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THE STATISTICAL MEASUREMENT OF SUPPLY AND UTILIZATION OF THE MINERAL RESOURCES OF THE PHILIPPINES[1]

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1. **The Problem Defined.** Supply is usually defined in economics as the amount of a good that sellers make available in a given market at varying prices usually during a specified period of time. This definition suggests the condition under which supply may be measured, namely: examination of the relationship beteewn changes in price and of the amount of a good made available under market conditions. Using this as our term of reference, our problem is then translated into how to measure Philippine supply of mineral resources in their respective markets at the range of prices offered them.

2. **Conditions of Measurement, Time References. The Market Period. The Short-run and Long-run.** To assist in the measurement, we are, fortunately, beneficiaries of a device originally conceived by the eminent economist Alfred Marshall, of conveniently dividing into specific time periods certain economic phenomena. This device enables us to conceive of supply in the market period which is thought of as being only a single or a few days; the short-run period which is usually long enough for supply of a commodity to be altered by increases or decreases in current output but not long enough for the fixed equipment to be adopted to a different level of output; and the

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long-run period wherein there is sufficient time for the firm's equipments to be altered so that output is capable of adapting more fully to changes in demand conditions. The short-run is usually thought of a covering a period of a year or less while the long-run normally extends from more than a year to a decade or, to use more meaningful time references, to that of the duration of a five year development plan or the lifetime of a mine.

3. **Specifics of Market.** Implicitly, the specifics of market or place of final disposition of goods is a central condition of measurement. As mineral commodities are in no way limited to particular markets, measurement of supply is made possible only if these details are brought to light. For this reason, the internal or local market must be differentiated from the external or world market and the latter further clarified into more specific geographical subdivisions. Thus within the world market we are enabled to refer to the more definite limits of, say, the United States market, the British market, Japanese market, etc. In looking into the conditions of supply in the Philippines where, as it happens, the mining industry is segmented into a sector that produces exclusively for the world market and another which is confined to the local market, this portion of the analysis is crucial to the measurement.

4. **The Role of Price Factors.** The manner in which price relates to the measurement is a more complex matter to define and articulate. In part this is due to the fact that price is a cause as well as an effect of movements in supply and as such plays a dual role which is neither easily nor necessarily defined in the measurement.

5. **Price Formulation in Mineral Markets.** Certain peculiar attributes of the mining industry in the Philippines tend to make our prices in the metals sector pre-arranged or fixed at a certain level or within a specified price range over a specified period of time for definite quantities of metals. This is resorted to as an hedge to sharp fluctuations by buyers and

sellers alike in prices to which the commodity is sometimes subject. For the mineral commodities more than in others, there appears to be marked differences in prices as one moves from one market to another because of transportation differentials which contribute greatly to differing conditions of supply. Also, there is often a time lag between movements in demand in principal trading centers such as New York and London and movements of supply from various parts. Therefore, sudden or unannounced changes in price are not immediately availed of by small suppliers in most parts of the world. To secure their positions, suppliers who exert no influence in the making of world prices, such as the Philippines, usually make it a point, at least in the short-run, to have the manner in which prices will be determined for their products stipulated in their supply contracts with the buyer. On the long-run, however, and with particularly important suppliers who enjoy secured positions with their buyers, the going price for most metals is established or guided by the Engineering and Mining Journal (E and MJ) prices quotations which keeps track of prices in the New York mineral markets or the London Metal Exchange (LME) quotations which keeps the tabs on London prices. Sometimes prices are a composite of both (which is true of prices received by Atlas Consolidated for its copper ores) or negotiated between these two price quotes or fixed at some agreed rate depending on buyer's spcifications and supplier's grade of mineral.

6. **Two Segments of the Philippine Mining Industry.** It is within this framework that measurement of supply may then be contemplated. For measurement of Philippine mineral commodities to be possible at all, two segments of the industry must be recognized and examined separately. These are the metal sector, on one hand, and the non-metal sector, on the other. The distinction must be made and measurement done separately because altogether different conditions obtain in each.

