On Savings Banks

Modeling the Diffusion of the Savings Banks Idea in Italy and the Performance of these Banks over Two Centuries

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Executive Summary

The banking system represents a compensation room for an intricate web of social relations, aiming at the *transfer of options* between present and future, *and keeping the bo*oks for these operations. The will of the individual appears dispersed into the intricacies, and the dynamics of the system largely unpredictable. As it will appear in this work, where the tools of systems analysis have been applied for the first time, the banking system is more of a *clockwork containing its future in its mechanisms*, and explicitates this future with secular selfconsistency.

As our historical analysis shows, the complexity of the system is reducible to a set of *Chinese boxes*, into which *simple structures* are hierarchically organized in *fractal order*. Taking again the analogy of the watch, the complexity of the machine can be reduced to a hierarchy (quasi fractal) of simple gears.

This historical analysis covers and models the dynamics of:

1. The foundation of the banks.
2. The savings books.
3. The deposits.
4. The assets.
5. The investments.
6. The bad debts.

This analysis has been done more in detail for the CRF (Cassa di Risparmio di Firenze) which originally commissioned the study, but many other Italian Savings Banks (and some European) have been studied, particularly in respect to the secular dynamics of their deposits, in order to set up a context for the behavior of the CRF. To see the container in its outer borders, we analyzed the secular dynamics of Italian GNP, the deposits in various classes of banking institutes, and the great competitor of all banks, the Public Debt. The model we use (see Appendix) is that of *social learning*, based on the diffusion of *action paradigms*. With extreme mathematical parsimony it produces a synthetic view of long evolutionary processes. Basically, an *idea that proved good is imitated*, and this imitation process has the mathematical aspect of an *epidemics.*

The results of this study that we think of special interest are the following:

- The evolution in time of the various parameters that measure the activity of a bank: *Deposits*, *assets, investments, bad debts*, etc., can be *modeled* with great mathematical simplicity over the *long term* (typically in stretches of about 50 years). The real data oscillate around the values defined by the model, which provides a reference paradigm. In some cases these oscillations have been separated from the trend, because they may contain a second–level message.
- The same kind of modeling has been applied to *evolution of GNP*, the largest container into which national banks like Savings Banks usually work. Modeling GNP over stretches of 50 years with great mathematical simplicity is probably a first. It may become an instrument of national planning, but it is certainly useful for the single bank that always needs a repositioning into the system. The model has been applied to various nations for the last hundred years.
- The same kind of modeling has also been applied to the *Italian public debt* in form of treasury certificates of various kind (BOT and CCT). The evolution of this debt can be decomposed into two logistic waves, partially superposed, but with very different temporal

dynamics. The first one, with slow growth and centered in 1977 has a saturation level of 850 10^{12} Lire 1989. The second one with fast growth is centered in 1985 and has a saturation level of 340 10^{12} Lire 1989. It has already saturated. On the basis of this analysis (done in 1989) we predicted that the Italian public debt expressed in BOT and CCT would not grow any more, in constant money, after 1992. In fact, the primary budget (excluding interests on debt and taxes on these interests) should balance in 1993.

- The taxonomic analysis done for about 150 Savings Banks in the period 1830–1990, and for other banks in the period 1940–1990 shows that the *banking system is strictly tied in its development* to the pulsation of social and economic activity, inside the so–called *Kondratiev* long cycles. The present cycle, going approximately from 1940 to 1995, implies a *stagnation in the GNP, in the deposits* (in constant money) and in the *occupational level until about 2000*. Up to 1995 the recessive brake will be operative, basically a non–growth (a depressive flare is still possible if panic spreads). Beyond 1995 (the date is just a reference point, the welding between cycles is bumpy), we should enter in the accelerating phase of the next boom, but starting from zero speed the movement will not be large. One can expect, however, a more optimistic mood in general. The analysis of criminality in the USA (homicides) and of suicides shows well how these cycles are linked (caused?) to strong changes in social moods.

As for other economic activities, also for banks, the impulse to grow requires the *invention of new functions*. The end of the Kondratiev cycles has been historically characterized by great entrepreneurial creativity and the banking system does not escape the rule. These evolutionary patterns, so crisply defined by the model, permit robust forecasts, or at least reduce uncertainty on future situations, greatly helping strategic choices. In the case of air transport, to give a parallel example, a logic at high fractal level, permitted to evaluate the basic parameters in the development of air technologies for the next Kondratiev (1995–2050). For the banking system in the frame of this research, we were not able to find the appropriate key to pry into this future. The modeling at the first fractal level, in fact, can be done only inside each Kondratiev cycle. On top of that, when approaching the end of the cycle many systems enter into an oscillatory phase, hunting for the asymptote, and we are not able yet to master these oscillations.

A last point we have started to explore is that of the *rank–size* distribution of banks. *Size* is the dimension measured through some essential parameter, e.g., the deposits, and *rank* is their position when ordered according to size. Structures occupying functionally a territory (e.g., cities, i.e, human settlements) tend to have a fractal rank size order. This means that the ratio of size of cities having rank *n* and rank *n+1*, is constant. We found that Savings Banks in Italy tend to have a fractal distribution. This can be useful in detecting cases of non–equilibrium, which points to rapid growth, fission or fusion. The connection of rank–size, fractals and Pareto distribution is an area of actual research and we have entered the subject only in a superficial way. It should deserve much attention in a period like the present of deep reorganization of the banking system.

Altogether, our analysis has revealed a high level of order, both taxonomic and dynamic all over the banking system. The research was an exploration to see if long–term order existed, and in that sense it has been very successful. The *single methodology* and the *fractality of the system*, down to the bank, puts a powerful tool into the hands of the explorer of the “infinitely large and the infinitely small". *Contrary to our personal perceptions, there is order everywhere*. A notation by Pico della Mirandola is very pertinent here: “… perché chaos non significa altro che la materia piena di tutte le forme, ma confusa ed imperfetta".[1]

[1]….. because chaos means only matter full of all forms, but blurred and imperfect.

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1 – General Considerations

At the beginning of the 19th century, and the parallel urbanization in Europe, the explosion of industrial activity led to the formation of a proletariat, very poor if seen with present standards, but much more monetarized that a peasant proletariat. The idea of the Savings Banks, if colored with philantropy as it appeared at the beginning, could flourish in this arid soil, through a capillary root system capable of extracting something even from the driest pockets. Just to give an idea, savings stamps were on sale, corresponding to the lowest monetary denomination, which, glued into forms, could permit assembling enough value to justify a scripture.

From the point of view, perhaps too cold, of systems analysis, the basic and constructive function of the Savings Banks was to scrape the bottom of the barrel to assemble capital to invest in industry, then developing at a fast rate. This may not appear true of we look in detail at the investments of the Savings Banks, mostly concentrated on the housing market, or, as in the French case, to financing the needs of the Treasury. But in this way the risk capital which was flowing into entrepreneurial activities was not distracted into these investments, necessary but with secular metabolism.

The idea matched the socioeconomic substrate and was timely. It took at once and, if slowly, as for any basic social innovation, it spread all over Europe. Processes implying a change in mental attitudes take in fact centuries to spread into their “ecological niches". Just to give an example that runs in parallel, a study of alphabetization covering the last two centuries has shown that to go from en endemic 10% alphabetized people to an endemic 10% analphabets took about 150 years. And this also in alert nations like Holland and Germany.

