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**Estimate of Capital Stocks, Depreciation and  
Formation of Gross Fixed Capital in Mexico**

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## SUMMARY

This document presents the evolution of the characteristics of the survey of capital stocks, depreciation and formation of gross fixed capital, from the first study carried out in 1969, to the description of the study currently under way: defining variables, types of assets, sampling framework, assessment and coverage.

The variables studied are gross and net capital stocks, annual and accrued depreciation of assets, the formation of gross and net capital defined in keeping with SNA70. The types of assets classified are: buildings, constructions and facilities; machinery and operating equipment; transportation equipment; and office furniture and equipment.

The sampling framework is that of 25,000 companies, of which a total sample of 2,379 companies was obtained, 2,070 selected by sample and 309 by census. The assessment is based on current and constant replacement costs. Coverage includes 72 branches of economic activity, exclusively considering the private sector. Similarly, the main operation procedures are described: surveying, validation and data processing, in addition to estimating the average service lives of the assets.

The surveys are performed by means of direct interviews; validation involves a manual process and an automatic process; data processing makes it possible to use a variable amount of questionnaires and assess the accuracy of the estimates.

The service life is calculated by using the averages obtained directly from the responses to the questions on declarations and retirements contained in the questionnaire. Lastly, we present the methodology of the estimates at current and constant prices for the cases which do not include abnormal retirement, as well as for those which do.

## ESTIMATE OF CAPITAL STOCKS, DEPRECIATION AND FORMATION OF GROSS FIXED CAPITAL IN MEXICO

### 1. BACKGROUND<sup>1</sup>

In 1969 for the first time, a system was published for measuring formation, depreciation and capital stocks for 45 types of economic activity and for the government sector. The estimates cover the 1950-1967 period at current and constant 1960 prices.

In 1973, a project was started for using direct sampling to measure the formation of capital and capital stocks, depreciation and changes in inventories for the 1960-1975 period. The information is now presented for 50 branches of economic activity of the business sector and by asset class, as well as the price indexes by asset class used in the calculations. The catalogue of economic activities was then made up of 55 branches. The branches of Agriculture, Livestock's, Forestry, Hunting and Fishing and the General Government were not considered for the project.

In 1980 a new sample survey was carried out to measure the gross fixed investment expenses incurred by the business sector during the 1975-1980 period. The directory of companies is obtained basically from the register of major taxpayers of the Ministry of Finance for 1976. The companies are classified in keeping with the catalogue of 72 branches of economic activity of the System of National Accounts.

The data provide information at current and constant prices at the level of the 66 branches of economic activity and are disaggregated in keeping with the different types of capital assets: construction and facilities, machinery and transportation equipment and office equipment. In addition, several Laspeyres type price indexes were listed, base 1970 = 100, measuring the variances in the "basket" prices of capital assets, representative of the group of assets used in each one of the economic branches.

In 1988, was published the methodology of the project destined to obtain a series of historical annual data on capital stocks, depreciation and formation of capital for the years of 1975-1987, structured in keeping with the classification of activities of the System of National Accounts and linked to data existing for the 1960-1975 period. The sampling design is basically the same as what was used in calculating gross fixed investment for the 1975-1980 period. The difference in the results vis-a-vis this last study is due to the fact that the investment is calculated as an "expense", whereas capital formation is estimated using the concept of "declaration".

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<sup>1</sup> The sources used in preparing this document are methodological documents of the Bank of Mexico.

In order to link the results of the survey on capital stocks, formation and depreciation for the 1975-1987 period with the 1960-1975 survey, it was necessary to reclassify the companies of the 1960-1975 survey in keeping with the 72 branches of economic activity of the System of National Accounts and of the input-product table. Thus, there is a series of data for each branch of economic activity covering the 1960-1987 period at current and 1980 prices, as well as the price indexes for each type of capital good in each branch.

Lastly, there is a system which makes it possible to provide a year-to-date up-date of the series.

## **2 CHARACTERISTICS OF THE SURVEY OF CAPITAL STOCKS AND CAPITAL FORMATION (1975-1996).**

As was previously mentioned, the Survey of Capital Stocks, Depreciation and Capital Formation for the 1975-1996 period is developed by taking into consideration the experiences of the Survey of Capital Stocks and Capital Formation, 1960-1975 and is based on the design of the 1975-1980 Gross Fixed Investment Survey.

Variables studied:

The variables studied are: the gross and net capital stocks, annual and accrued depreciation of assets and gross and net capital formation.

Types of assets:

The types of products or assets are classified as:

- Buildings, constructions and facilities
- Machinery and operation equipment
- Transportation equipment and,
- Office furniture and equipment

Sampling Framework:

The sampling framework is made up of a directory of companies considered by the Ministry of Finance to be major taxpayers, it is supplemented by the directory of the Industrial Census and specialized directories.

