be losing to its neighbors because of low productivity?

Measures of levels and changes in productivity are useful in analyzing economic growth. They allow us to gain insights on the impact on production of changes in technology and efficiency; provide measures of real cost savings and living standards and provide benchmark estimates of production processes. Productivity growth is affected by a wide variety of interrelated influences, such as technological advances, best practices to eliminate technical and organization efficiencies, shifts in production allocation and improvements in the quality of labor,

The measurement of productivity has been recognized as a data gap in the Philippine Statistical System (PSS). In fact, a key element of the Medium Term National Action Agenda for Productivity for 2000-2004 is the institutionalization of aggregate/sectoral TFP-based indicators in the PSS [13].

Initial attempts towards measuring and analyzing productivity performance in the Philippines started in 1960 and focused on measuring rice productivity trends and performance, which later spilled over towards measuring productivity performance in agricultural production as a whole --- agriculture being the dominant industry then [5]. With the growing and increasing importance of industry, starting 1982, there was a shift in attention to productivity change in industry. Hooley [5] cited a number of studies on productivity growth of Philippine industries, among which were that of Hooley (1968) which examined TFP in manufacturing covering the period 1948-1961; Williamson and Sicat (1968) who used the Denison methodology to measure technical change and estimated the rate of advance for manufacturing from 1957 -1968; Estanislao (1981) who looked at TFP growth for the period 1956-1978; Patalinghug (1980) who estimated TFP growth (TFPG) in manufacturing for 1956-1970; and Sanchez (1983) who also investigated TFP for manufacturing from 1957-1978. In 1985, Hooley [5] looked at the rate of output growth for total manufacturing and twenty four (24) specific manufacturing industries. However, all these efforts, as may be expected, did not find their way into the official statistics of the PSS.

At present, only labor productivity estimates are being measured and published in the Philippines. The NSCB, thru the Philippine System of National Accounts (PSNA)<sup>3</sup> releases annual estimates of labor productivity, defined as the ratio of GDP over employment (either number of employed persons or total hours worked). Other agencies that publish annual estimates include the National Wages and Productivity Commission, the Bureau of Labor and Employment Statistics, the National Economic and Development Authority (NEDA), the Institute of Labor Studies and the Development Academy of the Philippines. These agencies also estimate sectoral and regional indices of labor productivity.

Meanwhile, concerns have been raised on the adequacy and accuracy of present labor productivity indicators to assess progress in improving economy-wide productivity and to measure the competitiveness of the Philippine economy.

With this view, the institutionalization of TFP measurement in the PSS became a concern of the Technical Working Group on Productivity Indicators and Monitoring System (TWG-PIMS) under the Philippine Council for Productivity (PCP). As a strategy to fast-track and ensure institutionalization of TFP indicators, the TWG-PIMS placed the lead task of estimating TFP with the NSCB,

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<sup>3</sup> Table 14 of the National Accounts of the Philippines.

with data support from the National Statistics Office (NSO) and the Bureau of Agricultural Statistics. Recognizing the link between the national accounts and TFP, NSCB will start generating productivity estimates as part of its annual PSNA release in May 2005.

This paper presents the NSCB's efforts in institutionalizing TFP in the PSS. Section 1 provides an introduction on the rationale for measuring TFP in the Philippines and a review of past efforts to measure productivity. In Section 2, the general approaches and problems in productivity measurement are described. Section 3 discusses country compilation and dissemination practices. Section 4 presents the current efforts of the Philippines to measure productivity and the proposed official methodology while Section 5 analyzes the results of the NSCB estimates of TFP. Section 6 provides a discussion of methodological limitations as well as data issues and challenges in the compilation. Lastly, Section 7 presents future directions and recommendations.

## **II. General Approaches and Problems in Measuring Productivity**

The economic theory of productivity measurement goes back to Jan Tinbergen (1942) and Robert Solow (1957) who worked independently on productivity measures in a production function context [12]. Productivity is commonly defined as the ratio of a volume measure of goods and services (output) to a volume measure of inputs, such as labor and capital.

