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Note on Analyzing BGIE Data

Before one turns to data exhibits in BGIE cases, one should ask, "What information is needed in order to evaluate this case?" This means that one should first form hypotheses concerning the problem or likely outcome of the case, then search for supporting or contrary data in the exhibits. As part of this evaluation, one should use the exhibits to verify or refute important assertions made in the text of the case itself. The first section of this note will proceed through a series of questions one should consider when analyzing data. We will use examples from the exhibits in the "**Inauguration of Franklin D. Roosevelt**" (Case Number 9-798-051) for some calculations. The five questions discussed in this note are:

1. Which data should be used?
2. Which time period should be used?
3. Which form of the data should be used?
4. How does one evaluate the data?
5. What are the limitations of the data?

Answers to these questions will often form the foundation for valuable classroom contributions, since this is the raw material on which empirical arguments are made.

Which Data?

The many exhibits which often support the text of BGIE cases can be classified into various categories. Data may be indicators of performance, policy,[1] or context. Some data may serve more than one purpose. For example, budget deficits may be an indicator of fiscal policy, but some students might want to classify them as an indicator of performance or context as well.

Performance data are often the most abundant since there are so many different aspects of performance one can consider. We will classify performance data into broad generic categories: output performance and price performance, for example. A country does not exist in a vacuum: the output and prices for a particular country are affected by the actions of other countries. Therefore, we must consider the external balance between one country and the rest of the international community. These data will be classified as indicators of external performance.

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[1] Sometimes data will indicate the strategy which a country is pursuing, i.e., both its goals and its policies, but more often this must be derived from the text of the case in combination with the exhibits. Therefore, we will speak of data as "policy indicators" rather than the more comprehensive "strategy indicators."

Assistant Professor Michael G. Rukstad prepared this note as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation. This note was revised by Professor Louis T. Wells.

The broadest measure of output performance is real GNP (or real GDP), which we will describe in detail below. This should be the first indicator one examines to assess the general direction of the economy. Exhibits sometimes give GNP in constant prices (real GNP). Other measures are more detailed and include the components of GNP (consumption, investment, government spending, net exports) and sectoral production (agriculture, mining, manufacturing, services).

One could also include, as measures of performance, indicators such as unemployment and capacity utilization. The broadest measure of price performance is the GNP deflator, a price index that measures the movements in the general price level for all goods and services. Other measures are the consumer price index (CPI) and the wholesale price index (WPI).[2] Wage or earnings indexes, productivity changes, and profit margin data might also be considered as performance measures.

In addition to performance data, cases usually provide policy data as well. Policy data suggest future performance. Their impact depends on the context, past events and performance, and especially the goals that a nation is pursuing. Common examples of policy data are money supply figures, government budget figures, and debt figures.

Further insights can be gained from contextual data, such as public opinion polls, demographic data, sociological characteristics, and so forth. Often the context will help to explain certain policy decisions or place performance in perspective. For example, policy decisions are affected by contextual factors such as a strong showing in a recent election, a large social group which stands to benefit from the decisions, a small collusive group of decision makers, or strong ideological beliefs of the population. In addition, contextual data place performance figures in perspective. For instance, they allow one to compare GNP growth rates to population growth rates in order to determine how the average individual is faring.

Which Time Period?

Once we decide which data are useful, we need to determine which time period best tests our intended arguments. One method is to identify key events or policy changes that define the end points of the time period. For example, we may be interested in real GNP growth during World War I (1914-1919) which could be compared to the postwar years(1919-1929) before the Great Depression, which started in 1929. There are, however, problems with defining these periods. In particular, the 1919-1929 period aggregates over an economic depression in the early 1920s and sizable booms (see the annual growth rates of real GNP in Exhibit 3). Notice that real GNP fell significantly in 1920 and 1921. On the other hand, 1922, 1923, 1925, and 1929 were boom years. If we simply reported the average growth rate of real GNP of this period, it would be 3.4%, which smoothes over significant business cycles.

This suggests another method for choosing time periods—one could let the peaks and troughs of the data choose the endpoints of the period. Possibly one could divide the period into the postwar recession (1919-21 during which real GNP declined at approximately 6.5% per year) and the subsequent recovery (1921-29, during which real GNP rose at a 6.0% average rate). This division is an improvement over the 1919-1929 period which was initially suggested. However, keep in mind the benefits of examining longer time periods since they concisely summarize data that would become cumbersome if reported for each individual year.

