Estudios de Economía. Vol. 25 - N° 2, Diciembre 1998. Págs. 251-268

GENERAL GUIDELINES FOR THE DESIGN OF AN INDICATOR OF THE LEVEL OF INDUSTRIAL ACTIVITY*

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Abstract

The interest in the monthly indexes of industrial production is related to the large volume and the cyclical importance of industrial output. Around the 20th of each month, argentine agencies issue estimates of the industrial output for the previous month. This methodological paper describes the possible sources of data, the concepts and classifications used, the different measurements and the process of estimation. It is suggested that the industrial production index can be used in conjunction with other indicators, such as those coming from qualitative surveys, so as to reach a wider understanding of the evolution of industrial output.

Resumen

El interés en los índices mensuales de producción industrial se relaciona con el alto volumen y la importancia cíclica del producto industrial. Alrededor del día 20 de cada mes, las agencias argentinas emiten estimaciones del producto industrial para el mes anterior. Este trabajo metodológico describe las posibles fuentes de datos, los conceptos y clasificaciones usadas, las diferentes medidas y los procesos de estimación. Se sugiere que el índice de producción industrial puede ser usado en conjunto con otros indicadores, tales como aquellos provenientes de encuestas cualitativas para lograr una mayor comprensión de la evolución del producto industrial.

* I am in debt with Abel Viglione (FIEL), Alfonso Martínez (CEA) and Carola Pessino (CEMA) for their helpful comments. Any remaining error is mine.

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1. Introduction

The Industrial Production Index (IPI from now on) is of particular interest for several reasons. First, it measures the evolution of a huge portion of GDP on a monthly basis (in Argentina the industrial sector accounts for 25% of GDP). For that reason it can be used as a reasonable proxy of GDP evolution. Second, industrial output (together with construction) accounts for the bulk of the variation in total output over the course of the business cycle. Third, the index, with its sectorial breakdown, is helpful in illuminating structural developments in the economy. And fourth, the first estimates of the index are released only between 15 and 30 days after finished the month. This permits a monthly following up of the activity level, something that can not be done using the quarterly National Accounts figures which are issued with much more delay.

Only since 1995 Argentina has an *official index* of industrial production (the Monthly Industrial Estimator issued by the National Institute of Statistics and Censuses). The official series starts in September 1993 and extends till the present.

Until that moment the only indexes used by the analysts were those issued by non government agencies and were constructed on the basis of the poor information available. In the United States the Federal Reserve started publishing its IPI regularly in 1919. This is an example of the tremendous catch up Argentina needs to do in the field of statistics compilation.

Section 2 offers a systematic description of the recommended methods for the construction of these indexes. The best possible index construction is analyzed (as well as its practical problems of implementation) and the different measurements of industrial output are discussed. It is also discussed the roll of the weighting base year, the classification system. and the use of census data to weight the components of the index. In the last part, the use of Adjustment Production Factors, the linking of the index and its drawbacks are discussed.

Section 3 deals with the functioning of a System of Indicators of the evolution of industrial activity. For that purpose, the use of Qualitative Industrial Surveys is brought into the analysis. This permits to illustrate how the IPI is much more useful when used in conjunction with other indicators of the industrial situation.

2. The construction of industrial production indexes

2.1 The theory of the production index

2.1.1 *The meaning of production indexes*

To obtain a production index for a sector of the economy several different measures of output must be combined in some way. When, as usual, the basic data are quantity series expressed in different units, a simple aggregation is not possible and some common factor must be introduced to combine the series. *The need to introduce a common factor means that the IPI is not merely a simple aggregate of physical units.*

The most common denominator used to combine the individual series of physical volume is the price of the goods. Multiplying the physical units by their unit prices we obtain value measures that can be compared with similar aggregates for other periods. *When unit prices are chosen as common denominators, the regime of the weighting base period is being defined in terms of its price structure.* In this way, the index numbers of physical production are not pure measures of physical change since the changes in production are measured in physical units but weighted with reference to given a price squeme.

2.1.2 *Choosing the formula*

To compare the output levels between two periods we can use the Laspeyres Quantity Index (Q_L) or the Paasche Quantity Index (Q_P):

(1) $$Q_L = \frac{\sum q_1 p_0}{\sum q_0 p_0} \quad \text{y} \quad Q_P = \frac{\sum p_1 q_1}{\sum p_1 q_0}$$

Generally, a measure of real output with fixed weights of the current period increases less (or decreases more) than one whose weights correspond to a much earlier period. This property, often seen in the construction of index numbers, is explained by the fact that those goods whose production grows fast tend to be those whose prices increase slower (or even decrease). On the other hand, the goods that exhibit a slow production growth tend to be the ones whose prices increase faster. The would in general mean that the changes in prices and quantities are the result of shifts in the offer curve, while the demand curve for the product remains stable. In this case, when the IPI is calculated backwards using more recent prices the goods whose production was growing faster receive a smaller weight and the growth of the aggregate is reduced[1].