In monitoring economic growth, not all of a country's output growth can be traced to the increase in inputs. The amount by which output growth exceeds input growth is the productivity improvement. Aside from measures of productivity growth, which are used in comparing different points in time, measures of productivity levels are also important in comparing different points in space.

Productivity can be measured in different ways. Conceptually, the measure chosen depends on the purpose of measurement. In practice, the measure chosen also depends on the availability and quality of data. Productivity measures can be classified as follows [12]:

- Single-factor or Multifactor – Single factor, such as labor productivity, relates a measure of output to a single measure of input. Multifactor productivity (MFP) or TFP relates a measure of output to more than one input.

- Use of Value-added versus gross output as measure of output

In addition, there is also the capital-labour-energy-materials (KLEMS) MFP, based on a concept of gross output. The main productivity measures are shown in Table 1 from [12]. Among the measures in Table 1, the value-added based labor productivity is the single most frequently computed productivity statistic, followed by capital-labour MFP and KLEMS MFP [12].

### **A. Approaches**

As mentioned previously, productivity is usually defined as a ratio of an Output volume to an Input volume. This ratio derives from a production function, which assumes that the growth in the volume of goods and services produced can result from the growth in the volume of inputs used in production and/or the growth in productivity.

In operationalizing the concept of productivity, be it single factor or multifactor or value-added or gross output-based, two approaches are possible: parametric (econometric approach) or nonparametric (index number approach). In the parametric approach, the production function takes a certain form with a

number of parameters that need to be estimated. In the nonparametric approach, the productivity measures are expressed as ratios of index numbers. The growth accounting approach and the data envelopment analysis are examples of the nonparametric approach. The OECD Manual [12], [4] and [15] give a discussion of the advantages and limitations of some of the approaches falling under these two general categories and they are briefly described in Annex A. In providing guidance to statistical offices, the OECD is biased towards nonparametric methods because the econometric methods are “much more frequently used in the context of individual, academic research projects.”

## **B. Problems and Issues in TFP Measurement**

Although countries continue to put emphasis on measuring productivity growth, not many countries have included productivity measures in the realm of their official statistics. The following issues cause difficulties in productivity estimation.

### **1. Lack of Standard/Comparability**

Although TFP is now estimated in a number of countries, there is no prescribed international standard framework/methodology for measuring productivity like what is available for compiling the national accounts [1]. Some countries estimate TFP while others only come up with a partial (usually labor) measure of productivity. Countries differ in their operational approach for measuring TFP depending on the factors that influence productivity in their countries and the available data. There are some countries that make adjustments to account for efficiency of labor and capital or they add variables for quality change, business fluctuations, and education to determine productivity. Moreover, there are variations in their measure of labor and capital inputs or in their treatment of depreciation which are elements that go into TFP estimation. All these make productivity measures generally incomparable across countries and over time.

### **2. Data issues**

The accuracy of TFPG depends heavily on the precision of labor and capital inputs, with the latter's data being more problematic. There are only very few countries that compile capital stock estimates on a regular basis. Whether these are obtained from administrative sources or from surveys, there can be varying assumptions on the service lives, the age-efficiency and age-price profile associated with the various assets. Data support to these parameters are often weak especially in developing countries.

For labor data, the weights used in aggregation have an effect on TFPG. The variables used in adjusting for the quality change of labor such as age, sex and education as well as the use of number of hours instead of number of employees can cause differences in TFPG.

Moreover, the lack of long data series on labor and capital inputs and other determinants of productivity limits the usefulness of TFP estimates.

### **3. Methodological issues**

Aside from the problems associated with data unavailability, the measurement of productivity faces conceptual and measurement issues. The

availability of many options and the lack of clear, definitive guidelines may have contributed to the exclusion of productivity measures from the official statistics being generated by countries, although OECD has recently produced two important documents on this subject [11] and [12]. Interpretation also largely depends on which methodology is used, and how capital and labor inputs are measured. For partial productivity measures, one can easily fall prey to erroneous attribution as to sources of productivity growth.

In addition, the compiler of productivity measures has to decide whether to estimate single-factor or TFP or both. The issues of whether to compile industry-specific or economy-wide productivity measure and whether to use value added or gross output also have to be resolved.

