March to Numbers: The Statistical Style of Lucien March

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La réalité n'est qu'un vestige dans l'immense étendue des possibilités.
Celles-ci ne forment pourtant point un chaos.
—Lucien March, "Statistique" (1924)

The development of economic thought in France has long been characterized by a local idiosyncrasy: the tradition of *ingénieurs économistes*. Through their grappling with economic problems that confronted the public sectors and with concrete issues tied to the constructive problems undertaken by the state, engineers have often shown signs of originality and savoir faire—it has even been claimed that they "do economics while others talk about it" (Caquot 1939, quoted in Divisia 1951, x). In any case, these engineers laid the foundations of microeconomics (Ekelund and Hébert 1999), committed themselves in an early mathematization of economic issues (Kurita 1989) and, in a sense, paved the way for econometrics (Hébert 1986).

But these French engineers also developed an indisputable talent for measurement in economics, exemplified by their work on costs. Their involvement in measurement and more generally in statistics became particularly apparent around 1900: the Statistique Générale de la France

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(SGF), the main government statistical agency of the time, even became an engineers' fortress. Although the SGF remained small in comparison with other European statistical bureaus, the work it achieved during the early twentieth century remains impressive in two areas: the collection of data and the elaboration of explanations of what had been measured. Lucien March (1859–1933) deserves special attention in the engineers' involvement in statistics and economic measurement. He entered the École Polytechnique in 1878, became an engineer in the Corps des Mines, and was head of the SGF from 1899 to 1920.[1] March finds no easy home in our contemporary schemes, in the sense that he breaks with standard classifications. He reshaped the French statistical system, imported the new statistical techniques devised by British biometricians, investigated the field of time-series analysis, contributed to the spread of eugenics in France, promoted lectures in statistics at a time when they remained scarce, and made noteworthy incursions in economics and demography. Last, but not least, he developed a philosophy of science based on measure that—in some respects—illustrates the importance of the state in developing measurement, as the essays in this volume by Theodore Porter, Flavio Comim, and Martin Kohli suggest.

In this essay we will dissect March's methods of statistical research. We were motivated at the outset by the fact that his full contribution to the history of statistics has received scant attention. Our essay originates from two other concerns, both related to his specific approach to statistics. First, we would like to suggest that econo-engineers should be defined not only by their technical innovations but by their "nonmathematical arguments" as well, as Keiko Kurita (1989, 8) suggests. Indeed, their general training and practice sometimes led them to "take a detached view of their field" (Divisia 1951, 141) and to develop epistemological frameworks that remain underappreciated in the contemporary literature. Second, in debates that have recently occurred in the field of macroeconometrics, several protagonists—for instance, Summers (1991)—have questioned the usefulness of contemporary theory and called for more empirical inquiries and epistemological foundations. On this point, past episodes can afford enlightening lessons: several engineers of the nineteenth century and of the first half of the twentieth century based their practice of statistical economics on well-shaped

1. March had no academic position. Yet it should be noted that in 1920, he became involved with Emile Borel in the creation of the Institut de Statistique de l'Université de Paris, which played an important role in the training of statisticians in France (Desrosières 1993).

epistemological arguments—and such arguments, developed by scholars who are reputed to be advocates of mathematization, quantification, and measurement, could certainly be instructive. We found that March directly addressed both concerns. He carefully elaborated new tools for the statistical work in the social sciences and rooted them in an epistemological framework and in worldviews that were at the same time creating the scope and inscribing the limits of statistics. This association of statistics with worldviews delineates what we label March's statistical style.

We analyze this style in three steps. The first section of the essay deals with the way March viewed statistics—its nature, properties, and range of application. We will see that statistics was approached as an objective and scientific way to deal with complex phenomena and collections of heterogeneous facts. In the second section, we focus on March's concrete contributions to statistics in two areas: statistical methods and their application to economics. We will demonstrate that his work is characterized by the search for methods that could make possible the discovery of regularities at work in a complex and changing world and that he constantly pressed the limits of his own results. The last section sheds some light on March's worldviews and how they assigned a precise role to statistics. His was a means of approaching, measuring, and taming a social world characterized by an epistemic uncertainty, and his work is only meaningful in the frame of this epistemology that defines the scope and limits of statistics.

On Numbers and Measurement: Delineating Statistics

From the very beginning of his scientific career, March carefully tried to identify the nature and the frontiers of statistics. Such was not an easy agenda: at a time when the application of statistical procedures to the social sciences was controversial in France (Ménard 1980) and statistics was even derided (Porter 1995), March suggested that statistics was a path based on precise and scientific criteria, a path that various disciplines should follow.

Statistics as *Une Langue Commune*

March (1924, 341) thought that the identification of the territory of statistics resulted from the identification of the limits of the experimental method:

> The methods that suit the experimental sciences, and that are based on the possibility of isolating one circumstance among all those that coexist in a phenomena, do not perfectly apply to the observational sciences, in which a fact can never be reproduced in the way it had been originally produced, and where the invariability of the adjacent circumstances, with the exception of one, can never be realized.[2]

Thus, "when we do not control the main circumstances of observation, the statistical method is to be applied" (March 1930b, 9), and the scientist can only observe the facts "as they appear" to him (11). Statistics was thus a substitute for the experimental method. March shared here the views of other social scientists of the time: Mary Morgan (1990) indeed suggests that the use of statistics, especially by economists and the first econometricians, was based on similar arguments and that more generally this problem "arose in other social sciences and in natural sciences where controlled experiments were not possible" (9).