Summarizing, when comparing the production levels in two different years, say 1980 and 1990, if we use the Laspeyres Index and use the 1980 prices as weights, we will probably obtain a biased index that tends to *overestimate* the growth of output. In the same way, if we chose the Paasche Index we would tend to *underestimate* the real growth. Although these are not necessary effects, they are usually present as a result of the patterns normally observed in the movement of prices and quantities of physical goods.

Irving Fisher found a path out of the problem of the biases showed by the Laspeyres and Paasche indexes: he constructed what is known as the *Fisher Ideal Index,* which is the geometric mean of formulas exhibiting biases of opposed sign, that is the Laspeyres and Paasche indexes. The Quantity Fisher Ideal Index (Q_F) is constructed in the following way:

(2) $$Q_F = \sqrt{Q_L * Q_P}$$

And the growth rate between period 0 and 1 is $((Q_{F,1}/Q_{F,0}) - 1) * 100$.

Since the Laspeyres Index uses the prices of the first period being considered and the Paasche those of the second, the change in the Fisher Ideal Index

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[1] "Young (1992)..."

will be *between* the changes pointed by the Laspeyres and Paasche Indexes, becoming a more accurate measure of the change in output. *In this way, the Ideal Index. would be the best choice if the required information is available.*

When constructing a longer series with several periods it is very difficult to gather all the price information needed to calculate the Paasche Index. *As a result the Ideal Index is nearly impossible to construct in practice and the election of the formula is restricted to the Laspeyres Index.*

The United Nations recommend the use of the Laspeyres Index with base period weights to estimate the change in industrial output. It also suggests to frequently update the weights to avoid the obsolescence of the industrial structure reflected in the index.

2.1.3 *The nature of the quantity measurements used in the index*

Four types of measurements are normally used to account for the change in production: *the physical volume of output, the shipments of products to the market, the use of key inputs, the time devoted to work by employees and the electric energy consumption.* Each of these has its drawbacks.

a) The counting of the units produced in a given month will not be affected by the change in the number of units that are currently in the production process. Moreover, the simple counting of the new units produced does not include the production of sectors in which the repair of the existing goods take place.

b) The record of shipments or sales of finished goods has also the drawback mentioned above and can be inexact due to change in the stocks of finished products the producers usually maintain. That is, at least part of the shipments in a given period can be stocks of units produced en the previous period, leading to an underestimation of the output in the previous periods and an overestimation in the current one. A similar phenomenon would occur if there is a significant delay between production and shipment to the market. For this reason, the shipments should be adjusted to account for the changes in the level of stocks maintained by the producers. This measurement works better when the changes in stocks are small and there are no significant delays between production and shipment.

c) If the measurements of the output through the purchases of a key input to be accurate, it must be true that the levels of stocks are constant and that the production process is one of fixed proportions, so that the purchases of the input became increases in output at the same rate. This assumption is very difficult to met.

The accuracy of the record of output through the purchases of inputs can also be affected by technological change that change the unit requirements per unit of output. An example of this is the evolution of the output of some branches of the textile industry that can be estimated through the consumption of cotton fiber by the firms.

d) The series of physical units and the shipments cannot always be used to measure the output of complex items, such as huge machinery and nuclear submarines, whose production is not continuous and the production process of a unit extends over several months or even years.

With this in mind, the Federal Reserve started in 1940 using series of hours worked by employees to estimate the output of complex branches of industry

and in 1960 started to use series of sales of kilowatt-hour in some others. Both the kilowatt-hour and the hours-worked series must be multiplied by adjustment factors to convert them in estimates of output and these factors should be updated regularly to capture the changes in productivity (this will be discussed in detail in the item refered to production adjustment factors).

As a conclusion from this section we can say that *in general we should define the production indexes in terms of the change in the physical volume of output and the first of the measures considered is the most relevant.* In many cases other measurements must be used to measure output, but the counting of the units should be the primary goal.

2.2 Basic concepts

2.2.1 *The scope of the index and the role of prices*

The IPI is designed to reflect the evolution of industrial activity only, that is that portion of GDP that corresponds to Great Division 3 in the National Accounts. The International Industrial Uniform Classification provides a guide to define the productive activities that should be covered by our index.

United Nations suggests to include a minimum of 100 and a maximum of 500 component series in the index. This recommendation is difficult to be met in Argentina given the scarcity of reliable output series for each product.

To estimate the change in output we should use *physical quantities* (tons. of iron, numbers of cars, etc.). In this way, the prices do not enter directly into the calculation of the index. This type of approximation serves to avoid the problem of deflating the value figures, a matter of importance particularly in inflationary periods. Given the difficulties in measuring the changes in the prices of particular items monthly, the method of using physical quantities offers a reward in terms of efficiency of the estimation. In spite of this emphasis on the physical units, the IPI is not independent of value figures. The fixed weights used to combine the individual series are *value added weights* obtained from industrial census data.