#### **4. Who should compile**

While there have been several efforts in the past to generate estimates of productivity measures in the Philippines and in other countries, most of them were done by researchers and on an ad-hoc basis, usually in connection with a project. Because of budgetary constraints and competing priorities, few statistical agencies have succeeded in institutionalizing productivity measures within the national statistical system.

A review of agencies handling productivity measures has identified the statistical agencies as the producers of productivity indicators, particularly the agency that compiles the national accounts. Examples of these countries are Canada, France, Germany, Australia and Singapore, among others. In the United States, TFP is produced by the Bureau of Labor Statistics (BLS) but the Productivity Commission and the private sector also come out with productivity measures by industry or sector, using data coming directly from the enterprises.

This paper argues that for any productivity measure to have a chance of compilation in the long term and hence produce a data series that will be useful to policy-makers, its compilation must be lodged with a statistical agency. The reasons why TFP should be generated largely by the statistical agencies are: (i) TFP is dependent on data inputs provided by these agencies; (ii) the statistical agencies are in the best position to deal with problems on the data inputs that go into the estimation of TFP in a consistent and coherent manner; (iii) possible biases in the estimation of TFP are minimized; and (iv) in the analysis, they can link productivity with other indicators, especially those in the national accounts. Thus, institutionalization is more likely to happen if TFP compilation is lodged with the statistical agencies.

### **III. Country TFP Compilation and Dissemination Practices**

As mentioned in [12], the value-added based labor productivity is the single most frequently computed productivity statistic. In terms of data release, productivity estimates are usually produced on an annual basis since some data sources are only available annually.

In Australia, the Australian Bureau of Statistics (ABS) publishes annually a variety of productivity estimates, namely, labor productivity, capital productivity and MFP (a preferred term over TFP). The MFP measure for Australia relates to the market sector and does not take into account the efficiency with which inputs from other sectors (such as energy, subsoil assets, materials and services) are used in production. The ABS measures MFP as the ratio of chain volume estimates of market sector GDP to a combined measure of capital services and

hours worked. Estimates of sectoral MFP are not yet compiled by ABS, although the Productivity Commission has produced such estimates.

Meanwhile, in the United States, two annual sectoral productivity series are readily available from the BLS website. These are the indexes of MFP for: (i) the private business and private non-farm business sectors of the economy and for the aggregate manufacturing sector, as well as for 20 2-digit Standard Industrial Classification manufacturing industries and the utility and gas industry where a gross product originating measure of output is being used; and (ii) the 140 3-digit manufacturing industries and the railroad transportation industry of which a sectoral output concept of real output is applied. MFP measures are available as historical time series on the BLS website. The annual indexes of MFP and output per unit of capital services for the private business, private non-farm business and manufacturing sectors are also published in “*Multifactor Productivity Trends News Release*” of BLS. In addition, the BLS produces quarterly measures of labor productivity or output per hour.

Statistics Canada publishes several sets of productivity measures for the Canadian business sector and its major constituent subsectors (subsectors producing goods and services and manufacturing). Currently, four categories of annual MFP measures are available, each of which is based on a different measure of output and therefore serves a different analytical need: (a) MFP based on gross output; (b) MFP based on gross output net of intra-industry transactions; (c) MFP based on value added; and (d) MFP based on gross output net of all inter-industry transactions.

#### **IV. TFP for the Philippines**

##### **A. Recent Work on Productivity Measurement**

###### **1. National Initiatives**

In 1996, the first National Action Agenda for Productivity (NAAP) was formulated to serve as the country’s blueprint for improving TFP. In 1999, President Estrada directed<sup>4</sup> the formulation of the MTNAAP 2000-2004 consistent with the Medium Term Philippine Development Plan 1999-2004. These development strategies highlighted the importance of TFP measurement.

In line with these developments, the PCP commissioned the “Study on the Establishment of Productivity Indicators in the Philippines” to provide recommendations on the conceptual framework for the TFP indicator system. The study proposed the growth accounting approach for estimating TFP at the aggregate and industry level. The methodology developed under this study was later used by the NSO to come up with TFP estimates for the Philippines.