The first objective of this study is to model mathematically such a “slow explosion" of the population of Savings Banks from the origins, at the beginning of the 19th century, up to date. This in terms of *number of Savings Banks deposits, assets, and investments*, singling out institutions of special longevity for a personalized treatment. Modeling has two purposes: piles of data can be condensed into the few parameters of the equations, permitting a rational organization of the taxonomy of the system and of its parts. On the other side, the unsuspected regularity and long–term stability that emerges from the modeling, provides a robust basis to evaluate the present and hint into the future.

Taking decisions that project ahead into the future is typically a *trial and error* process. This mechanism is very expensive, even if imitation of the successful one reduces the social cost. A good model puts labels on open doors and on closed doors. Even if these labels have only a probabilistic value, the service they provide in reducing decisional risk can be very valuable.

Judging from the point of view of the analyst, the success of this exploration is rewarding. The model had been previously used to map the evolution of physicals, but we never dared to deal with an abstract and elastic ware as money. We observe that the extreme simplicity of the model, in conceptual and mathematical terms envelops a deep change in the philosophy of how to interpret the behavior of social and economic systems, strongly attenuating the importance of isolated and voluntaristic choices. This fact is clearly perceived by the reader, and induces to accept our results with great prudence. But this is part of the game. The model operating on the simple and general mechanisms of social behavior, has reflexive properties and shows, through the analysis of parallel cases, that its final acceptance will require something in the range of 50 years. The general theory of relativity did not require less, to go from a much applauded and admired intellectual exploit, to an efficient working tool in the area of physics and astronomy. The intellectual elite of the physicists does not escape the general rules of social behavior. Also the acceptance of margarine by the American housewives took about 50 years for substantially substituting butter.

Coming to brass tacks, the model supposes:

- That the actions of single persons and of organizations are normally modeled on *action paradigms* that have been already successful. If Bank A opens a Bankomat system and is successful, it will be followed by Bank B and so on.
- That the *diffusion of action paradigms* can be modeled with the mathematics of an *epidemic diffusion*.

These two hypotheses have been verified in detail in a significant number of cases, and constitute the lead of the life work of Prof. Haegerstrand (1952) of the University of Lund in Sweden. He searched into the mechanisms of the intricated web of social interactions that make the imitation process a form of epidemic diffusion. Some of his publications are referred to in the bibliography. This kind of research, however, is possible in vivo, or short–term, when the memory of persons can provide the soft data that are part of the selfconscious behavior.

In the thousands of cases we analyzed at the International Institute for Applied Systems Analysis (IIASA) in Vienna, such a procedure was impossible, both because it is extremely time–demanding, and because many analyses had to be done on processes going back tens of years or centuries. We had to make the hypothesis that the mechanisms identified by Haegerstrand in a few cases had a general character. The great success of the model in dealing with the thousands of cases we examined is a strong support to the hypothesis. As we shall see, the model works also very well in the about 100 cases here reported and dealing with Savings Banks.

The history of this model is meandering. It was used more than a hundred years ago by the Belgian biologist Verhulst (1838) to describe the growth of an animal population inside its biological niche. The process can be reduced to an epidemiological diffusion, because growth is proportional to the reproductive capacity of the population, i.e., to the size of the population itself, and to the resources of the niche not yet tapped. In epidemics the number of new cases is proportional to the infected population, which spreads the disease, multiplied by the non–infected which constitute the untapped *resource* of the infection.

From animal populations the model was transferred to human populations (Pearl, 1924) sometimes with success, but often not. A point demographers had missed is that the ecological niche is normally taken as fixed, as it is for an animal species that operate with fixed technologies over short periods of time. In the case of man, *Homo Faber*, which continuously improves the *technology of access to resources*, this is obviously not true. Consequently, the niche keeps growing (normally) making that parameter in the equation variable and unpredictable. This is said with the famous *wisdom a posteriori*. When the model did not fit the facts, the demographers of the period of the twenties–thirties, with a formation in mathematics or statistics introduced refinements, generalizations, and complications, making it so twisted that finally it was dropped. However, during this period (1930–1945) some very interesting explorations were made, applying it *tout court* to the social system, i.e., to the diffusion of *action paradigms*. Also this line finally went lost for various reasons, one of them the authors did not even suspect: *the deep modulation of most human activities by a cycle of about 55 years*, that Kondratiev identified in the economy. Most processes of diffusion go to saturation toward the end of the cycle, even when they are loosely related to economy, with instabilities around this point. Because the last cycle ended in 1940, our explorers in the thirties went into serious difficulties.

A line of development directly connected to the work of Verhulst on animal populations developed in the twenties through the work of Haldane (1924), which considered the case of two populations in a relation of commensalism inside a given niche. Volterra (1927) and Lotka (1924), more or less in the same period of time, tried to generalize the preceding situation to the case of a number of species, animal and vegetal, interacting in the same geographical area. The extreme complexity of the system was reduced to a skeleton core by Volterra, applied mathematician in Pisa, and Lotka, mathematical physicist in Princeton. The system of differential equations assembled by these two gentlemen is now called Volterra–Lotka and still constitutes the backbone of ecological modeling (Kingsland, 1982). The reduction to stochastic processes can be found in the papers of Mollison (1977) and Tuckwell and Koziol (1987).

The modeling we now use at the Institute in Vienna exploits all these researches, and *the mistakes* that finally blocked their large–scale application, by introducing some points of view, quite natural to a physicist, that cleared the system from procedural impediments. The first point is that when mathematics does not fit the facts, instead of complicating it in a self–destructive cycle, we simplify the facts in the sense of redefining the limits and the angle of the object under study. A typical case where our predecessors stumbled systematically, is that of two or three processes of diffusion going on at the same time in the same niche (multiple competition) which were treated as they were a single one. This is a normal situation in a market where a sequence of new products compete with the old ones displacing them progressively. The newcomers *change interactively* the dynamics of the older competitors, which however during certain time–slices appear to behave as if they were alone, confounding the ideas and the mathematics of the modeler.

Still on the analogy with physics, that slowly liberated itself from the animisms implicit and explicit, we eliminated all “interpretations" that plague economic and social studies. *The model must be capable of organizing the facts* as the orbits of the planets into Keplerian ellipses, without incommodating angels and free will. The quality of this organization will be judged from the *ability to forecast*. To adopt coherently this procedure is more easily said than done in the area of social behavior where, by tradition, “explanation" is the seducing conversation piece and is automatically required. When a scientific procedure is introduced actually *forecasting becomes the touchstone*. The Keplerian method permits today to forecast a lunar eclipse twenty years ahead with the precision of one second. Our modeling is far from these pinnacles. But to have done forecasts with the precision of a few percents, 50 years ahead, in the turbulent field of energy markets, gives us the feeling we are on the right track.

Apart from the forecast, the systematic analysis of a certain area, explicitates the underlying *taxonomy and its temporal dynamics* in a quantitative and crystalline form. The various hierarchical levels of the structure can be represented with the same mathematical formalism, evidencing *quasi fractal taxonomies*. *The banking system and the single bank can be modeled with the same equations*.