2.2.2 *The comparison base and the index formula*

Whether for the aggregate IPI or its component series, the information of the quantity produced is reported in index form. This is convenient since the growth of the different branches of industry can be compared without considering the original units of each of them.

The individual indexes are built expressing the values of the output series as percentages of the value of a particular period, called the *comparison base.* The period used as a comparison base can be freely chosen, since the change of the index is independent of the base elected.

The IPIs are calculated, following the recommendation of the United Nations, according to the *Laspeyres* formula, whose formal expression is:

$$(3) \qquad Q_{L.s} = \frac{\sum q_n p_0}{\sum q_0 p_0},$$

were the subscript denoting each product has been omitted for simplicity and where

$Q_{L,n}$ = Laspeyres Index for the reported period n
q_n = quantity produced in the reported period n
q_0 = quantity produced in the weighting base period used
p_0 = unit value of output in the base period (aggregate value per unit)

In practice we can seldom count with the aggregate values per unit for each of the production series. But in general the value added figures for each branch of industry are available (or can be estimated) from industrial censuses. For this reason, *the version of the Laspeyres Index that is operative in practice is that of a weighted sum of quantity relatives, in which the weights are the value added shares of each branch in the total value added by industry in the base year.*

$$Q_{L,*} = \sum \left(\frac{q_0 p_0}{\sum q_0 p_0} * \frac{q_n}{q_0} \right), \quad (4)$$

In this formula, the first term in the sum is the weight and the second is the quantity relative. The sum of these weighted relatives is the aggregate IPI.[2] The use of weighted relatives is convenient since the changes in the individual series can be observed directly.

Once the weights for each series has been estimated from census data and that the individual indexes have been constructed and expressed in the same base, it is possible to combine the individual series to obtain the IPI and its component groups.

The index is not always directly aggregated from the individual series. Sometimes, it is obtained be successive aggregation of the indexes representing market groups, which in turn are aggregates of individual series. This is done in this way because these groups are meaningful and because the seasonal adjustment is frequently done at the group level instead of adjusting each series which is a tedious process.

2.2.3 *Choosing the base year for weighting the index components*

The election of the year whose value added data will be used to capture the industrial structure and derive the weights of the IPI, that is the year to be used as a *weighting base*[3] for the series, should be guided by the following principles:

1. Recent year
2. High level of activity
3. Normal market conditions
4. Low inflation
5. Availability of information

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2 Algebraically, expression (4) reduces to the aggregative form (3).

3 Note the diference between the weighting base and the comparison base of the indexes.

The first requirement refers to the fact that the index should reflect the current structure of industry. Remember the potential bias of the Laspeyres Index, which makes desirable to have a weighting base of an year as near to the present as possible, since the bias increases as the weighting structure becomes obsolete.

The second requirement points out that the price structure should account for the dynamic factors of the economy, such as the relative reduction in prices of items whose production is growing fast, avoiding if possible the use of contractionary years in which the relative prices tend to distort as a consequence of deflation.

The third suggests to avoid using anomalous years in which there was no free functioning of the market as a result of price controls, rationing or strikes, so as to avoid relative price distortion.

The fourth tells us not to use inflationary years in which the high price variability distorts relative prices.

The last, but the most important restriction, it is necessary to count on the required information. Nowadays in Argentina the industrial censuses are made each 10 years, what permits us to update the weights only in those moments[4]. This fact makes trivial the election of the weighting base year. It is not possible to choose a different year from the one in which the census was made. So the first requirement becomes dependent on the census squedule, while requirements 2, 3, and 4 can only casually be met. If Argentina counts in the future with an Annual Industrial Survey which provides estimates of intercensal value added data, such as in the United States, we will be able to choose the weighting base freely.

2.2.4 *Statistical units of information*

The most appropriate statistical unit to compile the physical output data is the *factory*. In spite of this, a great deal of information is collected be producer associations, what sometimes makes it easier to gather the information directly form these sources, and operating an important reduction of the cost of gathering information.

The output estimates are based on the data provided by firms, which in turn are included in industries that are classified by type of activity following the Uniform International Industrial Classification according to the similarities between products and production processes. This is an important limitation of the classification squeme, because the firms although classified by their primary activity also pursue secondary activities. For this reason the census data may contain a variable portion of output that does not correspond from the point of view of the primary activity pursued.

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[4] In several countries, among which is Argentina, it is imposible to put in practice al the theoretical recommendations, as a result of the lack of reliable information that prevail in most of those countries.