Although these views were not original, March's arguments deserve attention. In various textbooks he explained that, in contrast to the experimental method, statistics was concerned with complex phenomena and heterogeneous collections:

> These facts are generally ruled by complex influences that remain impossible to separate or to control at will. They arise from the shock of circumstances that we do not master and often from intentional facts whose scattering and capriciousness disconcert. . . . The phenomena that are studied are often influenced not only by causes that operate in the scope of observation (for instance, the health of workers in the case of wages), but also by causes that largely preceded observation (for instance, those relative to heredity, habits, and traditions in human societies). In short, the complexity of the range of observation is particularly important in the studies of collections of living beings or of social facts. (1930b, 145)

At that stage, March's thought moved in two directions.

2. All translations from the French are ours.

First, given its complexity, the human world could only be observed and knowledge of it required data. This requirement can be illustrated by the institutional role March played in France at the turn of the century. In 1892 he joined the Office du Travail (OT), which had been created the previous year to study the various elements of labor.[3] At that time the SGF was a department of the OT.[4] This connection was not by chance: it was necessary for the OT to get precise information on national economic structure as well as on individuals, and such information could be collected through censuses that fell within the scope of the SGF. The SGF reported regularly on demography and economics (industrial structures, wages, and so forth) and collected data for various ministries and administrations; some of their findings were published in the associated review, the *Bulletin de la Statistique Générale de la France*. The work these agencies achieved during this period was impressive, especially that concerning the collection of data, and a large part of the work is largely to be attributed to March (Huber 1937).

But March's concept of "observation" requires more precise definition. To him, social scientists had "to describe carefully and to measure as exactly as possible the facts to be observed" (1924, 331). Consequently, statistics and measurement were closely associated: "the method of statistics intervenes when we want to measure" (1908, 290). March's historical survey of the development of statistics directly led him to believe that "the development of a lot of sciences has followed the creation or the improvement of instruments of measure that made possible immediate and objective determinations of what was studied" (1924, 326). Otherwise stated, just as he defined statistics on a basis of exclusion, he identified its range of application through the elimination of nonmeasurable phenomena, such as those of psychology (1924, 332)—and we guess that March never appreciated the "calculus of pleasures and pains" discussed by Harro Maas in this volume. Yet statistics has a wide range of application, as March's applied work illustrates. March's work mainly concerned demography and economics and is a hymn to statistics: it was constantly based on measurable phenomena or on phenomena that he helped to make measurable, such as unemployment (Topalov 1994). Perhaps less known is his involvement in eugenics. From an institutional point of view, he contributed to the creation in 1912 of a French society

3. On the history of the OT, see Luciani 1992.

4. The history of the SGF is rather meandering, in the sense that it is characterized by a successive dependency on various ministries and administrations (see Marietti 1947).

devoted to the promotion of eugenics, the Société Française d'Eugénique, and in various papers he remained open about his eugenic beliefs.[5] From a methodological point of view, this involvement is perfectly understandable given the other issues he tackled: eugenics involved a quantification and a measurement of the hereditary makeup of individuals, "a reduction of people to numbers" (MacKenzie 1981, 34).

Second, March saw such a gathering of data and measurements as a unique means to approach the social world. Some regularities could then be unveiled, and statistics aimed precisely toward the discovery of signs of constancy, of order within the chaos of complex phenomena: "Because the human mind does not easily understand a complex or variable group, it can only exert its power for generalization through the reduction of complexity to more simple notions, of variables to something constant. The method of statistics tends toward that" (1924, 327). This idea was not highly original: March here exemplifies the nineteenth-century use of statistical methods in which relationships were extracted from varying measurements (Porter 1986). It should be remarked, however, that he rejected the belief that Nature was basically a simple machine.

March thus saw statistics as closely associated with observation and measurement. It offered a means of condensing heterogeneous data and of identifying regularities in mass phenomena; statistics was defined in "Statistique," a masterly paper published in 1924, as *la pléthométrie*. It was also *une langue commune* (1924, 363), applying to large territories and to a large diversity of objects. Just like Karl Pearson, March believed that statistics "provided the proper discipline to reasoning in almost every area of human activity" (Porter 1995, 20). The foundations of March's statistical ambitions need now to be explored.

Objective Foundations of Measurement and Statistics

March exposed the way statistics could extract regularities in a way that could achieve a scientific status. Statistics was defined as a three step process including observation, the determination of results, and interpretation and forecasting. This final step was believed to be unduly influenced by personal and *subjective* judgments and was thus excluded

5. See, for instance, March 1929. See Carol 1995 and Desrosières 1993 and 1998 on March's involvement in eugenics.

from the range of science. By contrast, the scientific status of the first two steps was based on their *objectivity*: statistics "helps one to reduce conjectures and gain precision in the objective dimension of the results of observation—and consequently to increase the scientific value of these results" (March 1924, 364).