During the period when the idea of the Savings Banks was still diffusing, new banks are founded, and they can be seen collectively as a “population" that fills a niche at regional, national, or international level. Also the single bank grows to fill the local niche. The substance of the process appears independent on the hierarchical level, although the coefficients in the equations depend on it. An idea that titillated the imagination of the students and the poets of organizations is whether they have a “soul". Our analysis gives a crisp answer, if a little oblique. Inside a cycle of Kondratiev, i.e., by blocks of 55 years, an organization can usually be represented by a single equation, in terms of some quintessentially representative parameter like the number of cars per year produced by Mercedes, or the value in constant money of the deposits of the Cassa di Risparmio of Florence (CRF). As in the case of a biological individual, the actual values can move up and down by respect to the trajectory traced by the equation, with a “noise" that changes from case to case, but rarely exceeds the percents. This looks as if the company had a personality transcending the persons that constitute and control it. It is however simpler to locate the destiny of a company into the heads of its potential customers (the niche!), and the diffusion of an idea into these heads times the destiny of the company. It is the simplicity and regularity of the process, mirrored in the development of the company itself, that makes it appear as if the company had a long–term program and a clock. However, if a perturbation modifies the actual trajectory, the company will strive, this time under its own steam, to readjust it toward the equation. This means to go back to the line representing the diffusion of the Action Paradigms, which kept going independently.

Exceptions to these rules are extremely rare and in the thousands of cases studied we found only two sets that did not match: one referring to France and the other to Japan. In both cases the clocks seemed to stop for a number of years and then start again. It must be clear that large and traumatic events, such as World War II produce deep irregularities which, however, are *completely reabsorbed in a number of years* (e.g., five). This means that the reference trajectory is not modified and no time is finally lost. In the case of France and Japan we have to cut away a number of years to restore the continuity. It is very interesting to observe that the position and number of years corresponds in both cases to the periods of occupation, when the countries lost their sovereignty. How all this influences the diffusion of action paradigms into the heads of the citizen would be a fascinating subject for an investigation.

The reason to enter into the details of these exceptions is that the third case discovered is the Italian banking system in general and the CRF in particular, which, measured in terms of deposits in constant money, “lost" about seven years between 1980 and 1987. We tried to present the phenomenon under various angles. The “loss of sovereignty" that assimilated France and Japan, and could constitute a lead to quantify the phenomenon, does not look as a plausible mechanism in the case of the Italian banking system during that period. The analysis of the GNP, on the other hand, does not show any discontinuity. The inroads of the public debt was also suspected, but it does not really match in terms of quantities and timing.

This view of the social and economic world with strong imprints from the biologic disciplines, may be reminiscent of Hobbe's Leviatan and similar constructs of the social and political imaginary. Our quantitative modeling confirms some of these views: *Our society is a cultural ecosystem* made of an intricate web of interacting organized structures. In the optics of fractal hierarchies these structures can be seen as the *materialization of Action Paradigms*, that diffuse into their niches to be in time substituted by new ones in an *inexhaustible sequence* of speciations. At this level of abstraction the analogies between the dynamics of human cultural system and that of DNA in living organisms become very strong, and in fact *the mathematics is identical*.

In this context it is possible to *forecast* within due limits, as the subsystems are bound to the diffusion processes. The “programs" which these processes imply can be identified through past behavior, and also through numerous taxonomic regularities.

2 – Plan of the Work

This report is conceptually divided into three sections:

- In the first one, comprising the first four chapters, we discuss *the methodology* and some *taxonomic properties* of the economic system that will help the interpretation of the subsystem of banks and Savings Banks.
- In the second one, comprising chapters 5 and 6, we analyze the process of opening and closing Savings Banks in Italy and its regions, with some examples from other countries. As indicators of the state of diffusion of the system, we took into consideration the *number of banks*, the *deposits*, and, when data were available, the *investments*.
- In the third one, chapter 7, the analysis concentrates on the CRF from its foundation to date, with particular attention on the last period starting in 1940. A number of other Savings Banks are studied in parallel to create a context for comparison.

3 – Some Mathematics to Help Interpreting the Tables

According to a principle of economy, in a quantitative study like the present one the results should be reported and discussed in terms of fitting equations, their parameters, interrelations, and taxonomies. But this would have reduced the readers to a very restricted number of specialists. Because the results, once some general concepts have been grasped, are very intuitive and visual, we though to publish them mostly in form of charts. For the specialist who prefers to think in terms of equations, the numbers from which their parameters can be constructed, are reported on the charts.

The mathematics we used to fit the data is the simplest solution of the Volterra–Lotka equations for ecological competition. Actually to the eyes of the analyst, *human society appears much simpler than the ecological system of a wood*. After all, humanity is a very recent development of the biosphere. The banking system, at least in the limits of the present analysis, appears still simpler and to fit the data in our charts, we will use only *logistic equations of epidemic diffusion*. For the more complex mathematics referring for instance to multiple diffusion, one should refer to the bibliography. The concept on which our dynamic analysis is based is that of (cultural) diffusion at various levels. The hypothesis is that this diffusion occurs through *personal contacts statistically stable in time*. The model then becomes very similar to an epidemiological one, where the epidemics is transferred through personal contacts. The rate of the spread is proportional to the number of contacts between infected and infectable, statistically to the product of their members. The plague starts then slowly, because of a shortage of infected, reaches a maximum speed when infected and infectable are almost equal, and fades out at the end due to a shortage of infectable.

An epidemic diffusion is represented, free hand, in Fig.3–1, where we have reported the new cases of infection versus time. *Action paradigms*, which are finally social models of behavior, are the infectious agents dispersed through social contacts. If we look at the *cumulative* number of infected versus time, we get an S–curve, a three–parameter logistic reported in Fig.3–2. The number of infected moves progressively toward that of the infectable. Their number is called the *niche*, a definition directly borrowed from biology. The penetration of a product in a *market niche* follows precisely the same pattern. In the case of multiple competition we have to complicate somehow the mathematics and we developed computer packages to deal with the problem (Nakicenovic, 1979). The substance however remains the same. *The basic mechanism is still the interpersonal epidemic diffusion*.

The three parameters of the logistic penetration are reported on the charts in a form that can be intuitively grasped: the *saturation level*, or the niche is given as a number in parenthesis and the *temporal dynamics* of the process, i.e., how fast the diffusion moves, is given as ΔT = time between the two crosses located at 10% and 90% of the diffusion process (Fig.3–2). The *chronological positioning* is provided by the *date affixed to the central point* of the logistic (t_0). In most charts, a free–hand linear version of the logistic is reported as a small insert.

Also the growth of a company can be represented in the same way as it reflects the number of its clients which are *coopted through a diffusive mechanism*. A company cannot have a size different from that of its market. In a formally more complex way, one can analyze the dynamics of competitors in a given niche, with companies appearing and penetrating and others phasing out and disappearing.

Clients are not necessarily individuals. The process of diffusion of *action paradigms* between companies, institutions, and various forms of organizations, always follows the same course. To give an example, the use of stamps to pay for the postal service diffused in Europe and America during the last century following a perfect logistic (Fig.3–4). The adopters in this case are the states through their appropriate ministry. To interpret correctly Fig.3–4 we must go one step back. S–curves presentation can be improved by using a transform (Fisher–Pry) that make them appear as a straight line by modifying the ordinates (Fig.3–3). In this way we can check at a glance that the S–curve is actually a logistic. Only logistics are transformed into straight lines. And when comparing many cases on the same chart, straight lines look crisp and readable. In the Fisher–Pry transform the equation is always normalized to the saturation point, the size of the niche. Values are expressed as a *fraction F* of saturation. The logistic equation is expressed in terms of *F/1–F*, the part of the niche already filled divided by the part still available. The ordinates in the chart report log (*F/1–F*), but the value of *F* is indicated at some points to facilitate interpretation. In particular, the values of *F*=10% and *F*=90% which are used to define ΔT, i.e., the speed of the process, are always reported.