2.3 The classification system

The similarities among the basic output series make possible the combination of them to construct groups that are analytically meaningful and statistically reliable. Two important classification systems have been developed to combine and present the component series of the index.

The classification by type of industry or sectorial classification, based on the supply side, has been the way in which the series were grouped originally. This has the advantage of being consistent with the census data classified by type of industry from which the value added weights are derived.

Analysts are also interested in grouping the basic series according to other criteria. Generally, industry branches can be grouped using their similarities: product durability, the materials used, the stage of production, the process employed and the final destiny of the product. These similarities have been the criterion used to develop *the market structure of the index.*

INDUSTRY CLASSIFICATION BY MARKET GROUP

Aggregate index

Products

Final products

Consumer goods

Capital goods

Intermediate goods

Materials

The distinction between products and materials reflects an input-output focus, since it is an approximation based in the stage of the productive process in which the good appears. This classification permits the detection of imbalances among sectors. The products group correspond to series which, as opposed to materials, are not subject to a posterior *industrial* process. The products include the final products (items consumed either by the private sector or the government and those whose destiny is the capital accumulation) and the intermediate products (items used as inputs *outside* the industry).

In practice it is difficult to distinguish between intermediate goods and materials, because it is common that the output of a good has both an intermediate good component and a material component. As an example, notice that part of the glass production could be sold as an input for the construction sector (that is outside industry) and would have to be classified as an intermediate good, and other part could be sold as an input for the automotive industry and would have

to be classified as a material. For this reason, usually intermediate goods and materials are considered y a unified group: the intermediate products, which includes all non final products. Furthermore, it is also useful to classify the series according to the final use of the goods produced. Consumer goods and capital goods are some of these groups.

The production and purchase of durable goods is more variable in the course of the business cycle that of non durable. The occurs because the useful life of durable can be extended and new purchases postponed in difficult times. For this reason, it is convenient to classify the goods in durable and non durable goods.

Another useful classification would be the one that distinguishes between goods sold abroad and those absorbed by domestic demand, since the output pattern of these groups shows a different behavior, particularly during recessions.

The market groups that distinguish between final products and materials are useful for an input-output analysis, particularly considering the changes in supply and demand conditions in the markets of final products. The differences between the output of materials and final products are usually attributed to changes in the stocks of materials. *Similarly, different evolution of the final products index and a sales index indicate stocks imbalances in the market for goods.*

2.4 Monthly production series

The election of the basic series of production to include in the IPI is an extremely important step and should be done using two basic criteria: that they have the wider possible coverage and accuracy relating the item that is intended to estimate and that the data is of rapid availability.

Ideally, we should use only series consistent in time that do not require ad-hoc adjustments of the data. This is important to avoid contamination of the estimates with the own perception of the economist about industry evolution. Series that have changed substantially in coverage or definition in the considered period should not be included. This assures that the index is comparable in all periods.

When some circumstances obviously distort the comparison of different periods, the IPI should be corrected to avoid misunderstandings. The calendar irregularities that affect the number of working days in a month are the most important of these mechanical difficulties. For the month to month comparison to be valid, Miron and Romer[5] suggest to divide the physical output series by the number of working days in that month, so as to calculate a daily average production and to use this average for the construction of that IPI. It would be useful to compute and index that includes a working days correction that could be compared with the original (not corrected) index, since the difference in the number of working days can explain a great deal of the monthly change in output. To compute the working days we should eliminate Sundays and Na-

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5 "Miron and Romer (1990)..."

tional FERIADOS and the strike days and assume that Saturday is half a working day, while the optative FERIADOS industry works normally.

A practical argument against this type of correction is that when industry has spare capacity, such as what happened in Argentina in 1995, the limiting is not the number of working days but the demand. Formally, the assumption underlying the working days adjustment is that elasticity of production to working days is unitary, so that the change in the number of working days produces a proportional change in production. This assumption is probably met when industry operates at high levels of capacity utilization and the adjustment should be correct. But when there is spare capacity the assumption will not be valid. In this case, the elasticity is expected to be lower than unit and that the changes in the number of working days produce less that proportional changes in production, making the working days adjustment invalid..

To test the assumption on unit elasticity in argentine industry in a study of FIEL a logarithmic regression of the original IPI against the number of working days was run, so as to "clean" the original series from the working days effects and obtain an estimate of that elasticity. The study for the 1990-96 period showed two things: for the global IPI the estimated elasticity was clearly below unit (near 0.7) and differed substantially between branches of the industry (ranging from near 0 to 2.7).

Although this is still a matter of discussion, the author considers the adjustment proposed by Miron and Romer would be correct when industry is operating near full capacity but not when there is an important spare capacity. For this reason, this adjustment can not be applied to a long series in which the capacity utilization changes.