The scientific dimension of the first step, that of observation, originates in the elaboration of nomenclatures and in the training of collectors. Both were seen as making statistics objective, in the sense that they contribute to "the elimination of particular and personal influences" (337). Nomenclatures as such deserve little attention, but to remark that March believed that they became objective tools as soon as their structure was detailed in such a way that it minimized the collectors' doubts.[6] Interestingly, he also advocated the need for homogeneous nomenclatures at the international level: nomenclatures should be "universal conventions" (1930b, 5), standardized tools that exclude judgment. In that sense, he had in mind a kind of objectivity associated with distance, one that transcends frontiers and hints at Porter's similar analysis of quantification as "a technology of distance" (1995, ix). The search for objectivity in the collection of data was also at work on the collectors' side: "The observer has to indicate no personal tendency; his impartiality has to be absolute" (March 1924, 330). March (328) stressed the need for the training of collectors, who have to be "impartial," "honest," and "competent"—such "morality" would lead to a reduction of errors in the collection of data. Thus he thought that careful and objective measurement was a prerequisite for scientific work in statistics.

The second step in the process of statistics was the determination of results—that is, the extraction of constant results from measurements. Once more, objectivity was at work: aggregate results aimed at identifying what individual cases share in common (342) while transcending personal behaviors. To reach this goal, the statistician had to use appropriate tools: graphs, index numbers, the correlation coefficient, and the principle of compensation associated with the normal law. March recognized that this law was beneficial and that "the use of more or less elementary mathematical schemes makes possible the determination of objective values" (1909, 255); yet he also believed that it was "an ideal model" (255) or a "bold hypothesis" (1912c, 378), and other kinds of

6. The collection of data was not a purely observational process: it was preceded by a priori beliefs (March 1930b, 36).

distributions were available for use (1908, 293). The key to this puzzle is to be found in his belief that science needs conventions: the Gaussian law was “precious since it establishes the practical unity of [a] group” (1909, 255–56)—it was a “frame” that sets precise limits (1910, 485). Similar arguments were developed concerning the correlation coefficient and index numbers. Although these tools could—and should—be criticized, they were parts of the conventional language of science and made possible the coordination of scientific activities; such routines work toward objectivity.

These two steps in March’s process of statistics formed an objective and scientific path from heterogeneous, individual, and complex facts toward aggregate results. This statistical path in science deserves two further comments. First, March constantly insisted on the need for identifying—and also for overcoming—the limits of every component of these steps. It is striking to note that his whole work leaves space for criticism—for what he labeled “scientific criticism” (1924, 323)—which was, for instance, associated with the search for more realistic conventions. Second, March stressed the need for the elaboration of a precise and simple vocabulary. A precise vocabulary, in the sense that any confusion should be banished. For instance, “one has to regret that words such as *probability* and *correlation*, which possess a well-determined meaning in mathematical language and in logic, are used differently in statistics” (1909, 262). As we will see below, March harshly criticized the assimilation of correlation with causality practiced by several statistical economists of the early twentieth century. Otherwise stated, March claimed that we cannot demand too much of the tools used in statistics or ask for more than their hypotheses stipulate. He continued to advocate the use of simple vocabulary to help avoid misunderstanding and because he hoped that statistical tools could be used by nonspecialists, (for instance, businessmen) as well.

Graphs, Coefficients, Barometers: March’s Measurement Implements

Now we will analyze the manner in which March approached and practiced statistics in his concrete work. We will here suggest that his contribution to the elaboration of statistical tools for the social sciences as well as for his own economic work, especially on business cycles, perfectly illustrates how he extracted regularities from heterogeneous data and how he pressed the limits of such attempts.

Fechner and Pearson Revisited: New Tools for the Comparison of Socioeconomic Time Series

Today March remains known for his study devoted to the comparison of socioeconomic variables, *Les représentations graphiques et la statistique comparative* (1905). This work aimed at presenting two kinds of tools that he considered useful for such an enterprise: graphic representations and mathematical indices, which he called *indices de dépendance*.

Here March's analysis of these indices deserves special attention.[7] *Les représentations* opened with Gustav Fechner's indices,[8] which March pedagogically exposed and applied to various examples, including the relationship between marriage and birth rates in France and the relationship between several financial variables such as the Banque de France cash balance and discount rate. He then presented "improvements" to Fechner's indices and moved toward Pearson's coefficient of correlation. But the use of these indices led him to face a problem relative to time: "In the previous studies, we have supposed that we dealt with annual changes. But it frequently appears that, in the changes that affect statistical facts, we can distinguish various phases. We will distinguish yearly changes, changes relative to several years (for instance, decennial changes), secular changes, and of course changes relative to periods inferior to one year" (1905, 32). March thus recognized that using a tool devised outside the social sciences required adaptation. Actually the correlation coefficient could not be immediately used by economists, since economic laws did not deal with variability within the population, "rather, socio-economic data often consisted of single observations . . .

7. As explained below, March saw these indices as closely connected to graphs.

8. March presented two coefficients of dependency devised by Fechner. The first one is $i = (c - d)/(c + d)$, where c is the "number of agreements" (i.e., cases in which the two series move in the same direction) and d is the "number of disagreements" (i.e., the opposite case). However, "this index does not take into account the magnitude of the compared differences" (1905, 26). March also referred to another coefficient, defined as $I = (C - D)/(C + D)$, where C is the sum of the products of the values of both variables when their variation reveals an "agreement" and D is the sum of the products of the values of both variables when their variation reveals a "disagreement." However, this index "does not sufficiently take into account the amplitude of the compared variations" (1905, 27).

connected together to form a time-series which exhibited variability over time. Available correlation techniques were not designed with such time-series in mind" (Morgan 1997, 49). March recognized the difference between biometrics and the social sciences, and therefore the question was: Which of several units of time should be correlated? As Judy Klein (1997, 229) noted:

> The earliest writers saw the time-correlation problem as isolating the different components and correlating only similar components of two or more variables. It was usually of greater interest to economists to investigate correlation of short-term oscillations, in particular the movement through the trade or business cycle. Economic statisticians recognized that the correlation coefficients of unmanipulated observations only indicated a relationship between the secular changes.