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[2] A price index is a weighted average of the individual prices of goods and services. The difference between the GNP deflator and the CPI is the weights which are used. The GNP deflator uses the proportion of goods and services in the GNP as the weights assigned to individual prices. The CPI uses some hypothetical basket of goods purchased by consumers as the weights. These measures will not give the same answer and neither is "more correct" than the other. The choice depends on what one is examining.

Finally, one should try to reconstruct the frame of mind with which policy makers and other contemporary observers viewed data. In addition to asking which data were available to the policy makers, one should consider what time horizon they were concerned with when evaluating policy. If we are attempting to explain how policy reacts to sudden poor performance, we should focus on more recent and more highly visible signs of that performance, rather than long time trends. For an evaluation of the events immediately before and during the Great Depression, see the excerpts from the Economic Reviews of the U.S. Secretary of Commerce reproduced in Appendix 1 in the cases on Herbert Hoover (A) and Herbert Hoover (B). Notice which comparisons are made in the report and what they indicate about the time frame with which these reports were written.

Which Form of the Data?

If our answer to the first question, "Which data should be used?" is Exhibit 4 which shows nominal and real GNP, and if the answer to the second question, "Which time period should be used?" is 1929-1930, then we still must determine in what form we will evaluate these data. This section will discuss three important considerations regarding the form of the data. Should we present:

1. Nominal or real data?
2. Levels or growth rates of these data?
3. Ratios of these data to other data?

One crucial distinction is between nominal and real data. In column 1 of Exhibit 4 we are given "GNP in current prices," which is nominal GNP. We can define GNP[3] as the "market value of all final goods and services produced by nationals of a country within a given time period." This was conceptually equivalent to taking the quantity of every good and service produced and multiplying each by its current market price. Real GNP, however, is determined by taking the same quantities of every good and service produced and multiplying each by a base year price. The base year used in column 3 of Exhibit 4 is 1958. This technique allows us to add quantities of apples and oranges and all other commodities in a consistent manner for comparison over time. One should see that nominal GNP may change due to changes in either the current market price or the quantities produced, whereas real GNP will change only if the quantities produced change.

The general relationship between nominal GNP and real GNP can be expressed in the following form:

$$\text{Nominal GNP} = \text{Implicit Price Deflator} \times \text{Real GNP}$$

$$GNP = P \times Q$$

The "Q" used in all notes for this course will indicate real GNP unless specified.

If we examine Exhibit 4, we should be able to verify this relationship using actual data. The nominal GNP for 1930 is shown in the column for 1930 as 49.3, which means that the price level in 1930 was 49.3% of the price level of the base year, 1958 (which equals 100). The real GNP for 1930 is shown in the third column to be $183.5 billion. When we multiply the deflator (in its decimal form)[4] and real GNP together, we get:

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[3] Whenever we use the term "GNP" without using the qualifier "real," we will be referring to "nominal GNP."

[4] The convention is to express the deflator not as the decimal form that one uses in the equation (.493 in our example), but as the number times 100 (or 49.3). Likewise, the base period is not 1, but 100.

Deflator x Real GNP = Nominal GNP
.493 x 183.5 = 90.4655 billion

The nominal GNP shown in Exhibit 4 is 90.4, which is very close to the nominal GNP we calculated.

This relationship between nominal and real variables is completely general. For example, if we wanted information on the price level of investment goods in 1930 compared to the base year, we could use this same relationship:

Nominal Investment = Investment Deflator x Real Investment

Exhibit 2 gives us nominal investment in 1930 of $10.1 billion and real investment in that year of $27.4 billion. Thus we can rearrange the above equation to get:

$$\text{Investment Deflator} = \frac{\text{Nominal Investment}}{\text{Real Investment}}$$

$$.369 = \frac{10.1}{27.4}$$

This means that the prices of investment goods in 1930 were 36.9% of prices in the 1958 base year. Notice that between 1930 and the 1958 base year, the investment price index indicates that the prices of investment goods rose more than the general price index during that same period.

A second distinction we must make in deciding what form of the data to use is whether levels or growth rates of the levels are more helpful. It is sometimes difficult to compare, for example, GNPs of different countries measured in different currencies using different base periods. On the other hand, it is often useful to examine growth rates of GNP (and growth rates of other variables). Growth rates of GNP provide an important measure of the performance of an economy.