2.5 Use of census data and weighting

The changes in the industrial structure make obsolete the weights of the index, and the change is the rule in a dynamic economy. The United Nations recommend a periodic revision of the basic series and update of the weights each 5 years. The update of the weight must be done on the base of the information of the census data and the industrial surveys.

2.5.1 *Production adjustment factors*

The production adjustment factors (PAF) can be applied to input or output series. The PAF have two important uses. First, they can be used to account for the changing nature of the goods produced and second, they provide a way to incorporate the changes in the productivity of inputs.

For the physical output series the PAF adjust for the incomplete coverage of the items in an industry branch and account for *changes in the quality of the products* not reflected in the simply counting of the units. An improved unit is "more product" than the original unit, although both would count as one in a simple counting of units produced. In this case the PAF would inflate production over the level indicated by the simple counting.

For the input series the PAF are the result of dividing the annual average output level of the desired item by the annual average level of the input series used to represent it in an indirect way. The adjustment permits the incorpora-

tion of productivity changes, since the PAF are used to convert input in output series, which is of great importance because provides a solution to the intrinsical problem of the estimation through the use of inputs.

2.5.2 *Weighting the component series*

We need an adequate method for aggregating the basic series into a global index. The changes in the number of the units produced are not all of equal importance. Clearly, the combined estimation of the global change in output must take into consideration the relative importance of each item.

The weighting using unit prices is correct only when combining items *in the same stage of production.* But the aggregate index combines the output in *different* stages of production and unit prices can not be used, since in doing so we would be mistakenly double counting production leading to an overestimation of output.

As a result, the prices used in the aggregative formula of the index are not the market prices, but the unit value of net output or *value added per unit of output.* In that way, the weight of the automobile assembling should account for only the aggregate value in that process and exclude the value of tires, iron and other components not produced in that stage of production.

Most weights for the individual series are derived directly from census value added data. When the classification breakdown does not match the weighting requirements and the use of census data is not possible the value added is estimated on the basis of the *value of shipments* made by the branch in question. That is, the total value of sectorial shipments is calculated and the census value added data is distributed among the component series on the basis of their share in the total shipments of the branch. In the particular case of firms producing only one product, it is possible to estimate an approximate cost structure for the product and derive the value added weight from the balance sheet of the firm.

2.6 The monthly estimation and the linking of the index

2.6.1 *Features of the monthly estimation*

The IPI figure for a month is no t precisely determined at the moment of its first release. The initial estimates for a month are published by the 20th of the next month and are revised several times after that.

In each month the making of the index includes the estimation of the new figure and the revision of the provisional data of the previous months. The missing information becomes available gradually as time passes and the preliminary estimates can be replaced by the final data.

For instance, FIEL's IPI is usually estimated at the moment of its first release using about a 40% of the basic information in terms of the weights of the basic series. The estimates for the three preceding months are revised with the 60% for the first month, 70% for the second and 80%, respectively. Another example is the Federal Reserve index, which has at the moment of the first issue a 38% of the information for the new month, a 88% for the second, a 93% for the third and a 98 for the fourth.

When the monthly data need is not yet available it is estimated. The estimates are made using recent trends in production, production patterns in time, experience about the behavior of the cycle, *seasonal behavior of production,* new events and information about related industries. Sometimes it is possible to survey a few firms in a sample and estimate the behavior of the population on that basis. In this way the missing data is estimated in complete detail, but the estimates became definitive usually after 4 or 5 months.

It is also important to evaluate the effect on output of *random events,* such as strikes, bad weather and technical stops of the plants. Particular attention should be paid when estimating indirectly through the use of an input. If the purchases of the input have not been affected by the event but production have, then the appropriate correction should be introduced.

When the missing data has been estimated and after checking the unusual or unexpected information the process of aggregation is performed, followed by the seasonal adjustment.

2.6.2 *Comment on the linking of the index*

Generally the indexes cover long periods of time which include stages of prosperity, recession, war and peace, appearance and disappearance of industries, price stability and inflation. All these changes affect output. ¿How could be compared the industrial output of 1984 with that of 1993 when the products produced in both times are different (what means that the index includes different series in each period) and when changes in the industry structure and in the price relationships have occurred claiming for an update?

The IPI is not constructed directly on the basis of the same weighted series. On the contrary, for the index to be descriptive of the particular situation in each period, it must be constructed in *chronological segments,* each of them with its own series and weights. These segments must then be linked to obtain a continuos series. As a result, neither the series nor the weights used to estimate the change in output in one segment are necessary equal to those used in any other segment. The resulting index is a *linked* Laspeyres Quantity Index.