7. **In Metals Sector: Production = Exports = Supply.** The one overwhelming feature of the metal sector is that there is no local market to speak of. Except for gold, the supply of which is subsidized and controlled by the government, the bulk of production of our metals—copper, iron, chromite, lead, mercury, zinc, manganese, etc.—is intended for foreign markets notably the Japanese and United States markets. In view of this, the first feature, and incidentally a rather confusing one, of our concept of supply emerges. And this is that of a local supply for foreign markets. Supply as used in this sense is, however, more aptly termed as production. The two are not the same. Supply is a step further from production. Production is the source of supply and supply is indeed first conceived as production, but only that portion of production which sellers release to the market at the going price is, in the true economic sense, what may be properly be referred to as supply. Furthermore, production is measured at the source (mine or mill) with its value estimated at a uniform rate which does not reflect various conditions of the market while measurement of supply is done under market conditions and its estimated value is necessarily a reflection of the prices obtained by it there.

Notwithstanding this variance in concept between production and supply, each may be used interchangeably for the other under certain assumptions and/or conditions. And the peculiar relationship between local production and price formulation in its various markets make out the conditions which allow for this simplification. To start with, we should note the fact that when the Philippines produces of its metallic minerals it immediately disposes largely in the two markets earlier mentioned with a small portion finding their way in markets Europe and Asia. Only an insignificant amount is retained for local consumption. The country does not maintain a stockpiles nor do our producers keep significant amounts as inventories.

All these factors then contrive to make possible equating, first, production with experts or shipments. From here it is a

short step to the equation "total production equals total exports equals total supply". As a matter of fact, it is through this process that the Bureau of Mines arrives at estimates of aggregate supply of our metal resources. In a way, it literally equates supply with production or exports. Clearly this has been done as a matter of convenience and with the expediency of measurement as a primary consideration. For with this pattern of analysis, both the producer's and exporter's data may be effectively used as the bases of measurement. Moreover, each provide material which may be evaluated or checked against the other. But also, there appears to be a rationale behind this at least in the short-run period. It is no secret that all our local producers of metals are bound by individual contracts with certain buyers in foreign markets. Their intended output are, more often than not, forecast and scheduled at least a year before actual production starts. Furthermore, as small producers in a large and fiercely competitive market, local producers have no voice in the formulation of world prices. Therefore, within their limited means they try and secure for their products through contractual arrangements the best possible price. Consequently, in the immediate short-run a sort of non-price rationing which is manifested in contractual arrangements hold sway, and whatever price differential exist with world prices is without a marked effect on Philippine supply in its accustomed markets. If and when these situations apply, then, demand and price factors may be held constant and supply could be truly equated with either production or exports.

It must be remembered, however, that over the long-run, holding demand and price constant even in the face of contractual arrangements is unrealistic and untenable. Total Philippine production of metals constitute only a small fraction of world supply and, thus, the supply position of individual producers is weak and extremely vulnerable. In fact, their very existence is depndent upon their ability to keep their products competitive and maintain their respective shares of the market. In the long-run, therefore, demand and prices will fluctuate unpredictably and this will necessarily offset the balance which

we have assumed exist between production, exports, and market supply of our metallic mineral resources. In the long-run, the simple measurement of supply as taken as its source and computed at a stationary price level does not apply.

8. **The Macro Case: How Total Production or Aggregate Supply is Estimated.** Bureau of Mines estimates show that for each metal, total national production or aggregate supply is computed as the summation of the actual tonnage produced by all firms engaged in the production of said metal for that given period. The bases for this measure are actual mill output as reported by individual mining firms. On the other hand, total supply when conceived as total export or the Philippines' share of the world's metal morket is similarly computed as the sum of all the individual shipments or exports of metals classified according to kind of metal and country of destination or market. For this we have the export license which eventually finds its way into Central Bank files via agent banks and the customs manifest, copies of which are retained by the Bureau of Customs and the Bureau of Census and Statistics. For both measures, the unit of volume used is the troy ounce of gold and silver, flask for quicksilver or mercury, and metric or dry metric ton (short or long) for all the other metals. To express value, the one price received for the metals in their respective markets initially stated in dollars is translated into pesos at the current rate of exchange. Both measures are normally taken at the end of a short-run period of usually a year. This end-of-the-reference-period measurement is deemed the most meaningful and nearly accurate approximation. Hence, the same material is utilized as raw data in preparing forecasts or projections of production or supply in the long-run period. A measure in the market period or immediate present is insignificant and often ruled out as earlier mentioned because of the absence of either inventories, stockpile-or-local market.