The result is a framework of 25,000 companies which was divided into two subpopulations: one made up of 17,000 medium-sized companies and the other made up of 8,000 large companies. The companies are stratified based on the value of their assets, according to data provided by the Ministry of Finance.

The design and selection of the sample was the result of sampling for both types of subpopulations. For the subpopulation of medium-sized companies, 770 establishments were selected by means of systematic stratified sampling, assigned in proportion to their size. Thus, the selection was carried out at the branch level and the number of establishments selected for each one was determined based on importance.

For the subpopulation of large companies, 1,300 were selected by means of a random stratified sampling of Neyman designation (the value of fixed assets of each company is stratified). The selection was carried out by branch, at the level of each one of the strata, obtaining a variable sampling fraction for each one.

On the other hand, due to their importance, 14 branches of economic activity were censused, amounting to a total of 309 companies. Of the total number of companies, 126 belong to the subpopulation of medium-sized companies and 183 belong to the subpopulation of large companies.

In summary, of a total sampling size of 2,379 companies, 2,070 were selected by sampling and 309 by census. The sample covers a total of 68 branches of activity, of which 14 were censused and 54 were selected by sampling.

Assessment:

The assessment is carried out based on the replacement value (current and constant). Thus, the survey asks that the declarations and retirements of assets be listed at their historical value (or acquisition value) and later, once the information has been gathered, the price indexes of the "baskets" or capital assets are applied by type of asset, in order to up-date the information to the year in progress or to the base year, as applicable.

### **3. SURVEYING.**

For surveying "direct interviews" are performed, whereby the interviewers personally explain to the entrepreneurs the concepts contained in the questionnaire for the purpose of reducing errors in interpretation, minimizing non-reply, as well as for recording changes in activity, mergers or disappearance of companies subject to investigation. The interview schedule is designed in keeping with the optimization criteria, in an effort to make the most efficient use of the available resources.

The average yearly response rate of the companies is 75%. However, if we consider the subsample of large companies, the response rate is 85%.

### **4. VALIDATION AND DATA PROCESSING.**

Validation.

In order to validate the information there is a system consisting of two stages: the first stage is manual and is for the purpose of reviewing the classification of the company and comparing the information recorded. The second stage is automatic and is for the purpose of storing data on electronic media. If a questionnaire is rejected, the errors are corrected and the cycle is started anew.

Data Processing.

Data processing has the following characteristics:

- The results can be estimated using a variable number of questionnaires.
- The evolution of the accuracy of estimates can be observed, and it is possible to decide at which point the results can be used although all the responses may not be available.

On the other hand, the structure of the processing system made it possible to re-estimate the 1960-1975 survey and link the results to the 1975-1987 survey estimates.

The processing system provides results based on the estimates of gross fixed

capital formation in each branch. Thus, the first calculation level consists of estimating the gross formation of capital of each one of the strata of companies which make up the branch. The data by strata are inferred based on the sampling measures and on the total population of companies.

Formally:

$$\frac{\hat{\bar{FB}}_h}{FB_h} = \frac{\sum_{i=1}^{n_h} FB_{ih}}{n_h}$$

$$\hat{FB}_h = \frac{\hat{\bar{FB}}_h}{FB_h} N_h$$

$$\hat{FB} = \sum_{h=1}^k \hat{FB}_h$$

Where:

$FB_{ih}$  = gross formation of capital of company  $i$  belongs to stratum  $h$ .

$n_h$  = number of companies in the sample of stratum  $h$ .

$\hat{\bar{FB}}_h$  = estimator of the mean gross formation of stratum  $h$ .

$N_h$  = number of companies of stratum  $h$ .

$FB_h$  = estimator of gross formation of stratum  $h$ .

$k$  = number of strata in the branch of economic activity.

$FB$  = estimator of gross formation of capital in the branch.

The prices indexes of the different types of capital assets in each branch are based on the representative baskets and weights of the group of domestic and international capital goods used by the companies. The indexes are taken from the system of producer price indexes. For imported goods, specialized international publications and the system of price indexes of U.S. exports are considered.

Service Lives:

The average service life of the different types of assets used in each field of activity are obtained directly from the survey questionnaires: the companies provide information on the years when the goods were declared and retired; this data makes it possible to have a direct estimate of averages.

## 5. PROPOSALS FOR IMPROVING THE SURVEY.

The changes planned for the survey are as follows:

- Increase the conceptual framework to include definitions and classifications of fixed assets considered in SNA93.
  
- Increase survey coverage to include the government sector.
- In addition to the concept of "net declarations" as Gross Formation of Fixed Capital, consider the invest expenditure incurred as an additional indicator.
- Offer additional products to the user of the information by means of the ratio between Investment and Gross Formation of Capital with other economic variables.