In summary, the IPI must use different weights and series in each period to accurately reflect the changes in output composition. The result is an index whose weighting structure varies periodically and in this sense the linking of these segments into a continuous index is not strictly correct from a statistical point of view. But the linking is necessary to obtain a long and continuous series as well as the update of the weights and the inclusion of new series are required to capture the changes in the economic structure. *In conclusion, the linking of indexes whose structures are not homogeneous is justified from a practical point of view.*

2.7 Limitations of the index

It is important to mention the weaknesses of IPI as an indicator of the level of output, since these would prevent incorrect use of the estimated index.

a) Many times the great revisions modify the basic data for complete years. The magnitude of the revisions can be of importance for the individual series, but in the aggregate the changes usually cancel each other and the global index shows revisions much less important. In this sense, the IPI is subject to the modifications common to every statistical series.

b) It was already mentioned that when the weights are updated the share of fast growing industries in the global index tends to reduce. As a result, when updating the weights we should not be surprised by a reduction in the computed growth rate and a change in the data for the recent years at least.

c) Another limitation arises form the fact that the firms produce several goods but are classified according to their primary activity, so the census data used to estimate the value added weights might include a variable proportion of items that do not strictly correspond to the primary activity.

d) Ideally, the IPI should be based in physical measurements only, with items narrowly defined to be homogeneous and representing only one product. Unfortunately, in practice many times the is not available in the appropriate way and the index is compiled on the basis of series that are the sum of heterogeneous items with different sizes, quality and value.

e) The coverage of the index is not always complete and some sector are estimated indirectly, what produces an estimation error. Besides, sometimes the lack of information leads to the omission of entire branches of industry in the index.

f) The mentioned fact of the linking of different segments is also an important limitation.

The statistical limitations of the IPI must be considered in the appropriate context in which the series are to be used, since these limitations have more or less importance depending the particular use of the index. After saying this, it is only left to say that the Industrial Production Index has been widely accepted as a coincident indicator of the business cycle.

3. Towards a system of indicators of industrial output evolution

3.1 The utility of the production index

The first important matter to analyze is the relationship between the industrial output and GDP. Two facts should be pointed.

a) The business cycle is centered on the evolution of industrial output. This is not a surprise, since industrial output represents in Argentina around 25% of GDP. As a result, the *sign* of the changes in both aggregates usually coincides, indicating that peaks and throughs in the economic cycle are generally the same for both aggregates.

For the reason mentioned above, the U. S. National Bureau of Economic Research classifies the IPI as a *coincident indicator* with the business cycle.

The studies concerning business cycles has recently been initiated in Argentina and the first leading and coincident indicators have been constructed already[6].

b) Generally the industrial sector, together with construction, is more affected by the cycle than GDP. This tendency of industrial output to show a greater variation during the business cycle is an empirical regularity observed in most countries. For this reason it is to be expected that when the economy grows the industry does it in a greater proportion and when the economy contracts the industrial output does it even more.

From the preceding discussion, it is obvious that if we can count on a reliable indicator of industrial output evolution, we can infer the sign of the evolution of GDP on that basis, and probably also to detect the turning points. Furthermore we can infer the magnitude of GDP growth using the relationship mentioned in b) and the available information about the other sectors of the economy.

The second important aspect refers to the periodicity of the estimates and their rapid availability. The attractive features of IPI are the monthly basis of estimates and its soon availability: they are published only 20 days after the end of the month (remember that the quarterly GDP figures are released with much more delay). This allows the early detection of economic changes what is of a great deal of importance for policymakers.

The third thing to mention is that the IPI figures can be compared and used in conjunction with other indicators to obtain a much richer information about industry developments. The following are some of them:

a) The IPI can be compared with measurements of input utilization to illustrate about the supply conditions (measure factor productivity) and with measurements of available production capacity to detect possible inflationary pressures (when plants operate near full capacity increases in demand reflect in price increases in the short run and not in quantity increases).

b) It is very important to maintain statistics about installed capacity and its rate of utilization to be used in addition to IPI. The changes in the utilization rates of capacity are a useful guide to analyze potential movements in the production index. Particularly when the utilization rate is high important production increased are not to be expected in the short run, indicating the need of investment in plant and equipment. When there is spare capacity it is also possible to obtain a measure of potential output.

c) The IPI can also be compared with the imports of industrial goods, since the global supply is the sum of both. In this way changes in the supply composition can be detected.

d) The stocks cycle can be studied through using in conjunction both the IPI and a sales index. Furthermore, the evolution of current sales provides a useful

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[6] The pioneering study in this subject was done by Juan Mario Jorrat and Nora Jarma de Cortés of the National University of Tucumán.

information concerning the future behavior of production, and the comparison of production plus inputs imports and the use of such inputs shows the change of the stocks of inputs.

e) In the end, the sectoral breakdown of the IPI and its market classification are a powerful tool for the analysis of the changes in output composition and the potential weaknesses and strengths of industry.

3.2 The index and the qualitative surveys

The following is an example of the way the IPI can be used together with other indicators to obtain useful information. In particular, it will be showed how qualitative surveys can be a powerful tool if they are used in addition to the IPI.