And as March (1905, 32) stated, "In a careful analysis of the conditions of dependency between two statistical series, we have to calculate the coefficient of dependency between annual changes as well as between long-term changes—for instance, decennial changes." Here we should note that the 1905 study contained new techniques that could solve the time problem. March suggested that correlation of first differences could be used to capture the correlation of short-term changes,[9] whereas the correlation of long-term changes was based on a ten-year moving average. He applied the method to the relationship between the marriage and birth rates in England and also introduced lags in the analysis. But the study also contained a new method of time-series decomposition (independently developed by Reginald Hooker in 1901 and John Norton in 1902)[10] that enabled him to isolate short-term changes defined as the deviations from a moving average representing the trending factor: "In order to offer a greater precision to our analysis," he wrote, "we have to decompose the changes that are studied. . . . We can determine a coefficient of dependency between: (1) the *courbes interpolées* or *courbes moyennes*; (2) the differences between the observed numbers and these *courbes moyennes*" (1905, 34). He applied this

9. A similar method was independently suggested by Reginald Hooker in 1905. See Klein 1997 and Morgan 1990.

10. See Klein 1997. Note that in 1863, Jules Regnault, a largely neglected French economist, formulated the basis of such a decomposition in his modeling of the stock market (Jovanovic 2000; Jovanovic and Le Gall 2001).

decomposition to the study of the relationship between the marriage rate and unemployment (36).

Les représentations undoubtedly deserves a special place in the history of econometrics and time-series analysis. Several of March's other contributions also illustrate the intersections of his work with econometrics, for instance his parametric estimation of a distribution of wages (March 1898). Moreover, two statisticians trained by March, Henri Bunle and Marcel Lenoir, also wrote econometric treatises.[11] However, an econometric interpretation of March's economic work would be misleading: he had a greater predilection for other statistical strategies, as his construction of a business barometer suggests.[12]

March and Business Cycles: On Barometric Indexation

In the 1920s March attacked the challenging task of measuring business cycles. He constructed a French business barometer—barometers defined as "time-series representations of cyclical activity" (Morgan 1990, 57)—based on index numbers and considered an equivalent to the Harvard barometer.[13]

Although March postulated that business cycles were complex in the sense that they resulted from "innumerable and very different economic facts" (1923, 252), he believed that they could be analyzed with the help of index numbers, "instruments of observation and analysis" and "instruments of measurement" (277). But such numbers were also "conventions" (253) or instruments of international comparison. March thus adopted indices that were counterparts of those on which the previously constructed barometers were based: the price of financial instruments (*A*),[14] the wholesale prices (*B1*), the British wholesale prices (*B2*), and

11. On Bunle 1911 and Lenoir 1913, see Chaigneau and Le Gall 1998, Desrosières 1993, Hendry and Morgan 1995, and Morgan 1990.

12. March's research path can here be contrasted with that of Hooker (on Hooker, see Klein 1997; Morgan 1990, 1997). Around 1900 both examined similar problems, but March's work took an almost opposite direction and became concerned with historical time. This helps explain why the correlation coefficient was of little importance in the papers he published after 1905.

13. On a history of business barometers, see Armatte 1992.

14. During the 1910s, the statisticians of the SGF became interested in the influence of the stock market fluctuations on economic activity, and Lenoir led the study of that issue. In a first step, he developed in 1919 the first long-term indices relative to the French stock market. This included the construction of two indices: an index relative to bonds (including 17 securities)

the Banque de France discount rate (*C*). He thus ended up with *ABC* curves in Warren Persons's Harvard style (see Morgan 1990). March's barometer, shown in figure 1, illustrates the cycles in France, England, and the United States. The barometer suggests the ways the various curves are related within the cycles—their "*successions*," in March's own words. It also suggests a kind of international regularity: March remarked that "the *ABC* curves in England reveal the same pattern [as those in the United States]: the oscillations of speculation precede those of prices, which are themselves followed by the oscillations of the discount rate" (177). These successions, however, were less apparent in the case of France.

March's index numbers approach remains at times ambiguous. On the one hand, he seemed to view them as physical measurements of variables (277), as in the price index work of Wesley Clair Mitchell and Irving Fisher (see Spencer Banzhaf's article in this volume)—and the purpose was to get measures of their movements through time. On the other hand, the important thing about March's measurement approach was not the numbers as such (compared to the point of the exercises discussed by Marcel Boumans [this volume] and Banzhaf [this volume]) but rather the search for graphic indicators that could establish facts about economic phenomena and make possible the discovery of regularities, in the style of Mitchell's business cycle work. Then the existence of such regularities had to be verified by the *indices de dépendance*: "These movements can be usefully compared to each other . . . in order to search for possible links. I have already exposed in the Société [de Statistique de Paris] adequate methods to reach this aim" (263).[15] This means that March believed that graphs and indices were two complementary technologies that should be used hand in hand.