In 2002, the PCP passed a resolution<sup>5</sup> recommending that the TFP estimation activities be spearheaded by the NSCB. This is expected to facilitate linking TFP with the national accounts to provide a more complete and fuller analysis of the factors affecting economic growth.

###### **2. NSCB Efforts**

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<sup>4</sup> Under Memorandum Circular No. 28 issued on 8 April 1999.

<sup>5</sup> Resolution No. 1, Philippine Council for Productivity, 31 July 2002. The MTNAAP 2000-2004 previously identified the NSO as the lead agency.

In response to the PCP Resolution, the NSCB-funded a study entitled, “Development of a Methodology to Estimate the Philippine Capital Stocks and a NSCB-Based TFP” and implemented by the Statistical Research and Training Center. The study sought to explore ways to improve productivity estimates through the use of alternative data inputs for both capital and labor. A major output of the study is focused on the development of a methodology for estimating capital stock that is consistent with the GDP measure of aggregate output.

The NSCB, thru its TFP project consultant and TFP team of 9 members, conducted a series of activities aimed at developing a methodology and arriving at estimates of capital stock and TFP. It started with a review of literature on TFP and capital stock measurements through a staff lecture series as well as briefings/workshops on TFP estimation. It also looked into country practices on the compilation of productivity and capital and labor measures. This was followed by an intensive evaluation of available data to look into their appropriateness for TFP estimation. After data assessment and evaluation, the conceptual and operational frameworks for the compilation of Philippine capital stock data and TFP measures were developed.

## **2.1 Conceptual Framework**

With due consideration to available TFP and capital stock measures, manuals/guidelines, TFP/capital stock estimation practices in other countries and available data, the NSCB study explored an MFP/TFP model using value added as output indicator and capital and labor as the given inputs.

The study adopted the same methodology as recommended by the TWG-PIMS, which is a growth accounting approach using a transcendental logarithmic (translog) production function. The strength of this model is that it allows aggregation of production functions at the micro level into an entire economy. To allow for more relevant analysis of TFP, a market economy<sup>6</sup> is adopted as main domain for the study. However, a TFP for the total economy can also be estimated. As an innovation, it introduces alternative data inputs specifically for capital stock, compilation techniques and more disaggregations.

### **Value-Added as a Measure of Output**

There are two concepts of real output used for MFP measurement: gross output and gross product originating or GDP. When MFP measures are based on a gross output concept, MFP growth approximates the rate of ‘neutral, disembodied technical change’<sup>7</sup> [12]. However, this requires information on prices and quantities of intermediate inputs, which may be difficult to achieve. On the other hand, GDP is the sum of Gross Value Added (GVA) originating from each industry of the economy. It excludes intermediate inputs. When MFP measures are based on value-added concept, it ‘reflects an industry’s capacity to contribute to economy-wide income and final demand’.

Thus, for the study, industry GVAs were used as output. The current PSNA series has a long series of GVA estimates by industry, disaggregated further into organized and unorganized sectors. The series is updated quarterly/annually and so TFP can be updated regularly.

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<sup>6</sup> A market economy excludes the government sector and imputed rent on owner-occupied dwelling units.

<sup>7</sup> As mentioned in Annex A, the TFP formulation based on growth-accounting approach approximates the exogenous, disembodied and Hicks-neutral technical progress.

### **Capital Input**

Capital data used in the study consist of durable equipment, structures (construction) and other capital goods. Other capital goods include expenditures for orchard development and breeding stocks.

Capital input is measured by the capital services, which were estimated based on capital stocks; changes in capital services were assumed to be proportional to changes in capital stocks for each type of capital asset.

Short-lived assets such as a car or computer must provide all of their services in just a few years before they completely depreciate. Office buildings provide their services over so many years. This implies that in a year, a peso worth of a car provides relatively more services than a peso worth of a building. Because of differences in capital services among assets, capital input can increase not only because investment increases the capital stock, but also if investment shifts towards assets which provide relatively more services per peso of capital stock.

### **Labor Input**

Labor input refers to total hours worked by paid labor as well as by unpaid family workers and own account workers. Previous studies used number of persons employed. But the study did not consider labor quality factors such as education.