FIEL's qualitative monthly survey gathers information for nine variables, but in this paper we will pay attention to only one of them: Demand Trend. This variable is constructed on the basis of the answers of firms to the next question:

"Not considering strictly seasonal changes, the demand trend faced by your firm is:

encouraging
normal
discouraging"

The answers are latter processed obtaining the percentage of surveyed firms that considered the variable to be in each of the three categories. The answers are weighted by the firms share in total sales.

For the purpose of this study the demand trend has been defined as the encouraging answers plus a half of normal answers. In this way sharp changes in the variable are avoided and it can be treated like a series. We are looking for the relation between IPI and demand trend and, more specifically, we intend to determine demand trend can be useful to study the cycle and whether an embrionary leading indicator of IPI can be derived on its basis.

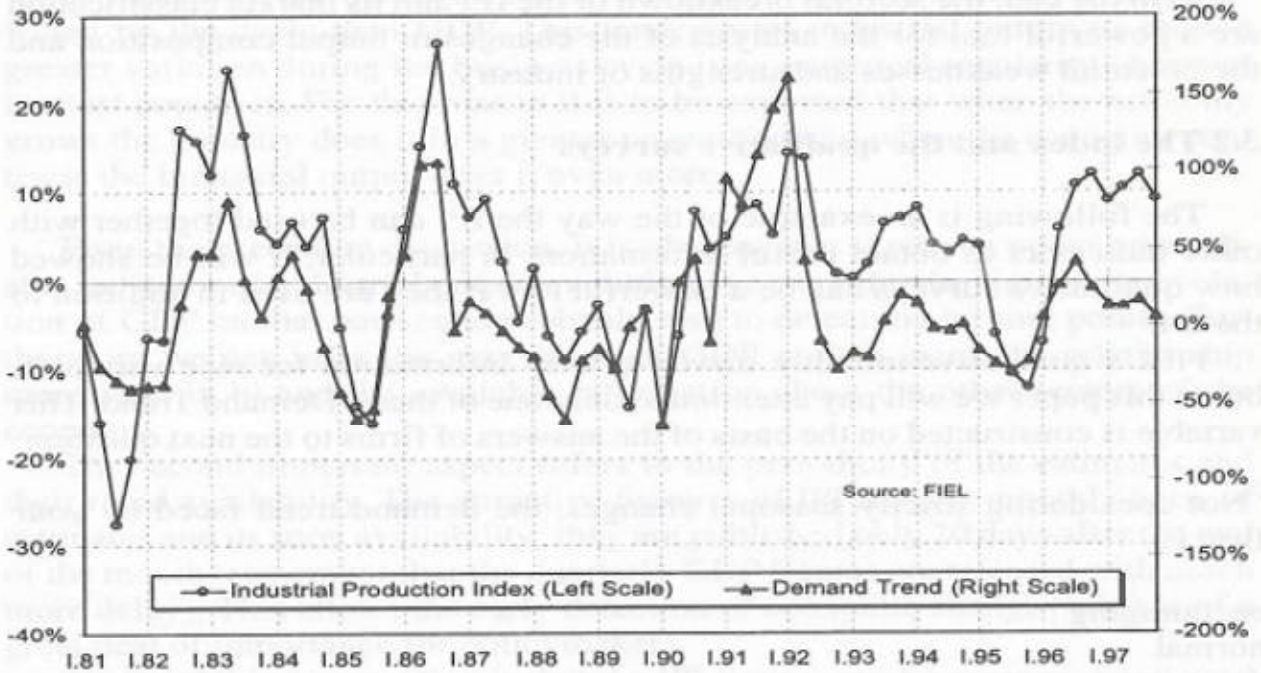
In the following figure showing annual data the three outstanding characteristics of the comparison between the two variables can be observed:

a) Generally demand trend has an evolution of equal sign as IPI. As a result the variable could also capture the peaks and throughs of the growth cycle.

b) As it is usual in an opinion survey, demand trend is a highly volatile series, much more volatile that industrial production. See figure 1 (notice the different scales of the figure).

c) The figures shows that demand trend can sometimes be used as a leading indicator of output evolution. As an example, see what happened in the argentine recession of 1995. The IPI showed its first year over year negative growth rate in the second quarter of 1995, but demand trend accumulated in that moment *two* consecutive quarters of contraction. In the same way, when in the second quarter of 1996 we had the first positive growth rate in IPI, demand trend was at the moment showing its second quarter of improvement. Note that demand trend leaded IPI in a quarter, both at the beginning and the end of the recession.

FIGURE 1
INDUSTRIAL PRODUCTION AND DEMAND TREND
% CHANGE YEAR OVER YEAR



The fact that demand trend is a volatile series can be thought as an advantage, since it amplifies changes that would go on inadvertely in other indicators. This is shown in figure 2.