9. **The Non-Metals Sector: Production and Market Conditions.** Measurement of overall production in the non-metals factor is done in much the same fashion but conditions here are

so markedly different that the process of measurement is rendered so much more difficult and imperfect. Here the bulk of production is retained and absorbed by a burgeoning local market. And except for *cement* which is believed to be under a *cartel* arrangement and *fertilizer* which counts only a few producers, a competitive condition faces the variety of products under this classification which includes limestone, coal, asphalt, clay materials, construction materials, fertilizer materials, and others.

Whereas the metallic sector is characterized by the predominance of a few producers in fair-sized and stable operations, the non-metallics segment is, in contrast, characterized by the presence of a large number of suppliers in small operations fairly scattered all over the country and without any formal organization to afford them knowledge of each other. Moreover, while in the former, transactions are properly documented as they pass through agent banks of the Central Bank and, the Bureau of Customs; and, financial positions, as well as progress of projects are made known to the public through periodic reports; in the latter, such matters are mostly a subject of rough estimates or conjecture. The proximity of producers to their market and the less formal nature of their relationship make for a greater volume and faster rate of turnover in transactions which is not easy to keep track of and not always properly reported. Also, within the country, facilities for transportation and distribution of these products are still so crude that several isolated markets really exist. Together, these conditions present difficulties of measurement quite different from those encountered in the metals sector. The situation is not helped by the seeming indifference or lack of appreciation for the importance of reporting that have been observed to pervade this sector. Reports from individual firms in this category are erratic and scanty. Besides, there is no way by which data which they furnish may be counterchecked.

10. **How Data on Production is Gathered and Organized.** It is within this context that the Bureau of Mines effort to provide a measure for the country's production of commodities in this class of minerals must be viewed. Admittedly, its data is limited to those concerns reporting their productions and, as such, may not always be conclusive. It should be mentioned, however, that the Bureau does not maintain offices in the provinces where most of these operations may be found. Instead, the municipal and provincial treasurers all over the country are requested to ask as deputies of the Director of Mines in the collection of vital information regarding mining activities in their respective jurisdictions. Eventually, the Bureau collects this information by circularizing statistical forms for this purpose to the different municipal and provincial treasurers all over the Philippines as the end of every 3-month period.

Over the past years actual reporting among the non-metallic producers has been erratic. A case in point is that of available statistics in salt. The ups and downs of reported production have on occasion been so sharp as to invite doubt of its statistical probability. For example, in 1965, total volume of production of salt increased by 383.61% while value rose by 389.16%over 1964. For 1966 preliminary figures show a decrease in volume of 37% but with an accompanying increase in value of 17%. In 1965, the increase in production figures was plainly too big to be credible. It becomes comprehensible only with the explanation that an area not earlier included in the reporting had suddenly surfaced and reported its production. Thus, the big jump in figures. Again, the 1966 data seem irreconcilable with 1965 figures. The 37% decrease in volume is simply too big a drop to elicit a 17% increase in value even assuming that prices of salt have gone up drastically during the period. But, despite the fact that these figures do not accurately reflect the supply situation for salt, at the moment, it is the next best indicator of the condition of supply. Until a better system of reporting and estimating supply is evolved, these figures stand as indicators of the trend obtaining there, although not necessarily reflecting the exact conditions

in that particular market. I have brought this up certainly not to put my office in bad light but on the contrary to generate better understanding of its position. For surely these imperfections show up quite well the limitations of even a national government statistical agency when it lacks control over significant data for which it is a primary source of information.