The growth rate (i.e., percentage growth rate or compound growth rate) of a variable over one period of time — for example, real GNP (Q) for the one-year period from 1929 to 1930 in Exhibit 2 — is given by the following equivalent expression:

$$\frac{\Delta \text{ Real GNP}}{\text{Real GNP}} = \frac{Q_{1930} - Q_{1929}}{Q_{1929}} = i$$

$$\frac{-20.1}{203.6} = \frac{183.5 - 203.6}{203.6} = -.098 \ (= -9.8\%)$$

Notice that Exhibit 3 gives the computed average annual growth rates of real GNP for all years. Now suppose we were examining the five-year period, 1924 to 1929. One way to describe the period is to say that the annual growth rate of real GNP was 8.4% for 1925, 5.9% for 1926, 0% for 1927, 0.6% for 1928, and 6.7% for 1929. Or we could ask what the average annual compound growth rate (CGR) was over this five-year period. From Exhibit 3 we can see that the answer is 4.2% but we will not always have computed tables (such as in Exhibit 3). Therefore, compound growth rates can be computed from the following formula[5] (i), using the original data from either Exhibit 2 or 4:

[5] Some students may recall another formula for compound growth rates: Future Value = Present Value x e^{in}, where e = 2.718…. The difference between the two formulas is that the formula in the text assumes growth is

$$\text{Future Value} = \text{Present Value} \times [1 + i]^n$$

$$\text{Real GNP 1929} = \text{Real GNP 1924} \times [1 + i]^5$$

$$203.6 = 165.5 \times [1 + i]^5$$

$$i = (203.6/165.5)^{1/5} - 1 = 0.0423$$

Most calculators will compute the compound growth rate, i (which equals 4.23% in this case), once the future value, the present value, and the number of periods, n, have been entered into the calculator.

We gain an intuitive understanding of the concept of compound growth if we examine the case of compound interest on savings. Imagine we have $100 of savings which will be "growing" at a 10% rate compounded annually (i.e., which earns 10% interest compounded annually). After one year we would have $110 using our CGR formula:

$$\text{Future Value} = \text{Present Value} \times [1 + i]^n$$

$$\$110 = 100 \times [1.1]^1 \text{ after 1 year}$$

$$\$121 = 100 \times [1.1]^2 \text{ after 2 years}$$

During the second year, the $110 would grow to $121 since we would earn another $10 interest on the principal and $1 interest on last year's interest. It is this last component, earning interest on the past accumulated interest, which makes this "compound interest" or "compound growth." If we only earned $10 of interest on the principal every year and earned no interest on the accumulated interest, then we would have "simple interest" or "simple growth." When we refer to "growth rate" in BGIE, we will mean "compound growth rate."

One useful approximation of the growth rate of nominal GNP is the sum of the growth rates of the price level and of real GNP, even though we multiply the price level by real GNP to get nominal GNP. In symbols we have:

$$GNP = P \times Q$$

$$\frac{\Delta GNP}{GNP} \cong \frac{\Delta P}{P} + \frac{\Delta Q}{Q}$$

For example, if we compute the compound growth rate for nominal GNP, real GNP, and the implicit deflator for the one-year period from 1929 to 1930, we get:

$$\frac{\Delta GNP}{GNP} \cong \frac{\Delta P}{P} + \frac{\Delta Q}{Q}$$

$$-12.32 \cong -2.6 + (-9.8)$$

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only compounded once per period whereas the formula here assumes continual compounding over the period. The formula in the text is the algorithm used by most calculators.

This relationship holds anytime one variable (C) can be expressed as a product of other variables and the changes are relatively small.

Then we can write the growth rate of C as a sum of the growth rates of the other variables:

$$\frac{\Delta C}{C} \cong \frac{\Delta A}{A} + \frac{\Delta B}{B}, \quad \text{when } C = A \times B$$

The distinctions between real and nominal and between levels and rates of change are useful considerations in determining what form of the data one should use. Another consideration which will be discussed here is the formation of ratios of two variables for comparison across countries and across time. In fact, our real GNP definition is one example of such a ratio. For example, the real GNP figures (Exhibit 2), may be growing , but the population (in column 1 of Exhibit 5) may be growing more rapidly. Thus it is often useful to examine real GNP per capita. Again we could calculate real GNP per person in one year, say 1927, and calculate it in another year, say 1928, and then compute the growth rate. But since we are interested in the growth of GNP per capita over that one-year period, we could subtract the population growth rate from the real GNP growth rate. In this case, the growth rate of real GNP per capita between 1927 and 1928 can be calculated using real GNP data from Exhibit 2 and population data from Exhibit 5.

$$\frac{\Delta(\text{Real GNP/capita})}{\text{Real GNP/capita}} \cong \frac{\Delta\text{Real GNP}}{\text{Real GNP}} - \frac{\Delta\text{Population}}{\text{Population}}$$

$$-0.63 \cong 0.6 - 1.23$$

Even though real GNP was growing over the year, it was not growing as fast as population. By forming a new variable, real GNP per capita, we have more information on which to evaluate performance. Of course we could have directly calculated the growth in real GNP/capita (using column 4 of Exhibit 4), but these data will not always be available.