### **Classification / detailed grouping**

The TFP estimation was carried out at the aggregate, national level and at the eleven major sectors level namely: (1) agriculture, fishery and forestry; (2) mining and quarrying; (3) manufacturing; (4) construction; (5) electricity, gas and water; (6) transportation, communication and storage; (7) trade; (8) finance; (9) business services; (10) real estate (excluding ownership of dwellings); and (11) other services (excluding government services). For analytical purposes, each major industry was further subdivided into the organized and unorganized sector using the PSNA definition adopted by NSCB. In addition, whenever the contribution of government owned or controlled corporations (GOCCs) is significant to the industry, such as in electricity, gas and water and in transport services, it is highlighted.

## **2.2 Sources of Data and Methodology**

The TFP estimates presented in this study took into account existing data from the NSCB, NSO, Department of Labor and Employment, Commission on Audit, Bangko Sentral ng Pilipinas and Securities and Exchange Commission.

The NSCB study adopted the TFP methodology as recommended by the TWGPIMS, using alternative data inputs and compilation techniques. Given the limited time involved for the study, other potential data sources were not explored.

Thus, TFP measure was based on the growth accounting approach, which assumes a transcendental logarithmic (translog) production function. This is

calculated by dividing a Tornqvist<sup>8</sup> volume index of output (value added) by a Tornqvist volume index of combined inputs. The Tornqvist formula [1] yields growth rates which are differences in logarithms. The antilogs of these rates were chained to form the index.

#### **a. Output**

In the estimation of Output, an index of output in physical terms for each industry/sub-industry of the economy was calculated using a translog pairwise index. Output quantities for each industry are based on GVA adjusted for price change, specifically, GVAs at constant 1985 prices. The GVAs in producers' prices are adjusted for indirect taxes and subsidies to obtain GVA at basic prices using ratios from the 1994 Input-Output tables.

Subgroup GVA index is Tornqvist aggregated to the major industry level. GVA at constant 1985 prices for each of the sub-groups was derived by using the implicit price deflator of the major industry.

#### **b. Combined Inputs**

Labor and capital inputs are combined into an input index. The index of combined inputs is a Tornqvist aggregate of separate indexes of labor input and capital input. The labor weight is based on the total value of labor compensation including fringe benefits. The weight for capital is calculated as a residual or GVA minus the value of labor compensation.

#### **Labor Input**

The labor input indexes are estimated by dividing the aggregate employee hours for each year by the base-period aggregate. Total hours worked are obtained by multiplying total employment by class of worker with the corresponding average weekly actual hours worked for each corresponding class of worker for each industry and subgroup. Total hours of all employees are derived by adding the total hours for production workers and the estimated hours for non-production workers. Imputations on the total hours worked on own-account and unpaid workers are made. Data on employment and average hours worked are sourced from the NSO's Labor Force Survey. For TFP compilation, average of quarterly data is used, instead of the October data which is traditionally used in most studies.

#### **Capital Input**

The measure of capital input is based on the flow of services derived from the stock of physical assets. Capital services are estimated by calculating capital stocks; changes in the stocks are assumed to be proportional to changes in capital services for each asset. Stocks of different assets are then Tornqvist-aggregated into one capital input measure using estimated rental prices<sup>9</sup> to construct the weights for assets of different types.

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<sup>8</sup> A Tornqvist index belongs to the superlative symmetric indexes and is commonly used for productivity measurement. Its volume index is a weighted geometric average of the quantity relatives using arithmetic averages of the value shares in the two periods as weights. In this paper, a Tornqvist index of output is developed by computing a weighted average of the growth rates of the various industry products between two periods, with weights based on shares of industry to total GDP.

<sup>9</sup> See Annex B for reference on the calculation of rental prices for each type of asset.

Capital stocks are calculated using the perpetual inventory method<sup>10</sup> (PIM), which takes into account the continuous additions to and subtraction from the stock of capital as new investments and retirements of old capital take place. Gross capital stock at the end of the year is equal to a weighted sum of all real investments where the weights are the assets' efficiency relative to a new asset. This is calculated by summing up all of gross fixed capital formation in previous years, of which the service lives<sup>11</sup> have not yet expired. A straight line depreciation of fixed assets is assumed partly because it is the common approach followed in local business accounting<sup>12</sup>.