March's views on cycles deserve two comments. First, he thought that index numbers could not "be considered as precise" (277) and could not take into account the whole range of circumstances—this was to him a major difference between measurement in economics and measurement

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and an index relative to stocks (including 186 securities, decomposed in twenty-five sector-based sub-indices). In a second step, he constructed after 1919 several indices complementary to those previously mentioned and some monthly indices as well. This work by Lenoir deserves two brief comments. First, it illustrates the role of the SGF in constructing instruments that make possible the observation of economic activity. Second, his work was closely associated with graphs used to infer some of the relationships between the stock market and economic activity.

15. He made here no use of correlation.

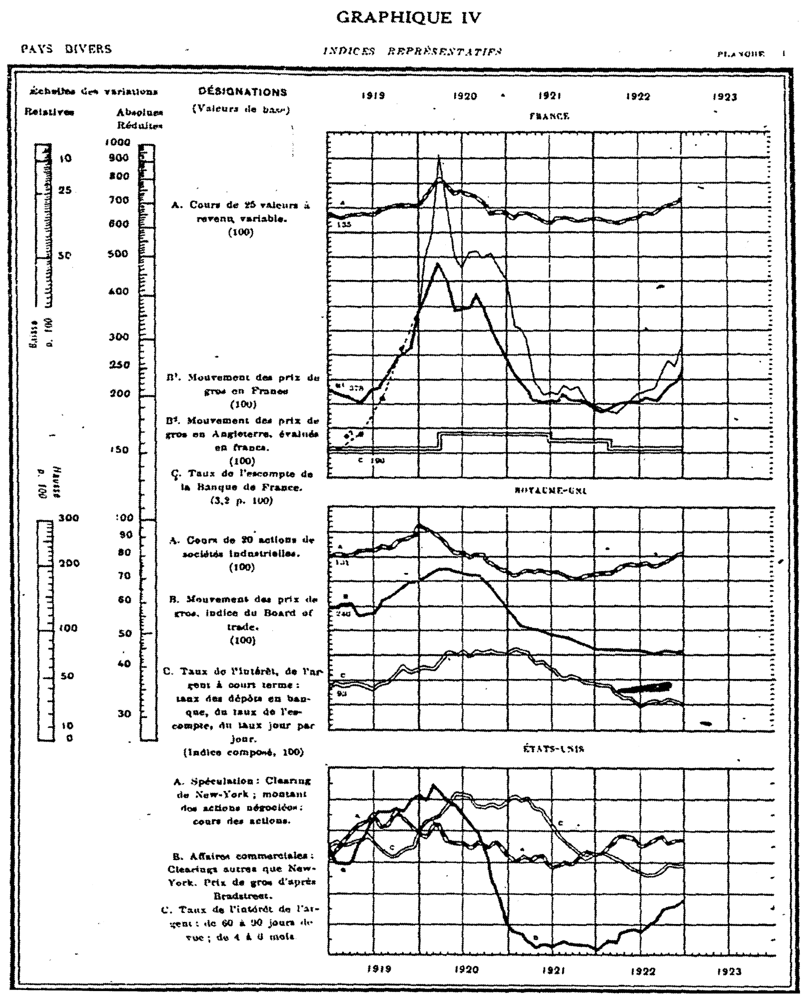

Figure 1 March's barometer (1923, 276)

in some of the natural sciences (277–78). However, he believed that a large variety of indices could help in narrowing uncertainties (278–79). Second, the complexity of business cycles was grounded in the belief that their origins could not be traced back to a single cause: "Cyclical fluctuations cover phenomena of very different origins: meteorological accidents (drought, frost, flooding, and so forth), social accidents (wars, strikes), or monetary phenomena" (271). March did not use the term “fluctuation” by chance. He rejected the possibility of strictly periodic cycles because economic conditions were changing in such a way that the length of cycles was expected to vary; business cycles were seen as recurrent but not strictly periodic. From that point of view, his cycle approach strongly differs from William Jevons’s and Henry Moore’s social astronomy (see Sandra Peart’s essay in this volume and Le Gall 1999). Moreover, some of the phenomena influencing economic conditions could not be quantified and measured (March 1923, 270). This meant that institutions, history, and so forth were significant and consequently that partial theories should be considered cautiously.

Similar conclusions can be drawn from a paper March published in 1912 on a statistical and graphical test of the quantity theory of money (considering the 1783–1910 period). March doubted the relevance of such a simple relationship and believed that “other factors have to be taken into account” (1912b, 114). His approach to monetary issues can here be contrasted with the episodes in the quantitative assessment of the value of money analyzed by Kevin Hoover and Michael Dowell (this volume) and Thomas Humphrey (this volume). A common concern of the authors they study was the search for causes, and some of them referred to John Stuart Mill’s emphasis on a single main cause[16]—although Mill thought that no one such cause could be extricated empirically from a multitude of significant causes (Peart this volume). By contrast, March found it necessary from the start to take into account the whole range of circumstances; he developed a taste for a statistical approach that left no room for abstraction[17] and that could respect the complexity of the real world. He believed that statistics made possible the derivation of empirical regularities in the social world; we suggest, however, that such regularities could not be considered laws.