Let us see some examples of epidemic diffusion. Fig.3–5 reports on the London plague of 1665 where the number of deaths (cumulative) is taken as an indicator of the situation. For the parallel case of a cultural epidemic we report in Fig.3–6 the evolution of ownership of cars in Europe from 1900 to 1986. We see here two waves of epidemics, one saturating around 1940 and the second expected to saturate around 1995. Here we killed two birds with one stone, first because a *cultural diffusion*, the *paradigm to own a car*, is perfectly modeled by epidemic equations over a period of almost one century. Second, because the diffusion is clearly split into two waves, ending in tune with the *Kondratiev long waves*. One should add that in the last cycle 1940–1995, the middle point is 1969, neatly coinciding with the middle point of the second car wave. And also the diffusion of the stamp of Fig.3–4, which happened within the Kondratiev cycle 1830–1885, has its centerpoint in 1856, well in tune with that of the cycle (1857).

As we shall see, these Kondratiev cycles are also of paramount importance to modulate the flow and ebb of banking activity. The growth of GNP, and of bank deposits in constant money, comes in tune with them. The presence of a war in 1940 does not seem to have any weight. That cars in circulation should saturate around 1940 was already preset in the twenties, and could be calculated by fitting a logistic to the statistical data. The fitting can be done using normal minimum square procedures, but as it happens in all techniques, there are special recipes that build up with experience and we shall comment occasionally along the paper.

One of the results of our empirical exploration in a most variegated set of social, economic, and historical cases, amounting to about 3000 to date, we discovered that the *social and economic system has a fractal structure* as already said. This means that the same model can describe the system at all levels of conceptual aggregation, from a single person to the whole of the state. To the question that titillates the students of organization, if a company has a soul, we can give a direct answer: it behaves as if it had one. The intuition that Hobbes expressed in his Leviatan was a deep one, and more general than he thought. Current language on the other side describes companies with typical anthropomorphic attributes, one even speaks of marriages and cannibalization.

As a last example, we will give that of an extremely complex enterprise in various ways connected to the history of European banks and currency: the exploitation by the Spaniards of *gold and silver mines* in the New World. Because these metals were attentively measured and registered, statistics are credible. The result is fascinating: both for gold and silver the envelope of the extractive activity can be represented by a single impulse, well fitted by the model (Figs.3–7 and 3–8). The model being predictive, perhaps the king of Spain would have much appreciated to know *twenty years ahead* how much precious metals would be landed in Spain.

The spirit of this research has been to establish a taxonomy of the Savings Bank showing the gears under different angles. It will be apparent, however, that this methodology *lends itself to robust forecasts*, as in the case of the Spanish silver, because of the extraordinary dynamic stability in the trajectory of social and economic systems, banks included. We will give here and there some prudent hints. However, the Kondratiev discontinuity of 1995 makes medium long–term forecast tricky. The problem can be solved using sophisticated recipes, that we developed in some cases, e.g., to forecast beyond the year 2000 the basic characteristics of commercial airplanes. The procedure consists in identifying processes at higher hierarchical level which fly over the discontinuity, forecast them, and bring down the constraints to lower levels. In the case of the banking system, we have not been able to identify an appropriate logic to do that. A good argument for further research.

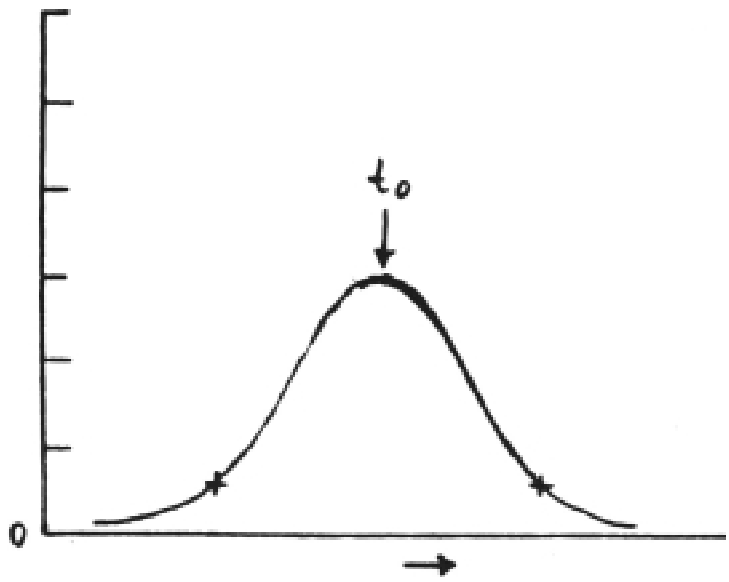


Fig.3–1. Epidemic spread in a population: The recruitment
This chart represent, free–hand, the course of an epidemic. The *recruitment*, i.e., the new cases registered, is here reported in function of time. The small initial velocity depends on the fact that there are few spreading centers which, by contact, infect the infectable ones. The maximum speed is when infected and infectable are about equal. The speed decreases then because of the shortage of infectable. Mathematically $dN = a\,N\,(\overline{N} - N)\,dt$ where the recruitment dN in the time lapse dt is proportional to N, the already infected, multiplied by $\overline{N} - N$, the still infectable. $\overline{N}$ is the niche, the pool of infectable at the beginning of the spread of the epidemic.

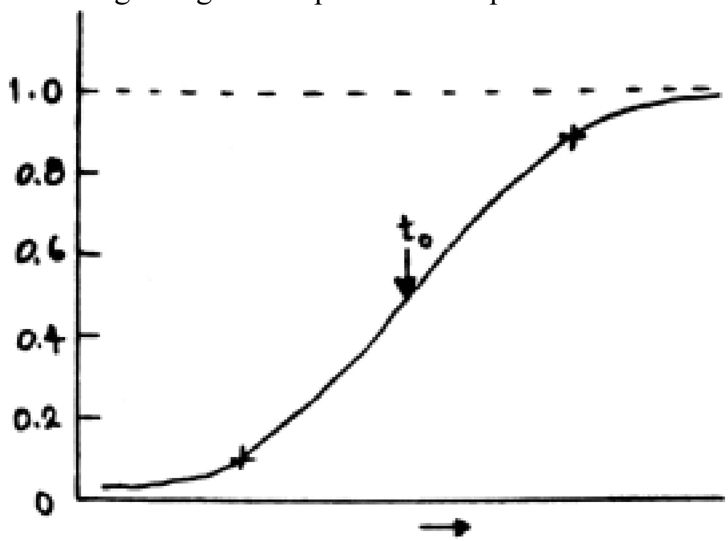


Fig.3–2. Epidemic spread in a population: The cumulative effects
This chart integrates in time the recruitment and shows the number of people infected up to a certain date. This number grows according to a *logistic equation*, up to a *saturation level*, the *size of the niche*. Because in fact we deal with cultural diffusion through social imitation, this niche represents the set of people ready to absorb a certain idea and act in consequence.
The characteristics of the equations are reported in the charts in intuitive terms, the saturation level, the point where the process is halfway (t_0) and the time between the penetration of 10% and 90% of the niche (ΔT) here marked with crosses, to give an idea of the speed of diffusion.
Integrating the equation of Fig.3–1 we have: $N(t) = \overline{N}/[1+\exp-(at+b)]$. The saturation point is $\overline{N}$, $\Delta T = 4.39/a$ and $t_0 = -b/a$. We can then rewrite the equation in function of the “intuitive" parameters reported in the charts: $N(t) = \overline{N}/[1+\exp -4.39\,(t-t_0)/\Delta T]$.