In the case of cement, measurement of production is easier because there are fewer producers who are known and organized into what is referred to as the Cement Produces Association in the Philippines. The individual capacities of these ventures are of public record and their production schedules, targets, as well as actual production for a given period, are periodically reported both to the Cement Association and the Bureau of Mines. However, a correct estimate of the supply in the market period is as elusive as in any sector of the local mineral market. It is no secret that in spite of the careful building up of inventories and the assurances of the adequacy of supply, this important commodity has oftentimes been scarce during critical periods of demand. This is partly explained by the seasonal nature of demand for cement where there are months of peak demand and periods of slack and partly to the ability of producers to sometimes muddle or keep supply tight when it means bringing forth a higher price for their product.

In the non-metals sector particularly, the sharp seasonal variations in demand and consequently in supply, is another fact to contend with. As this variation is more pronounced, data collected over a long period become more difficult to collate and subject to analysis.

Both in the metals and non-metals sector, we have so far looked at production or supply from the macro aspect or from the point of view of the nation as a whole. It must be stressed, however, that the aggregate picture is only a summation of individual supply data provided by the producers themselves.

The validity of the overall measurement is, therefore, premised wholly on the individual producer's concept and assessment of its production or supply position. This then behooves us to look into the measurement of supply as it is done by the individual mining firm.

11. **The Micro Case: Production and Supply From the Point of View of the Firm.** From the point of view of the firm, production or supply is a function of a number of interrelated factors which together bear down on its ability to come out with a certain level of output. In a mining venture, this includes the firm's reserves of minerals and its characteristics, its capital for development, the technology and labor available to it, the demand for the commodity and the prices obtained for it. The last two factors, however, are assumed or taken as constants when it applies to the local supply of metallic minerals since these are provided for before any decision to produce is made. In mining ventures everywhere, particularly those involved in the mining of metals, the buyer is first secured and terms of the sale worked out before production proceeds. Demand and price factors are, therefore, on a first level of priority and determines not how much is going to be produced but if production is to proceed at all. With demand and prices as constants, volume of production is then determined by the mineral reserves—its quantity and grade, the amount of capital available to finance operations, manpower, and the efficiency of metal recovery.

Executives of mining firms whom I consulted regarding this subject, insist that it is not possible to assign weights to the role that each of these variables play in determining a certain level of output. They maintain that one who is familiar with the realities of mining operations would know that each is equally important and are actually interdependent. A body of mineral reserves, for instance, no matter how extensive and rich is to no avail if there is not sufficient capital for its development or if perhaps government policy regarding credit stands in the way of acquiring this capital or if there has been

no perfected method by which the metal in the deposit could be extracted. These in fact, are the problems that have to be resolved in order that our extensive nickeliferous laterite deposits may be developed and put into production. In the same manner, when a strike is declared in a mine, one is unable to say correctly that it hampered production 20 - 30 or 50%. The fact is that operations simply stop because, without labor, the other productive factors grind to a standstill. And yet, paradoxically enough, mining is one of the most well organized and planned ventures one can possibly think of. It employs a team of highly trained technicians that include geologists, surveyors, all classes of engineers, chemists, perhaps even explosives experts, and a number of others whose efforts are all directed towards making an uncertain venture more certain. And so, mines have the mill capacity to tell how much production potential is possible under assumed conditions. There are assigned production targets for given periods, and provisions are made such that the progress of operations is carefully supervised and recorded at every stage.

Still, mining experts have not come around to fragment production as the consequence of say 20% reserves, 15% capital, 10% labor, 15% technology, etc. Many details remain which cannot be pinned down, isolated or quantified. However, I do not suppose that this is reason enough to beg off from speaking, even just in part, in the language which this audience best understand; that is, in statistical terms. Besides I don't suppose that you are about to admit, as I am willing to, that a model, nearly approximating reality even in the uncertain realm of mining, is that impossible. And so, with the help of my colleague here, Mr. Teodorico Abrigo, who is statistician in my office, we have prepared a model of the production function of a mining company engaged in the production of mercury metal.