Capital stocks are built up from investments (capital formation) by sub-groups, industry and type of assets using parameters from the Annual Survey of Establishments<sup>13</sup> of the NSO. Estimates are done for 3 types of assets for each of the 18 sub-industry categorization. Fixed assets are grouped into structures, transport machinery and other machinery and equipment.

To remove price change from investments, gross fixed capital formation is deflated at a more detailed breakdown using asset-specific price deflators. For example, imported durable equipments are deflated using foreign trade indices instead of extrapolating the previous year's estimates with a gross kilo index. More detailed breakdown of non-residential construction is also introduced as well as a number of improvements in both the valuation and the adjustment of the building permits data. These changes are based on a study on the stock of dwelling units using data from the NSO's Census of Population and the Family Income and Expenditure Surveys.

## **B. Proposed Official Philippine Methodology for TFP**

Taking into account the available data, the NSCB project recommends the same TFP model as proposed by the TWG-PIMS, as an interim approach on TFP measurement. This refers to the growth accounting model, which assumes a transcendental logarithmic (translog) production function. However, insights gained from the NSCB study, and adjustments to account for other determinants of productivity, can be explored to improve the productivity estimates. For instance, since changing service lives have an impact on the resulting estimates of capital stocks, examining the effects of changing the assumed service lives of fixed assets on TFP growth through a sensitivity analysis will help in evaluating the robustness of TFP estimates. In addition, factoring in some quality dimensions in the labor input such as age, experience, educational attainment and even the basis of payment of wages such as per month, per piece, or "*pakyaw*", would render the TFP estimates more meaningful.

## **V. Results**

The MFP/TFP results cover the period 1993 to 2002<sup>14</sup>. As mentioned earlier, the series was compiled for the market economy. Estimates covered 11

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<sup>10</sup> See Annex C for the formulas used in PIM.

<sup>11</sup> Due to lack of data on the average asset lives for each type of asset, "best-practice" service lives are compiled using a survey of other countries' practices. See Annex D.

<sup>12</sup> Several countries have however opted to use other efficiency functions such as hyperbolic for BLS and geometric for Canada and Australia. The other reason that this efficiency pattern is used is the lack of empirical evidence on the applicability of other efficiency/retirement functions.

<sup>13</sup> This is now the Annual Survey of Philippine Business

<sup>14</sup> The PSNA estimates for the period up to 1999 are not linked with the estimates from 2000 onwards because of construction, so growth rates for 2000 should be ignored.

major sectors and 18 subgroups. The TFP for the private, non-agriculture, non-financial and the total organized sectors can also be compiled but are not included in the paper.

#### **A. TFP at the market economy level**

Annex E presents the TFP growth (TFPG) estimates, the TFPG as estimated by Cororaton [2] and the real GDP growth [10]. From 1994 to 1998, productivity continuously declined. This was the period when the Philippine economy was just recovering from the political uncertainties created by the failed coups against the Aquino government. The economy suffered additional blows during the period with the onset of El Nino and the Asian financial crisis in 1997. But from 1999 onwards, productivity recovered.

Annex F shows the contribution to real market output growth of capital, labor and TFP. From 1994 to 1998, capital input was the dominant factor behind the real market growth. On the average, it contributed 5.2 percentage points to the average market growth of 3.6 percent. This reflected the heavy investment in construction during the period, as the government was able to solicit the participation of the private sector in infrastructure projects through the Build-Operate-Transfer scheme. However, starting 1999, investments started to fall dramatically contributing only 1.1 percentage points to the average market growth of 5.9 percent during the period. Construction declined during this period. In contrast, construction grew in the earlier period except in 1998.

Labor input, on the other hand, contributed an average of 1.1 percentage points to real market growth during 1994 to 1998. Its contribution fell further to 0.4 percentage point for the period 1999 to 2002. Unemployment rates averaged 8.4% and 9.9%, respectively, in the two periods [9].