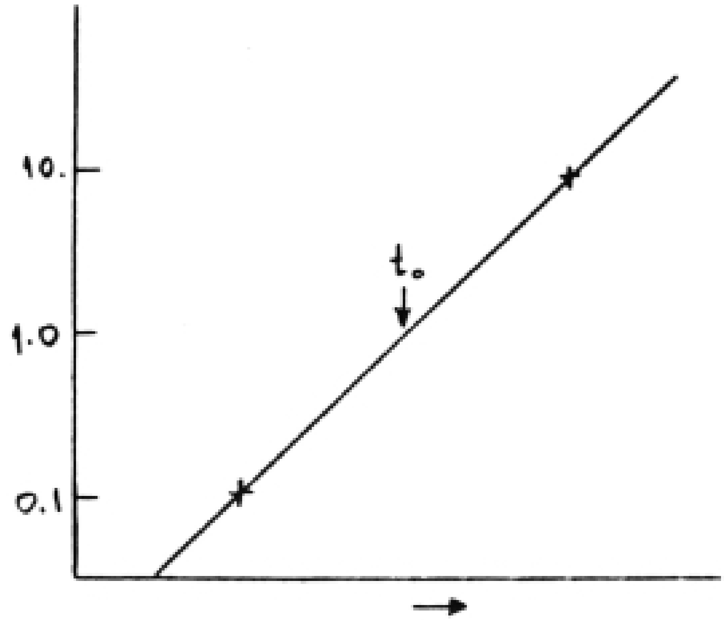


Fig.3–3. The logistic rectified: The Fisher–Pry transform
It is usually much more practical to represent the logistic of Fig.3–2 as a straight line by modifying the scale of the ordinates (Fisher–Pry). If we measure the evolution of the process in terms of fractions *F* of the saturation point ($F = N/\overline{N}$) we can rewrite the equation in the legend of Fig.3–2 in the form log $(F/1\text{–}F) = at + b$ or log $(F/1\text{–}F) = 4.39\ (t\text{–}t_0)/\Delta\text{T}$. Most of the charts in this report are presented in this form. The visual estimates of the values of *F* are helped by giving it at certain points of the ordinates.

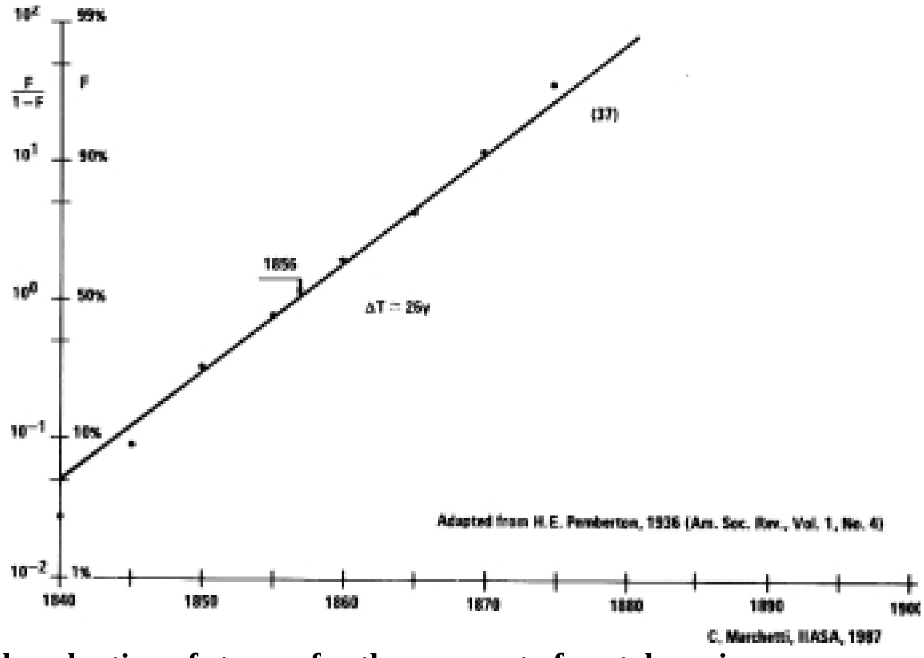


Fig.3–4. On the adoption of stamps for the payment of postal services
A first example of epidemic cultural diffusion is analyzed in this chart. Using stamps for paying postal services was a British idea which did not require any special technology or investment to be applied. It was only necessary to imitate what others were doing with success. The analysis reports the cumulative number of Western nations adopting the stamp in the course of the last century. They are finally 37. The process of adoption flows very smoothly with a central point in 1856 (Kondratiev central point 1857) and a time constant of 26 years, fitting snugly into a Kondratiev cycle.

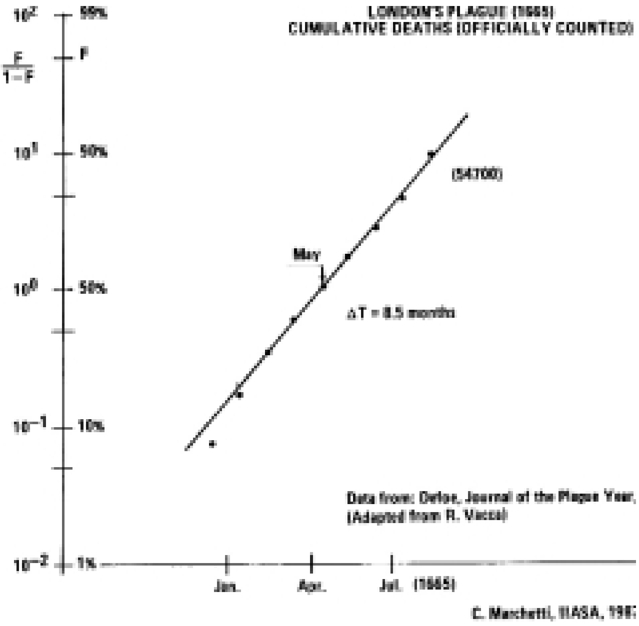


Fig.3–5. The London plague of 1665
Plagues are paradigmatic examples of epidemic diffusion, but the numbers we should count are those of the sick which are difficult to gather. Assuming the course of the illness did not change during the few months it lasted, we took as a proxy the number of deaths which are usually counted with a certain precision, and recorded. We see a logistic equation fitting the data from Defoe quite well. The final (calculated) deaths are 54700, the central point of the plague was May 1665 and the time constant of 8.5 months contains all the process into a dozen months.