According to this model, which was based on actual production figures for the last ten years $Y = f(X_1, X_2, X_3)$

CURVE FITTING OF MERCURY PRODUCTION

YEAR	Y	X_1	X_2	X_3
1956	3.02	37.39	6.80	1.35
1957	3.36	49.01	5.78	1.57
1958	3.39	64.28	4.60	1.85
1959	3.51	63.51	4.97	1.83
1960	3.06	64.15	4.31	1.85
1961	3.17	67.07	4.22	1.84
1962	2.76	72.47	3.46	1.84
1963	2.65	75.14	3.38	1.70
1964	2.49	77.60	2.99	2.07
1965	2.38	83.60	2.54	2.23

$$Y = f(X_1, X_2, X_3)$$

where

Y = output or production in thousand flasks
X_1 = mill tonage in dry short tons
X_2 = mill grade in pounds per day short ton
X_3 = capital in million pesos

It has been possible to reduce the variables in the equation into these 3 sectors, since mill tonage is based on definite quantities of reserves, labor, and equipment; mill grade is defined as the metal content of mill tonnage, and capital includes all costs involved.

The Cobb-Douglas function is non-linear. However, it can be transferred with ease into a linear function by converting all variables to logarithms. In logarithms, the associated linear function is:

$$\log Y = \log A + \alpha \log X_1 + \beta \log X_2 + \sigma \log X_3$$
$$\text{or } Y' = A' + \alpha X'_1 + \beta X'_2 + \sigma X'_3$$

Normal equations:

$$(X')' (X') \underline{b} = (X)' (Y')$$

$$\underline{b} = [(X')' (X')]^{-1} [(X')' (Y')]$$

$$[(X')'(X')] = \begin{bmatrix} 10 & 18.05579 & 6.16185 & 2.54738 \\ 18.05579 & 32.697735 & 11.011820 & 4.650402 \\ 6.16185 & 11.011820 & 3.951869 & 1.508650 \\ 2.54738 & 4.650402 & 1.508650 & 0.681519 \end{bmatrix}$$

$$[(X')'(Y')] = \begin{bmatrix} 4.70558 \\ 8.466101 \\ 2.955735 \\ 1.183550 \end{bmatrix} \qquad \underline{b} = \begin{bmatrix} A' \\ \hat{\alpha} \\ \hat{\beta} \\ \hat{\sigma} \end{bmatrix}$$

Applying the Abbreviated Forward Procedure, we have:

10	18.05579	6.16185	2.54738	4.70558	41.470600
	32.697735	11.011820	4.650402	8.466101	74.881848
		3.951869	1.508650	2.955735	25.589924
			0.681519	1.183550	10.571501
10	18.05579	6.16185	2.54738	4.70558	41.470600
1	18.05579	0.616185	0.254738	0.470558	4.147060
	0.096580	−0.113887	0.050906	−0.020621	0.003404
	1	−1.179199	8.527086	−0.312642	0.035245
		0.020734	−0.000979	0.020621	0.040376
		1	−0.047217	0.994550	1.947333
			0.005727	0.001749	0.007476
			1	0.305395	1.305395

The forward solution has reduced the normal equation to the following:

$$\begin{bmatrix} 1 & 1.805579 & 0.616185 & 0.254738 \\ & 1 & -1.179199 & 0.527086 \\ & & 1 & -0.047217 \\ & & & 1 \end{bmatrix} \begin{bmatrix} A' \\ \hat{\alpha} \\ \hat{\beta} \\ \hat{\sigma} \end{bmatrix} = \begin{bmatrix} 0.470558 \\ -0.312642 \\ 0.994550 \\ 0.305395 \end{bmatrix}$$

$\sigma = 0.3054$

$\beta = 0.994550 + 0.04722(0.3054) = 1.009$

$a = -0.31264 + 1.1782(1.009) - 0.52709(0.3054) = 0.7162$

$A' = 0.47056 - 1.80558(0.7162) - 0.61618(1.009) - 0.2547(0.3054)$
$= -1.52212$

Hence estimated model

$$Y' = -1.52212 + 0.7162X'_1 + 1.009X'_2 + 0.3054X'_3$$

or

$$\hat{Y} = 0.3328\ X_1^{0.716}\ X_2^{1.009}\ X_3^{0.305}$$

Conclusions:

1. As evidenced by the sum of the exponents the firm is subject to increasing returns to scale—in production. This means that with assured demand and prices for its products, the firm will increase its profits as it increases production.