16. According to Zouboulakis (1990), Mill and the economists of the “Ricardian tradition” had to demonstrate the relevance of an analytical approach which was based on the isolation of economic phenomena. Their proof rested on an argument—the “composition of causes”—directly taken from mechanics: when an effect depends on a concurrence of causes, these causes must be studied one by one and their laws separated in order to obtain, eventually, the law of the whole phenomena. See also Le Gall and Robert 1999.

17. By contrast, “Mill thought that abstractions were necessary to the scientific pretensions of political economy because they would reveal the true nature of economic activity to us,” although “he did not think that that was all you needed in order to explain things in the economy” (Morgan 2000, 153).

March's views on economic cycles and on the quantity theory show that he became more interested in the *composition* problem—the interweaving of phenomena, which was to him the fundamental issue in the social sciences—than in the *decomposition* problem, although he remains known for his technical contribution to the latter. We also see that March, even while he practiced statistics, which he saw as a methodological path to observe the social world, constantly put forward the limits of his exercises. To understand such a combination, we should examine the association he made between statistics and his epistemological views.

Approaching the Lost World: Epistemological Foundations of Statistics

We believe that March's statistical work cannot be separated from his epistemological views: the various limits he put forward—those in measurement and statistics—in both his theoretical and applied work originate in precise worldviews. March believed that the world was intrinsically complex, characterized by epistemic uncertainty, and out of reach—a kind of lost world. However, this does not mean that he excluded realism from the range of science and of statistics: he believed statistics offered a means of approaching—and taming, in the sense of Ian Hacking (1990)—the world and of allowing decision making in human societies.

Correlation, Historical Time, and Causality: March Attacks

March carefully delineated the range of application of the method of correlation: it was a tool that took no account of the time dimension and could not be considered to measure causal relationships.

He realized that a correlation coefficient cannot be sufficient to analyze the relation between variables, it makes possible the quantification of the intensity of their association, but it leads to a loss of information in the sense that it negates historical time. March thought that history mattered within the social world, that various circumstances could never be considered constant: "Economic laws, like every general formula, remain valid only during a certain period and under precise circumstances" (1912b, 112). However, unlike correlation, graphs illustrate economic movements over time:

> From the point of view of descriptive statistics, [graphs] present . . . the schematic picture of facts that can be measured. From the point of view of comparative (or analytical) statistics, they show the reciprocal relations between facts and can help in the discovery of what is constant in these relations. Moreover, they simplify the comparison of the various phases of a phenomenon, they reveal irregularities and anomalies. (1905, 4)

This conviction led March to proclaim that correlation and graphs should not be separated—and this was the methodological path he followed when studying business cycles, as seen above. This idea originated in the 1905 study, whose title was suggestive: *Les représentations graphiques et la statistique comparative*. If that study is today known for including pioneering ideas about correlation, it also contains long discussions about graphs that remain neglected. Yet its originality lies in the association of both tools providing a "control" for each other: "The alliance of graphic processes and calculus makes possible a precise analysis of the links between facts, as far as we can evaluate the appearances and the particularities that can be measured. The result is a method of investigation and control that should be recommended" (40). Morgan gives precision to the different roles of correlation and graphs: correlation was seen as a measure of the strength of an atemporal relation between variables, whereas "the arguments based on graphs were employed to justify explanations of specific historical time series" (1997, 73). She indeed suggests that "While the introduction of the correlation coefficient could be regarded as in some sense a significant technical advance, most economic statisticians continued [at the turn of the century] to use graphic methods extensively. . . . Correlation . . . does not tell you the history of the variable or help you to explain what has happened, nor even help you predict a time series; it is a complementary, not a replacement, technology" (74–75).

If correlation was thus associated as a complement to graphs, it was dissociated from causality. As early as 1905, March pointed out a basic difference between the *indices de dépendance*—including Pearson's correlation coefficient—and causality, a basic difference[18] that he carefully explained from the early 1910s through to his 1930 blueprint, *Les*

18. Of course with correlation, no dependency is explicit—just a co-relationship. Yet recent histories of econometrics and of statistics show that at the turn of the century, several scholars read causality into correlation (see below).

principes de la méthode statistique. His arguments largely originate in Pearson's positivist thought, as his translation into French of the third edition of *The Grammar of Science* suggests. That book, as well as the rest of Pearson's work, was an indictment of causality. Pearson believed that we cannot gain access to causes; instead, we perceive correlations:

> Nowhere do we find perfect lawlikeness, he stressed. Everywhere we find correlations. That is, even in mechanics there is always some unexplained variation. This should cause us no distress. The possibility of science depends only in the most general way on the nature of the phenomena being investigated. A correlation, after all, is not a deep truth about the world, but a convenient way of summarizing experience. Pearson's conception of science was more a social than a natural philosophy. The key to science he found not in the world, but in an ordered method of investigation. For Pearson, scientific knowledge depended on a correct approach, and this meant, first of all, the taming of human subjectivity. (Porter 1995, 21)

March and Pearson were led to believe that causality was a "pure concept" or a "conceptual limit" whose realism had to be questioned in each particular case. This idea was expressed by March in his preface to Pearson's book:

> The author of the *Grammar* adopts Hume's idea according to which no internal necessity, and consequently no absolute regularity, exists between cause and effect. The succeeding events [*successions*] never reappear in an identical way; the notion of causality is once more a borderline notion [*notion-limite*] that exceeds sensible experience. A more or less close *statistical* agreement exists only between the changes of the cause and those of the effect (1912a, v).