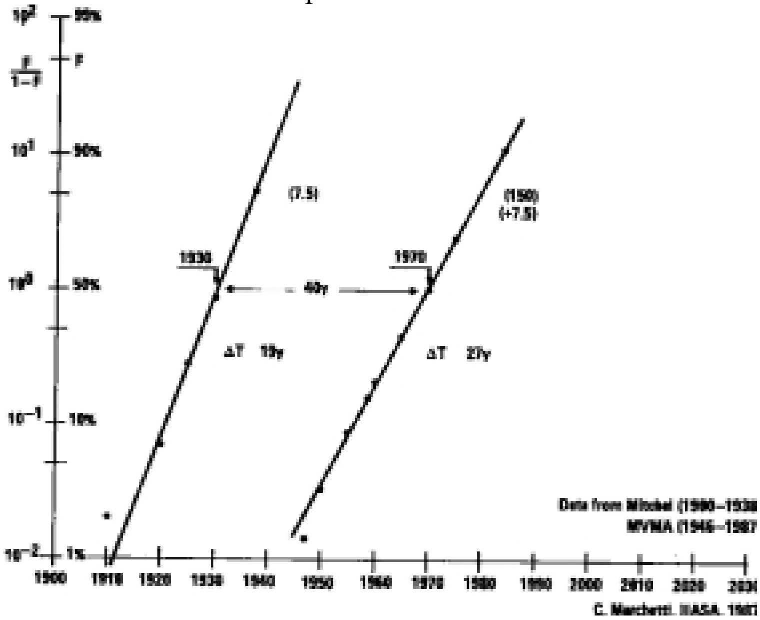


Fig.3–6. Number of registered cars in Europe (1910–1995)
The spreading of the idea that using a car is a good thing, leads under appropriate circumstances to the purchase of a car. Automobiles in circulation in Europe grew from a few in 1900 to about 7.5 million in 1940 following a logistic growth. After the war a second pulse of growth started, adding another 150 million cars (at saturation, which has been reached already). The two logistic pulses sit one over the other. The chart carries a few messages: (1) that the growth can be very smooth for 50 years without resenting from economic troubles or booms, or unexpected events like the oil shock; (2) the start of the first pulse comes when technology is ripe and ends in 1940 in tune with the end of a Kondratiev cycle. (3) The start–up of the second impulse and its end are fitted into a Kondratiev. The central points coincide quite accurately (1970 versus 1969).

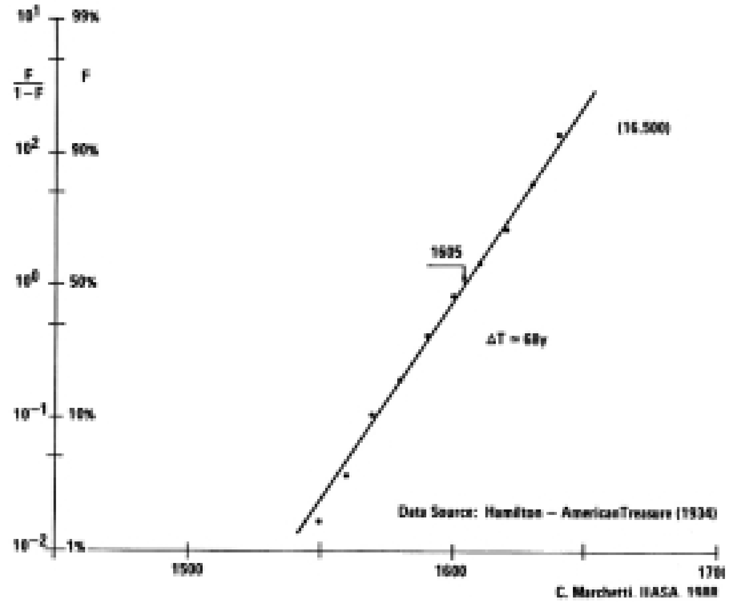


Fig.3–7. Silver from the West Indies
Exploiting silver mines in a newly discovered continent on a time scale of a century is a process so complex that one should feel discouraged to try to model it. We tried it and it works. The tons of silver shipped from America to Spain pile up into a neat logistic. The final amount is not impressive, 16500 tons, which corresponds roughly to a year of silver production today. But the effects were impressive at the time. The central point is in 1605 and a time constant of 68 years spreads the process over a century abundant. Silver and gold from the Americas had a profound influence on the political, monetary, and banking system in Europe.

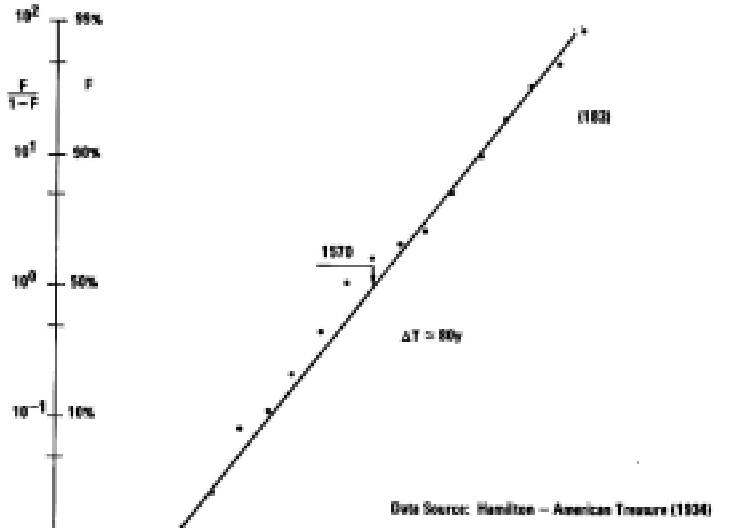


Fig.3–8. Gold from the West Indies
The same exercise we have done for silver can be reported for gold. Here the fitting is somehow more bumpy, perhaps because we face two sources of gold, one from confiscation and the other from mining. Gold flux reached the maximum in 1570, 35 years before silver, and both ended together before 1650. Gold has run high in the mythology of the riches of the new world, but the amounts were in fact very limited, and correspond to about a tenth of the world gold production in a year today. Also at the time, even assuming a ratio of 15 in the value gold/silver, the equivalent in silver is about 3000 tons, to be compared to the 16500 of silver actually imported. Incidentally, all this silver finally flowed into China and Asia, the final sink for this metal since Roman times.

4 – The Kondratiev Cycles

At various points, commenting the opening and closure of banks, their deposits and bad debts, we quote Kondratiev cycles. To create the atmosphere for correctly interpreting the intrusion of these entities that many people still think abstract and nebulous, we would like to report here the results of recent studies on these cycles, which seem to influence any level of social activity and not only the aggregate economy, as thought until a few years ago.

That economy has lows and highs is known since ever, but only toward the end of last century the question was systematized. Particular attention has been devoted to the recessive (or depressive) phase of the cycle. One is around 1885, and in the first years of this century two economists tried to interpret it. Parvus tried to construct the case of the capitalistic plot to better control the workers (recessions go together with unemployment). Karl Kautsky, much more subtly, interpreted the recessive process as due to a reduction of consumption (*Unterkonsumation*) which through a devil cycle progressively blocks all the economy. We are now in a period of *Unterkonsumation* (1995 is in the same position as 1885 with respect to the cycle) and we can verify the processes *in vivo*, including the irrational sides. To cite one, the retreat of the consumers is parallel to the increase of their purchasing power. Money is there, but it flows into financial roulettes, or into the black holes of Public Debt. Today, in Italy, the equivalent of more than *one year* of GNP has been sunk *irreversibly* into State Bonds. This represents about 75% of the savings, private and institutional. To give a visual impression of its size by expressing it in terms of physicals, it is equivalent to a hundred times the amount of gold mined annually in the world at present.