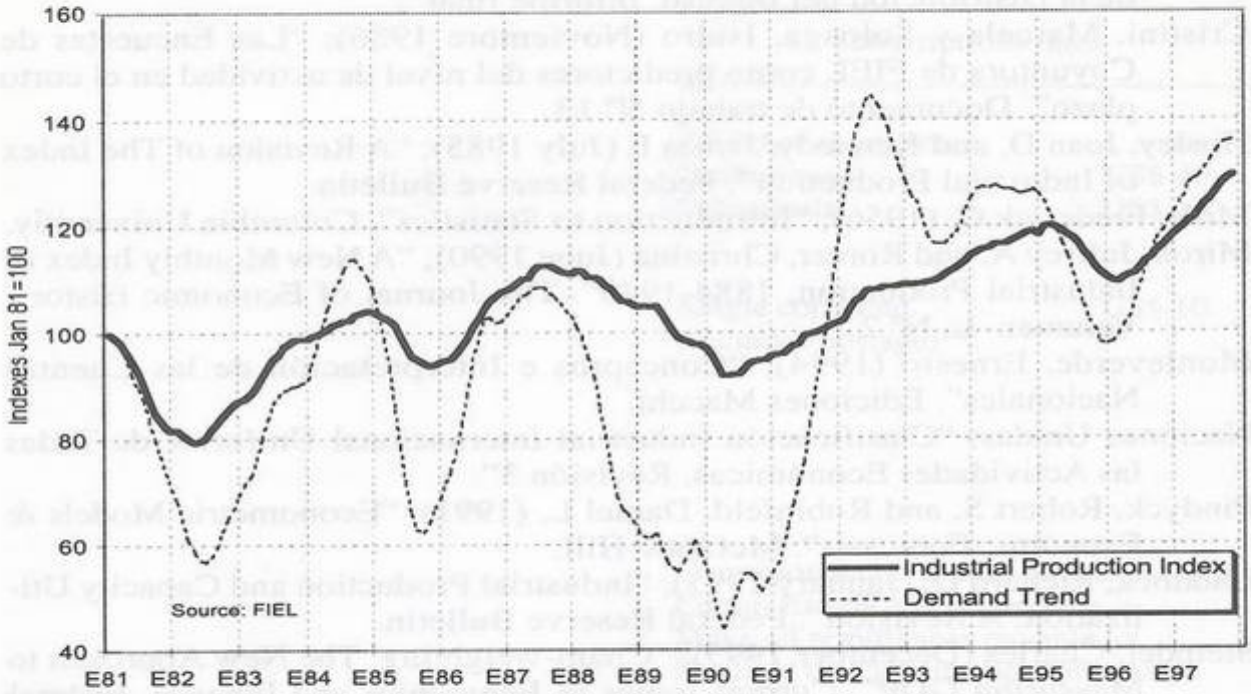
Notice how when industry goes into a contractive period demand trend falls sharply and, on the other hand, it jumps up at the beginning of a recovery. Noticing the jump in demand trend at the beginning of the argentine Convertibility Plan and its posterior convergence towards lowers levels, this can be interpreted as an overreaction of producer expectations the had to adjust downwards later.

It is also interesting to see that demand trend captured the transitory growth deceleration by the middle of 1992 as part of this process of expectations adjustment.

4. Summary and conclusions

The basic conclusions of the paper are summarized as follows. The index must be calculated according to the Laspeyres formula, which relies on the relative proportions of the basic index series as observed in the base period. Although the primary objective must be the use of series expressed in physical units, other measurements can be used when the required information in physical units can not be obtained. These measurements include the shipment of products to the market, the use of an input series as a proxy for the evolution of the item that uses it, the number of working-hours by the employees and the consumption of electricity. Each of these measurements has its drawbacks, whose importance depends upon then special circumstances being considered.

FIGURE 2
INDUSTRIAL PRODUCTION AND DEMAND TREND
12 MONTH MOVING AVERAGES



The quality of the estimation depends basically upon three things. The coverage of the index, the accuracy of the series in estimating the evolution of the specific components and the estimation of the value-added weights used in the process of aggregation of the basic series. The first two depend heavily on the availability of the information and the last one on the census data.

Despite its limitations, the industrial production index has been widely accepted as a coincident indicator of the business cycle.

There is a strong correlation between the industrial production and the evolution of the domestic sales. The evidence shows that the variable Domestic Sales, obtained from the qualitative survey, can be treated as a series. In addition, it is showed to detect quite accurately the peaks and troughs in the cycle and sometimes to function as a leading indicator for industrial production. This suggests that the industrial production index and the Domestic Sales can be used together to support strong assessments about the future behavior of production. Moreover, the industrial production index is a key input in the construction of Leading and Coincident Indicators of GDP, which have been recently developed in Argentina.

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