This concept of *notion-limite* indicates that for March there was an epistemological barrier to grasping all causal influences in concrete cases. Along with Pearson, March claimed that causal relationships were just simple and particular "images" of the world (1931, 475)—"simplicity of nature is ultimately a simplification introduced by a mysterious power, the mental mechanism" (1912a, iv)—that should leave room for recognition that the universe was not so simple and was rather inaccessible. Consequently, the general case became a "space in between": absolute independence and dependence were just borderline cases, whereas the general rule was the continuum of intermediate situations—that is, "the various degrees of association" (Pearson 1912, 200). Correlation was precisely the adequate tool for measuring the association between two variables, but there was no possibility it could help one infer the existence of a causal relation.

At that stage we can see that March's approach contrasts with the unwavering faith of other authors using correlation, including Moore[19] and Hooker (Morgan 1990; Le Gall 1999). Moreover this differentiation of causality and correlation strongly influenced the subsequent French pioneers of econometrics—and in a more formal fashion, Lenoir (Chaigneau and Le Gall 1998). Furthermore, in order to avoid confusions generated by previous studies such as Moore's, March rejected the use of the word *correlation* in his applied work and had a predilection for the words *covariation or concomittance*, which were to him free of notions of causality.[20]

Both the alliance of correlation and graphs and the dissociation of causality from correlation find their explanations in a worldview that reserves a particular place for history and that denies the possibility of the successful search for causal relationships.

Measuring and Taming the Lost World

A key to this worldview is to be found in March's belief in the "variability"[21] and the "complexity" of the world, to use his own words. Although some regularities and even a certain determinism could be unveiled by statistics (March 1924, 351), March thought that Nature—and especially the human world—was characterized by permanent change, by epistemic uncertainty. No absolute determinism ruled society in the sense that man permanently acts on reality and that social facts depend on a human will that cannot be understood (1924, 350). Thus history matters and "variability" was permanently at work. Moreover, a large variety of phenomena were interconnected in such a way that knowledge of them was unattainable—and here we find an explanation of March's rejection of the search for causal relationships.

19. In a review of *Laws of Wages: An Essay in Statistical Economics* (1911), March harshly criticized Moore's assimilation of correlation and causality (see 1912c, 368).

20. Yet in the 1905 paper, March still used the word *dépendance* for "reasons of euphony" (18).

21. In this he remained close to Mill's view that hardly any two cases are exactly similar (see Peart this volume).

But how does one deal with such a world? March thought that the social scientist could not understand it, and he rejected the construction of "pseudo-realities," to use a contemporary word, that aimed at modeling and reproducing the universe[22] and that belonged only to the range of "images." Indeed, he claimed that no "anthropomorphism" (1908, 294) could exist between a theoretical world—in the sense of an abstract model—and the real world: "Certainty or scientific evidence results from an accordance between thought and itself. . . . Scientific certainty only exists in the world of concepts" (1912a, iii). In other words, March was delineating a frontier between the real and inaccessible world and any theoretical world, where certainty can prevail but has no realistic counterpart. "Pseudo-realities" were certain in the sense that they obey formal rules of logic, but given the inaccessibility of the real world, they could never be satisfying: "a theory is only satisfying if it covers [*embrasse*] the whole facts" (1909, 258). Understanding the way the universe functioned was thus out of reach.

However, there was no renouncement of studying reality per se at work here. The world could not be exhaustively understood, but it could be approximately observed and measured. Here we understand the pivotal role of statistics for March: it was the unique way to approach reality. His worldviews thus paved the way for the kinds of studies that open the door to a large variety of indicators:

> In physical meteorology, we never obtain the best forecasts on the basis of a single look at the barometer, but on the basis of observations of the thermometer, the hydrometer, and the weather vane. I doubt that a single index that would be a synthesis of these four observations could be more useful than four indications taken separately. . . . Similarly, in the observation of business movement, we have to avoid a unique basis; it is useful to examine the whole basis. (1923, 281)

Such an increase in the number of measures could lead to a convergence toward more certain knowledge. However March also developed a more pessimistic idea: scientists would like to believe in such a convergence—we interpret this belief as a convention—but "the unknown and the known increase jointly" (1912a, v). In addition the social scientist could never be certain that he has reached reality: the regularities he extracted

22. The argument remains close to the distinction between statistics and the experimental method.

could have been different in another context, with other tools. "Reality is just a trace [*vestige*] in the large set of possibilities" (1924, 346); in that sense, statistics was only the expression of possibilities—it afforded means to study facts, but it remained impossible to infer that we had reached reality.