As history tells us, this money never comes back (Fig.4–1). The key question that brings us back to Kautsky is *why* people did not spend all that money to buy goods or services. To try to see the mechanisms, let us analyze a specific case, that of the automobile. Car production at world level during the last 10 years oscillates around 33 million units. One may think that the markets are intrinsically saturated in the rich countries where everybody has a car. In the poor countries there is no money for that. The interpretation appears very plausible, but seen historically it does not work. If we analyze what happened before the end of the previous Kondratiev (1940) we find that the number of cars circulating in Europe grew very fast in the twenties and *saturated* in the last thirties (Fig.3–6). The saturation value, 7.5 million, is too far from the saturation value of the present cycle (1995) of 150 million, to think of a possible *physical exhaustion* of the demand. In fact, after the war, the market started to absorb cars , and their number grew to 150 million (+7.5) following a selfconsistent logistic curve. Selfconsistent means that the number of cars in circulation developed *in view* of this final number. In economic terms there is no rational interpretation for the stops in 1940 and 1995. It must be clear that the same analysis leads to the same results in numerous other cases. We shall see later the situation for GNP and bank deposits. The presence of a depression in the thirties and of a war later on cannot be taken as a cause, because the equation was already set in the twenties and even the saturation level could have been forecast with fair precision. On the other hand, the present saturation occurs without a war in sight. *The idea of Kautsky that we should look into the heads of people, and not into their wallets, seems worth a second look*. We are then catapulted into the area of social behavior. A hint of the humorality of these process comes for instance from the analysis of the homicide rates in the USA from 1900 to date (Fig.4–2). And even more from the periodic change of the weapons used (guns/knives). The idea that the success of an enterprise or the profits of a bank or the GNP *tout court* are strictly linked to the *uncontrollable* tides of the moods of the system, will certainly *shock the manager*. But the knowledge of the tides is of great help to the quality and safety of navigation.

From the hundreds of cases in the analysis that show evidently the effect of the cycle, we take a few to give a perception of the variety of areas where the effects of the cycle are felt. The case of transport infrastructures: canals, railways, and roads, measured in terms of the extension of the networks, is reported in Fig.4–3 for the USA. The chart in this case is in linear form, and the logistic equations interpolating the data are represented by the smooth lines. The distance between the centerpoint of these penetration waves is almost exactly 55 years. These central points occur 6 years after the throughs of the cycles. Because they represent the points where the rate of expansion was maximum and the trough represent the deepest point of the recession, we see here a Keynesian spirit at work, long before Keynes was born. On the other hand, all the process of construction of a certain type of infrastructure is interpolated by a single equation, and this excludes that the pertinent decisions are wisely taken under the pressure of events. This Keynesianism is *implicit* in the secular mechanisms of the system itself.

Extrapolating from the three cases we may also induce that the expansion of the *air network* will have its central point around year 2000. The next 20 years will then be extremely active in this area. The *sudden* development of third–level airports, like the one in Florence, appears then as a small gear into a large system of gears with secular movements and has little to do with contingent causes. Fig.4–3 refers to the USA, but our analysis shows an *extraordinary synchronization* at world level.

To give a visual and intuitive view of these cycles, we report in Fig.4–4 the results of an analysis on the deviation from secular trends of the consumption of primary energy and of electric energy in the USA. Energy consumption (like GNP) is a very synoptic indicator and these deviations measure, in a *capillary and integrated* form, the oscillations in the metabolism of the country. They appear as a sinusoid with a period of about 55 years. The maxima and minima of this sinusoid can be interpreted as the end of a period of boom and, respectively, that of a recession. In the legend, 1940 and 1995 are indicated as the beginning and the end of the present cycle. The *point of maximum is around 1968*. In Fig.4–5 we report the logistic fitting of the *Italian GNP in constant money*. The interpolating logistic provides an excellent fitting from 1950 to date. The *central point is in 1969* and in 1995 it will reach 97% of the saturation point. *The indicator extracted from the energy consumption in the USA is a perfect frame for the dynamic of the development of the Italian economy*, in the most synoptic form, the GNP in constant money. The banks fish into this mass of income and, as we shall see, their activities too are framed into the Kondratiev cycles.

Another example taken from the area of transport is reported in Fig.4–6. It deals with the start of operation of Metros, at world level. We count the cities which have one, and take the date of the opening of the *first line*. Also here we have three logistic pulses modulated by the Kondratiev cycle. *The distances between the centerpoints is again 55 years*. These points are located about 8 years after the *maximum* of the cycle. Already in the recessive phase, but about 20 years before the minimum. Before making comparisons with the national transport infrastructures in the USA (Fig.4–3), it should be taken into account that these are just *starting points* in the construction of the network.

The results of this analysis are remarkable for various reasons. They show how the cycles condition the decisions; that the world operates as a single organism; and that the present wave of construction starts has almost ended. It will be 99% in 1995, and the cities “allocated" for the following years are about seven, worldwide. The next round (calculated on the basis of taxonomic regularities) is traced by the hatched line. The chart of Fig.4–9 shows a similar analysis done for innovation waves. This is the time to innovate, and the opportunity window will remain open until about the year 2000. The centers of the innovation waves are regularly placed near the *minimum* of the Kondratiev cycle and precede it by about 3 years.

We are taking the last example from the area of communications. As the scientific literature and the press keep hammering, we are in the middle of a communication explosion. We also think, utopistically, that all social and work relations will be explicitated by individuals sitting at their *computer desks*. It is interesting and sobering to go back to the historical roots of such an explosion. The case of Switzerland is reported in Fig.4–7, where the evolution in number of messages transmitted in terms of letters, telegrams, and telephone calls is analyzed in terms of logistic impulses. The central points of these impulses are located near the maximum of the cycles (as the GNP) showing a correlation with the evolution of the general activity of the social system. For every cycle the number of messages grows roughly by a factor of 6. Homogeneously distributed over a period of 55 years, this corresponds to a mean growth rate of 3.3% per year. Incidentally also passenger transport measured in terms of pass–km grows at a much similar mean rate. Parallel growth is not a sign of substitution. And the explosion, whatever it means, does not seem to be specially localized in our times.

The taxonomic extrapolation of the next pulse will be centered in 2010 and the pulse is already started. We now feel its exponential growth after the relative stasis of the previous one and this might give the impression of an explosion. On the other hand, interpersonal communication may move toward saturation and much communication will be between machines. We chose Switzerland for the data base, because the statistical series is long and of good quality, but as we have seen, we are all in the same boat.

To show how the Kondratiev cycles can influence operation usually considered stochastic for the great number of factors that influence both the possibility of realization and its practical success, we report here the case of the *basic innovations* put on the market, at world level, during the last 200 years (Fig.4–9). The data are taken from a publication by Mensch (1974). Mensch defines the date of an invention *when* a prototype works, and the date of an innovation *when* it is first commercialized. The three waves crisply defined and interpolated by logistic equations are spaced about 55 years on their central point. The taxonomic regularities permit the construction of a fourth wave into which we are now located (central point 1992).

Fig.4–1. Evolution of public debt in the USA (1800–1970) ($1913)

The problem of public debt in Italy is at the center of much thinking and discussions. Following the Chinese prescription that all is in history, it can be interesting to look at the historical evolution of public debt in two nations whose administration is considered reliable: United States and Britain. US public debt is here reported in constant money ($1913) since about 1800. The curious behavior is that debt grows during very short periods of time and then it stays constant. In other words it never diminishes. The exception here is linked to a whimsical idea of American president John Quincey Adams, to sell demanial land in order to repay debt. The coincident of that operation with the recessive end of a Kondratiev cycle (1830) gave the impression, confirmed by authoritative economists then and now, that the elimination of public debt was the real cause of the recessive phenomenon. However, debt was rapidly reconstructed up to the previous level.