2. Furthermore, as each input (variable) is increased by 10 per cent, the output is increased by 21.35 per cent. This can be easily seen by substituting the increased input in the model

X_1 increased to $1.10X_1$

X_2 increased to $1.10X_2$

X_3 increased to $1.10X_3$

Model: $\hat{Y} = 0.3328\ X_1^{0.716}\ X_2^{1.009}\ X_3^{0.305}$

$$\hat{Y} = 0.3328(1.10X_1)^{0.716}(1.10X_2)^{1.009}(1.10X_3)^{0.305}$$
$$= 0.3328(1.10)^{2.03}\ X_1^{0.716}\ X_2^{1.009}\ X_3^{0.305}$$
$$= 1.2135(0.3328)\ X_1^{0.716}\ X_2^{1.009}\ X_3^{0.305}$$

3. The model indicates that the greatest increase in production can be obtained by increasing mill grade. This may be done by undertaking exploration for high grade reserves or making use of available lower grade reserves. Either may

necessitate additional capital and possibly, expanded mill capacity which goes to show that there is a high degree of correlation between the three factors of production in our model.

ANALYSIS OF VARIANCE

Source of Variation:	d.f.	SS	MS
Due to $X'_1 X'_2 X'_3$	3	0.03048	0.01016
Error	6	0.00050	0.00008
Total	9	0.03098	

SS (due to $X_1{}^1X'_2X_3$) = (−0.030195) (−0.312642) + (0.020621) (0.994550) + (0.001749) (0.305395) = 0.03048 with 3 d.f.

$$\text{SS (Total)} = 2.24523 - \frac{(4.70558)^2}{10} = 0.03098 \text{ with } 9 \text{ d.f.}$$

SS (Error) = 0.03098 − 0.03048 = 0.00050 with 6 d. f.

$$F = \frac{\text{MS (due to } X'_1X'_2X'_3)}{\text{MS (Error)}} = \frac{0.01016}{0.00008} = 127.00 \text{ with } 3,6) \text{ d.f.}$$

$$\left.\begin{aligned} F_{0.05} &= 4.76 \\ F_{0.01} &= 9.78 \end{aligned}\right\} \text{(with 3,6) d.f.}$$

So that a highly significant association exists between these three variables.

$$R^2 = \frac{SSR}{SST}(100) = \frac{0.03048}{0.03098}(100) = 98.39\%$$

= Multiple correlation coefficient, meaning that the error explains only 1.161%.

This model of a production function may also double as a supply function provided, as earlier pointed out, price and

demand factors are held constant, as sometimes happens in the shortrun. Normally, however, supply is a function of production and price.

$$S_m = f(y\text{-}p)$$

S = supply
m = the firm
Y = production
P = price

Without further statistical computations, if we apply this equation to our model, we will find that with increased demand and a favorable price for mercury metals, the firm will do everything in its capacity to increase production and take advantage of the premium price. However, since our production model shows declining rate of production, this may not be immediately possible. Instead, since mill grade has been found to be the most highly correlated factor in production, the mining firm will, therefore, under the price incentive be motivated to intensify exploration for higher grade ores or, failing this, utilize marginal ores to add to production. Even with a continuation of the decline in production, the firm will find it profitable to operate provided prices are up. As soon as prices decline and the trend in production does not change, the firm will cease operation at the point where returns no longer cover fixed costs. As the trend in production is reversed, however, possibly as new discoveries of high grade deposit are made, the firm can then afford even lower prices. Maximum profitability is attained with increase in both production and prices while minimum returns are likely with a decline in both.

In the non-metallic sector production is a function of reserves, capital, labor and demand. Since the typical firm in this group is small, one does not think in terms of mill tonnage. Reserves and labor replace this item in the metal group and similarly, there is no mill grade to speak of. Production is, however, confined to the local market and demand is in-

deed a central factor in production. It is quite difficult to construct either a production or supply model for this group because of the paucity of data. However, except for the charges involved in production, the relationships described between factor in the production and supply function of the metals group also apply.