Another illustration of ratios is the ratio of the component expenditures to GNP, such as:

$$\frac{C}{GNP}, \quad \frac{I}{GNP}, \quad \frac{G}{GNP}, \quad \frac{X}{GNP}, \quad \text{and} \quad \frac{M}{GNP},$$

For example, in Exhibit 2 we could calculate the percentage contribution of total investment to real GNP for 1929 and 1932. In 1929, total investment accounted for 19.8% of real GNP but this ratio declined to 3.2% in 1932. These ratios can be meaningfully compared across countries and over time.

GNP is the denominator in several frequently used ratios. For example, the government budget deficit, trade deficit, or government debt are often expressed as percentages of GNP. This can be useful for comparisons across countries and over time.

How to Evaluate It?

Often the only way that we can evaluate data is by comparison. In the rest of this section, we will discuss four comparisons that might be made. We could compare the data with

1) a country's goals,
2) the past,
3) other countries,

4) theory.

One can compare actual performance to the goals which the policy makers set for themselves. This will give us some perspective on past performance as well as insight into future policy moves. If the U.S. government set a goal of 6% real GNP growth over a certain period of time, but achieved only 4% growth, we can certainly make the evaluation that actual growth fell significantly short of expectations. Of course, the expectations may have been unjustified. Often, goals are more amorphous than this example, and subject to wishful thinking; thus we need other benchmarks for comparison.

The most frequent comparison is with the past. If the long term, say 30-year, trend for real GNP is only 2.5%, then the 4% growth now is significantly better than the past. The strength of this evaluation rests on the comparability of the time periods. If the 4% was achieved during a period of war, then it should not be evaluated against a period of depression. Sometimes it is difficult to find comparable historical periods for comparison. For example, the periods of the World Wars or the Great Depression are in classes by themselves, but useful comparisons might be made to the Korean War or the Depression of 1921.

Another form of comparison is with other countries at the same period in time and in somewhat similar circumstances. Cross-national comparison is at the heart of BGIE case analysis. As the BGIE course progresses, one will develop an intuition for evaluating data across countries.

A final method of comparison is to compare actual data to predictions of theory. For example, actual real GNP growth of 4% may be compared to potential real GNP growth which could be calculated for other observed data such as the growth in the capital stock and the labor force. If we determine that potential real GNP is growing at 5%, then we have a theoretical basis for evaluating the actual real GNP growth rate.

What Limitations?

There are limitations to the conclusions one can draw from the data presented in the exhibits of BGIE cases. We will focus on three considerations: (a) problems with the data themselves (b) problems due to excluded factors, and (c) problems of inference from the data.

All data that we will use are subject to measurement errors and successive revisions; even data from more distant historical periods are still revised today. The older statistics have an additional problem since they are often estimated based on primary data that were collected for other purposes.

Even if the data were completely accurate and readily available, there are other limitations to interpreting the data. There is the problem of excluded and nonquantifiable factors. For example, we use GNP or GNP per capita as a measure of the well-being of individuals in a society. But GNP excludes many items that do not have a "market value." How do we value the negative aspects of the pollution resulting from the production of GNP? How do we value the positive aspects of the services of house spouses and leisure labor? So we must use the data as a first guess which must be modified by quantitative approximations or by qualitative judgments assessing the importance of excluded factors. Non quantifiable factors, such as worker motivation, cultural standards, or innovative ability should not be excluded or relegated to secondary status in the face of more concrete factors.

Finally, there is a problem common to all inferences drawn from nonexperimental data. We can observe only that two variables appear to be related to each other. We cannot prove that changes in one variable cause changes in the other. There may be some third factor responsible for the relationship we observe. This means that we must hypothesize reasonable explanations for the

behavior we observe and then check whether these explanations are consistent with the data. Of course, there may be a number of competing explanations which are all prima facie reasonable. If so, we must recall other similar cases from different countries or different time periods to determine which explanation has the most universal power to explain and predict.