The results show that the Philippine economy has not been helped by the volatility in productivity. In the 1994 to 1998 period, loss in TFP eroded the real market growth by 2.7 percent. On the other hand, in 1999 to 2002, it was the main driver of growth contributing 4.3 percentage points to the 5.9 percent real market growth.

Comparison of the results of this paper with those of Cororaton [2] shows that that they differ slightly in their trends specially, for the period 1994 - 1998. During this period, Cororaton computed positive TFPG while this paper posted a negative trend. But for the period 1999 – 2000, both studies showed similar trends.

#### **B. TFP at the industry level**

Annex G shows the results at the industry level. The organized agricultural sector exhibited a trend similar to that of the total market economy - a negative trend in TFPG from 1994 to 1998, followed by a positive trend starting 1999. The boom in agriculture's productivity peaked in 2000 when the productivity of the total economy also peaked up. On the other hand, the unorganized agriculture showed a relatively stable trend except for 1994 and 1997.

In Mining, the TFPG was erratic, highlighted by a double digit 33.4% in 2002 when the San Antonio Power Plant and the Malampaya Gas-to-Power project started producing natural gas and condensate.

The Manufacturing organized sector posted the second highest average TFPG of 5.4% after the 7.6% of Electricity, Gas and Water (EGW) for the GOCCs. However, it exhibited a pattern of alternating growth and decline from

1994 to 1998. The period from 1999 to 2002, on the other hand, showed robust growth of TFPG that averaged 9.7%. This may be attributed to the productivity of electronics-manufacturing industries. Meanwhile, except for 1994, the unorganized sector of Manufacturing posted negative TFPG, hitting a trough during 1997-1998.

Construction recorded a poor TFPG for the entire period under study

For EGW, separate estimates were done for the organized sector and the GOCC's. The organized sector experienced hugely negative TFPG during 1994 to 1995 following the energy crisis in 1992-1993. Its productivity promptly picked up starting 1996 when structural reforms were pursued in the Energy sector. Meanwhile, the TFPG for GOCC's showed an erratic trend during the first period but stabilized later, exhibiting the same trend as the organized sector.

TFPG estimates for the Transport, Communication and Storage (TCS) sector were compiled for the organized and unorganized sectors and for the GOCC's. In most years, the organized sector posted higher TFPG than the other two sectors, peaking at 20.5 percent in 2001 when GVA for TCS grew by 8.8%.

Likewise, for Trade, the organized sector had higher TFPG than the unorganized sector. The organized sector maintained a positive TFPG starting in 1998. The unorganized sector, on the other hand, was able to replicate such trend starting in 1999 with a big turn-around from negative 12.5% in 1998 to positive 1.4% in 1999. GVA for Trade grew by 4.9% in 1999 from 2.4% in 1998.

While not as impressive as the other sectors, TFPG for Finance was positive except for 1994 and 1995, when, ironically, the banking sector was liberalized. The trend has a narrow range from negative 0.9% to positive 3.4% percent. While TFPG decelerated from 1.6 percent in 1996 to 0.2 percent in 1997, during the last quarter of which, the Asian financial crisis started, the TFPG for the succeeding years manifested the resiliency of the Philippine banking sector in contrast to the financial woes suffered by our neighbors.

The TFPG for business services and real estate was negative except for 2002 when it hit 19.8 percent. The combined GVA of business services and real estate grew by 3.7 percent in 2002 with the former contributing 4.3 percentage points while the latter contributing a negative 0.6 percentage points.

The organized sector of Other private services had negative TFPG up to 1997 and in 2000, but recorded a blistering 17.5% and 18.8%, respectively, in 1998 and in 2001. The unorganized sector followed basically the same trend except in 1998, but had generally lower TFPG. In 1998, the unorganized sector TFPG was negative 8.4%.

## **VI. Issues/Limitations/Challenges**

While there is no general agreement on the most appropriate methodology to use, the different approaches used in different seem to produce reasonably acceptable estimates of TFPG. However, the data support to MFP/TFP compilation remains a big challenge, especially when nonparametric approaches are used.