12. **Present Pattern of Utilization of Mineral Resources.** The pattern of utilization of our country's mineral resources reveal certain points of strength as well as weakness. A cause of considerable concern is the fact that for nearly a century now we have not made any significant change from the colonial pattern of exporting our metals in their raw or semi-finished form. This puts us in the losing end of trade bargains. For this, we are short-changed, as evidenced in the unfavorable terms of trade which has come to characterize our mineral transactions with the rest of the world year in and year out. A glaring example is that of our iron exports. While we export iron ores at a reasonably low price per metric ton (₱36.70) we import a ton of steel 24 times this price (₱465.31). The facts are that in the metals industries, costs are high in the mining stage and prices low for the semi-finished products resulting there while at the smelting and refining stage costs are relatively low and prices obtained for the resulting products relatively high. Consequently, our position as exporters of metals of the pre-smelting and pre-refining variety is disadvantageous and indefensible. We lose out of the competition for substantial revenues from the premium prices received by metal manufacturers while our perfectly competitive raw materials are shipped and sold at comparatively low prices in foreign markets. And, as it is in the terms of trade, so also in the balance of trade. A typical example is that of transactions in base metals, metalliferous ores, crude minerals, non-ferrous metal scrap, non-metallic mineral manufacturers and manufacturers of metals in fiscal year 1965. The country's exports amounted to ₱313,047,346 whereas its imports were ₱413,473,457 showing up a deficit of ₱100,426,111.

But what is perhaps of more far-reaching significance is the fact that minerals are wasting assets and once depleted are not so easy to replace. As we continue to dig into the bowels of the earth to enhance the supply of essential materials in developed economies, we may unwittingly be subtracting irreplaceable amounts which may prove critical to our own industrialization efforts in the years ahead. While it is widely bruited about that the Philippines is highly and extensively minerallized there has been no conclusive study on the extent of deposits and how much of these have so far been used up. There is, as a matter of fact urgent need for such a study so that we may learn to use our resources more purposefully and sparingly, so that waste may be avoided and priorities assigned to uses that will best promote our national objectives.

On the other hand, a source of strength is the continued expansion of the range of mineral resources which have been brought to the fore and the increasing array of uses to which we have learned to put them. This is particularly true of the non-metallic group which today is increasingly utilized to gradually replace traditionally imported products. In recent years, it has been possible to manufacture fertilizer out of such materials as guano, sulfur, phosphate rock, and pyrite. This has enhanced, and will prove of no small help, in our effort to attain self-sufficiency in agricultural production. Cement production has likewise gotten a boost from greater exploration and expanded output of limestone, shale, gypsum, siliceous sinter and related minerals and this has massively reduced our imports of cement. It is, as a matter of fact, anticipated that as soon as planned operations come into production, imports will altogether be done away with. Excellent deposits of kaolin, feldspar, silica sand, and magnetite have given the ceramics and glass industries a fine start and continuing supply of local marble, marbolized limestone, dimension stone, perlite, sand, and gravel are positive factors in sustaining the construction boom.

A United-Nations-assisted program is presently engaged in studying better ways of utilizing our extensive deposits of coal in Malangas, Zamboanga del Sur, with particular emphasis on its possibilities as coking material in the manufacture of steel.

There is also hope that soon we may be able to develop and process locally our nickeliferous laterite deposits in Nonoc and Bucas Grande Island in Surigao. This is at present the subject of negotiations between the government and mining firms interested in developing the deposits. Also, two integrated steel plants that have long been in the blueprint stage are awaiting government assistance and technological breakthrough to come into the much-awaited production of steel manufactures. Copper and aluminum smelting plants are also now in the thinking stage and although it is a long way from here to actual production, we can take comfort in the thought that the starting point from which more concrete programs must necessarily follow are being laid now.

Unquestionably, it will take an uncanny mixture of forces technological, economic, social, political, etc. to bring about our hopes for industrialization and realize the maximum utilization of our mineral resources. How and when this will happen, we do not know. Unfortunately, this is a little too far beyond statistical estimation. But Filipinos are an optimistic lot and I am sure many are in their minds assured that this will one day happen. I would like to think so too, without having to justify my stand statistically.