Such an epistemological view was a watershed. March was rejecting nineteenth-century beliefs, and in a more formal fashion, the deterministic conception of the social world. Previous statisticians or economists (such as Adolphe Quetelet, Regnault, or Moore) based their studies on the belief that simple and deterministic laws were at work—that, after all, Nature was driven by only a few wheels. This also explains the mathematical modeling of the human world that is to be found in the work of some of these authors. By contrast March rejected mathematical economics. He perceived a complexity at work in reality, and he believed this complexity should lead to a reorientation of statistical work: statistics was not a means to approximate determinism anymore, but should now aim at approaching and measuring an evasive Nature. In a sense March's thought illustrates the way the development of statistics began to tame chance at the turn of the century; statistics made chance amenable to analysis and brought it under control—as Ian Hacking emphasized when he showed how Francis Galton's tools represent "a fundamental transition in the conception of statistical laws" (1990, 181). Moreover, recent work by Giorgio Israel (1996, 2000) suggests that the erosion of determinism in science around the turn of the century made room for kinds of instrumentalism—in the sense that the aim of science became more the reproduction than the understanding of reality.[23] Yet March never rejected the study of reality: he maintained along with nineteenth-century scientists the idea that science should reveal something about reality—indeed, such a belief was the reason he remained opposed to the development of instrumental models. Nevertheless, the social world was seen as intrinsically complicated, making the task of science and statistics immensely difficult.

Statistics, in taming chance, had become a means to measure the world. But it was also a means to improve the human lot and environment. These views originate in March's perception of forecasting. Straightaway it should be noted that forecasting is characterized by a form of paradox: it is the ultimate aim of statistics but at the same time it

23. Such an analysis perfectly fits the history of econometrics (Le Gall 2001a).

marks the end of science. Indeed, March believed that forecasting was a subjective exercise: the various users of statistical studies—businessmen or governments—have to interpret statistical regularities according to their own aims. It was taken for granted that statistics offered a fragile knowledge relative to a complex object. Forecasting was thus based on conjectures relative to what has happened and to what will happen and necessarily involved "personal judgment" (March 1923, 280). In March's words, it was "*un art*" (1931, 475) characterized by "*la liberté de se déterminer*" (1930a, 269)—and was the moment when science stops. Once more, this idea is to be contrasted with the appreciation of forecasting found within the deterministic paradigm, in which the discovery of laws was synonymous with the discovery of what the future had in store. In March's statistical work we see now both chance tamed and cracks in determinism. But this "end of science" does not reduce the usefulness of forecasting, and March's barometer is here an enlightening case study. Although the label is somewhat misleading,[24] the barometer was an instrument of prediction. It was a tool to be used by governments and businessmen: for instance, forecasting based on an analysis of the curves could aid in reasoning and decision making within the firm. An illustration can be found in the fact that a barometer makes possible the determination of the moment when "the prices will be the most attractive" (March 1931, 473). More generally, forecasting was a means to lessen risks, to dominate the environment, to aid community reasoning within a firm or a nation: "*administrer c'est prévoir*" (1930b, x) was March's motto.[25] Statistics was thus seen as a means of measuring but also of taming and shaping the social world.

Conclusion

March's statistical style can be understood as the search for tools and indicators that make possible an approximate measurement of the social

24. The visual language of the graphs provides not just an indicator of where the economy is going (as a barometer), but a whole picture of what it has gone through. March's "barometer" was not just an instrument of observation but more nearly an instrument of current indication and prediction.

25. We do not believe here that this emphasis on using statistics for prediction rather than explanation was exclusively influenced by his practical work for the government. We more generally suggest that it was associated with and resulted from well-shaped epistemological views.

world—a quest that was only meaningful with respect to precise epistemological views. His involvement in measurement was closely associated with the belief that a unique research path existed in the social sciences. Observation formed the path, and it generated knowledge per se.

Our history of March's statistical style can illuminate the way the relations between measurement, statistics, and economics were perceived in France during the early twentieth century, and the characteristic style of French thinking about economic statistics. March's statistical style—which, in certain respects, shares much in common with the American statistical parades of the 1910s and with the approach of the National Bureau for Economic Research and Mitchell—can explain the lack of recognition of the contributions to pre-probabilistic econometrics that arose at the SGF during the early 1910s (particularly those of Bunle and Lenoir, both of whom finally followed March's statistical path). But March's stamp was deeper: his statistical style flourished in France and contributed to a particular approach to public statistics. Between 1920 and World War II, the SGF—then run by Michel Huber, who had been largely trained by March—followed this approach. After World War II the INSEE[26] developed a method associated with national accounting that largely remained impervious to mathematical methods and to the Cowles approach and their methods of statistical inference, which were seen as a conservative practice based on the observation of the past (Malinvaud 1991). In some respects, that strategy was a wider feature of French economic thought during the period (Le Gall 2001b).

Yet, beyond this historical influence, we believe that March deserves a particular attention for his emphasis on the epistemological foundations of the statistical work to be done in economics, an emphasis that followed three precepts. First, he constantly stressed the need for criticism, sometimes in a pre-Popperian style. All of his work was constantly an occasion for the identification of limits. Second, his approach to the world remained wise. He claimed that scientists could never completely master the way the social world was functioning and, for that reason, would have to remain aware of their own limits and possibilities. Third, he was adamant that science has a precise aim: the knowledge of the world and of mankind and the improvement of the human

26. The Institut National de la Statistique et des Études Économiques. The SGF became the INSEE in 1946.

lot. Yet, as Israel convincingly explains, during the twentieth century, science progressively became dominated by another factor: its own language, in the sense that it became more concerned with the construction of its own models than with inquiries into the objects it was supposed to explain. Such an approach is perfectly exemplified by the construction of "pseudo-realities" in economics. However, and although our contemporary context strongly differs from that of the early twentieth century, March reminds us that "science offers means and not the ends of action" (Israel 2000, 196). We can still draw lessons from March's statistical style.

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