Towards improving productivity measurement, the OECD Manual [12] has identified at least four areas that need the attention of statisticians:

- Price indices for output measures by industry;
- Measurement of hours worked by industry;
- Measurement of capital input; and
- Input-output tables.

All these areas, including the use of imputations and “best practice” parameters from other countries contributed to the limitations of the study.

Additional data problem encountered in the study is assigning the proper share/weight by industry to arrive at aggregate output, labor and TFP indexes.

But the most critical challenge to the NSCB in its compilation of MFP/TFP statistics has been the weak data support on capital stocks. And even if this data gap has been identified openly, it is not likely that the resource constraints faced by the PSS today will allow the generation of satisfactory data needed in the estimation of capital inputs.

Notwithstanding the problems encountered in the study, it is important to document the steps, processes, involved in the development / improvement of TFP estimates to serve as useful reference in the institutionalization of MFP/TFP in the PSS.

In the meantime, even if some of them appear to have historical basis, the results presented in this paper should be treated as very preliminary. The challenge, therefore, is how to ensure that these preliminary estimates will be transformed into final estimates at some point in the near future.

## **VII. Future Directions/Recommendations**

Recognizing the importance of improving productivity growth, the NSCB as the agency tasked to estimate TFP for the Philippines, will pursue the following strategies and activities in line with the on-going improvement of its PSNA series:

1. To adopt the proposed framework/methodology as an interim step towards generating and institutionalizing TFP estimates in the PSS, that are internationally comparable;
2. To continue improving the quality of the data on the factor inputs especially of capital stock to enhance the reliability of the TFP estimates, including more appropriate disaggregation of sectoral labor and capital inputs, such as by industry and education/training as well as valid and updated depreciation variables, weights, etc.;
3. To institutionalize data support to TFP measurement through inter-agency collaboration and use of administrative data;
4. To continue conducting exploratory estimates of TFP, introducing enhancement/improvements in the approach either through the use of more reliable data, other determinants of productivity variables, modification in methodology, etc.;
5. To advocate estimation of TFP by firm and by industry consistent with the methods used for coming up with aggregate TFP for the country and in the process improve data inputs to the estimation of TFP.
6. To institutionalize TFP estimates at the NSCB by integrating them in the annual PSNA starting May 2005;
7. To conduct Users' Fora on TFP through which, users can help identify other possible determinants of productivity in the country towards enhancing the TFP methodology;
8. To consider inclusion of productivity measures in the System of Designated Statistics of the PSS to be presented to the NSCB Executive Board for approval; and
9. To advocate for government to have the political will to allocate the necessary resources for the systematic and regular compilation of TFP by the PSS.

## **ACRONYMS**

ABS	AUSTRALIAN BUREAU OF STATISTICS
BLS	BUREAU OF LABOR STATISTICS (US)
COA	COMMISSION ON AUDIT
GDP	GROSS DOMESTIC PRODUCT
GOCC	GOVERNMENT-OWNED OR CONTROLLED CORPORATION
GVA	GROSS VALUE ADDED
KLEMS	CAPITAL, LABOR, ENERGY, MATERIALS
MFP	MULTI-FACTOR PRODUCTIVITY
NEDA	NATIONAL ECONOMIC AND DEVELOPMENT AUTHORITY
NIRC	NATIONAL INTERNAL REVENUE CODE
NSCB	NATIONAL STATISTICAL COORDINATION BOARD
NSO	NATIONAL STATISTICS OFFICE
OECD	ORGANIZATION FOR ECONOMIC COOPERATION & DEVELOPMENT
PCP	PHILIPPINE COUNCIL FOR PRODUCTIVITY
PIM	PERPETUAL INVENTORY METHOD
PSNA	PHILIPPINE SYSTEM OF NATIONAL ACCOUNTS
PSS	PHILIPPINE STATISTICAL SYSTEM
TFP	TOTAL FACTOR PRODUCTIVITY

TFPG           TOTAL FACTOR PRODUCTIVITY GROWTH  
TWG-PIMS    TECHNICAL WORKING GROUP ON PRODUCTIVITY  
INDICATORS AND MONITORING SYSTEM

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