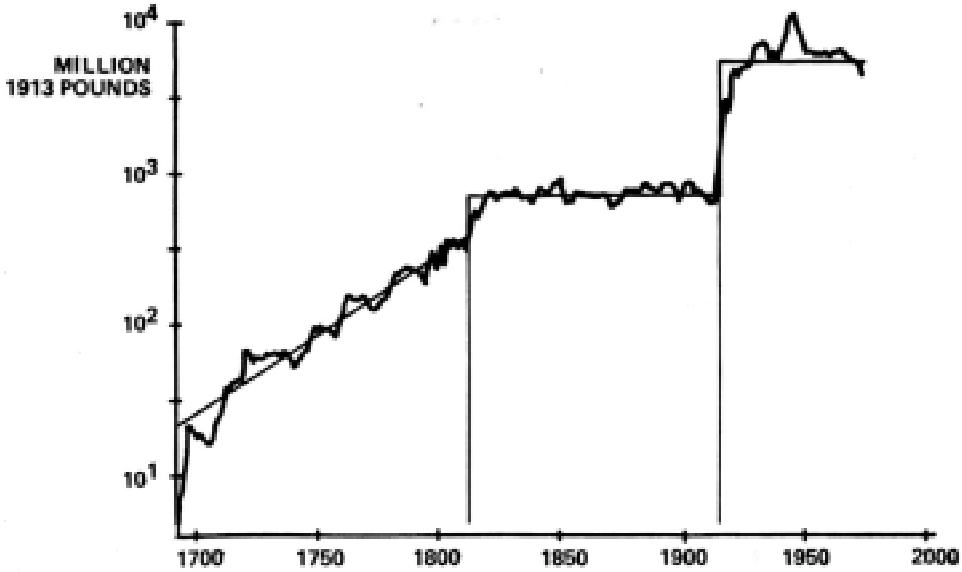


Fig.4–2. Evolution of public debt in England (1690–1970) (pounds 1913)

The growth of public debt in England is particularly interesting because it kept growing regularly, and not in fits, for more than 100 years during the build up of the empire. Then it remained constant for another 100 years and necessarily so. Around 1830 the ratio public debt/GNP reached the incredible value of 2. In fact, for many decades, *two thirds* of the income of the state were devoted to the management of debt, whose relative burden was diminished *only* by the increase in GNP. The last spurt in debt increase is linked to World War I, when the empire was at stake. World War II, when the empire was lost, in spite of its bitterness and costs, did not leave traces. Also here it is remarkable to observe that over 300 years public debt in constant money never decreased.

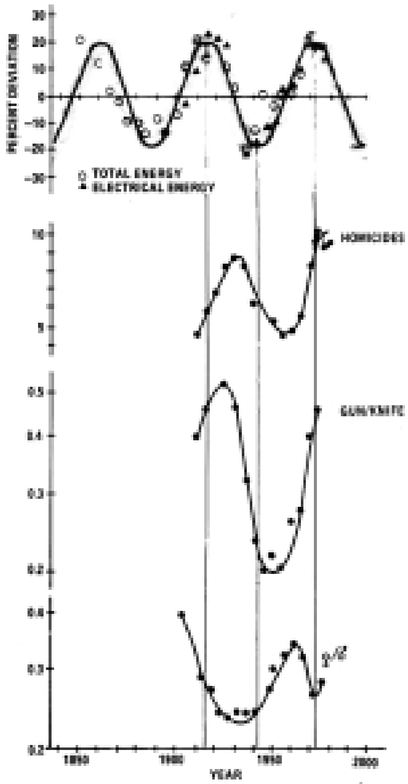


Fig.4–3. On the moods of the system: Homicides and suicides in the USA (1840–1970)
The cyclicity expressed in the Kondratiev cycles is very puzzling because all hardware explanations seem to fail. In our opinion, social mood is a central factor and we make a try here correlating economic cycles with things at first sight completely uncorrelated, like the choice of the type of weapon for a murder, or the level of murders *tout court*. The cycles are here represented by a very holistic indicator, primary energy and electricity consumption which oscillate around the secular trend with a period of 55 years and an amplitude of about 20%. Against this "clock" we reported: homicide rates, weapons to commit the homicide (gun/knife), and female/male ratio for the victims. With different phases, the three processes move in tune with the Kondratiev periodicity. The modulation is strong: for homicide rates we have a ratio of 2 between maximum and minimum. For the gun/knife a ratio of 3!. The raising branch of the clock curve is related to a boom period for the economy and the descending branch to a recession.

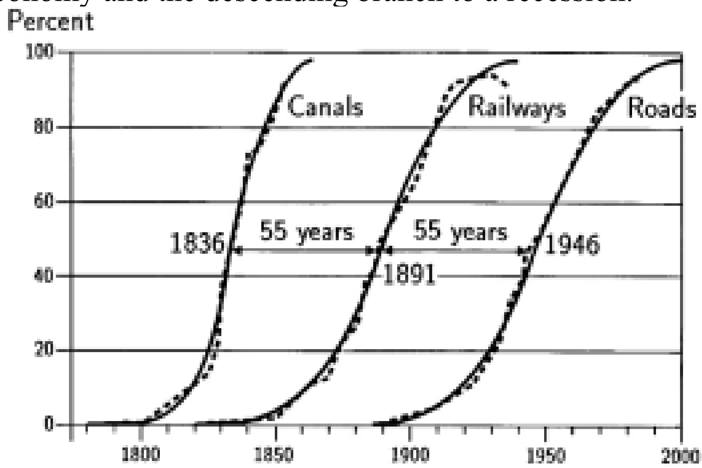


Fig.4–4. On transport infrastructures in the USA and the Kondratiev cycle
The growth of three infrastructures in the USA is reported here in selfreferent terms, i.e., as a percentage of their final length. We observe here three things that we think important: (1) The growth in length of these infrastructures is precisely matched by logistic equations (smooth curves). (2) The distance between the centerpoints of growth is exactly one Kondratiev cycle. (3) The distance between the lowest point in the Kondratiev and the central point of the construction is six years. Apart from the astonishing synchronization, the maximum rate of growth occurs in the darkest point of the recession. Because the process of growth is preset and self–consistent from the beginning, we must conclude that *the system is intrinsically Keynesian.*

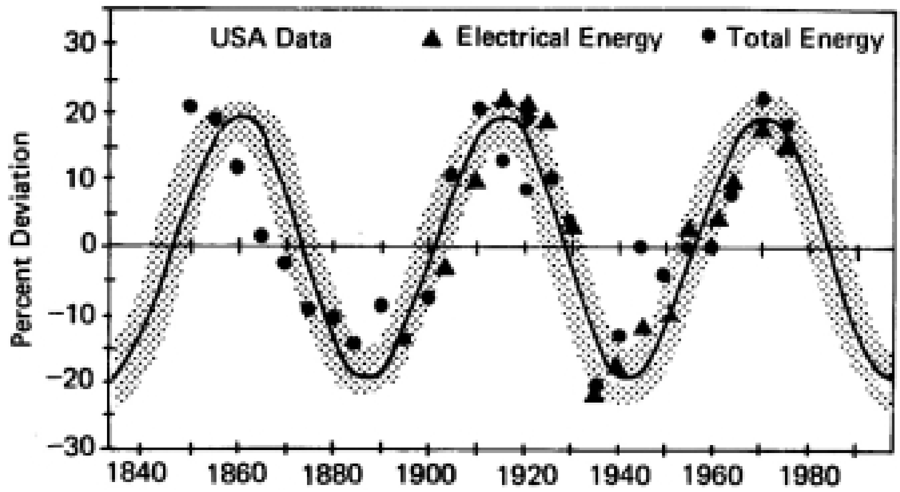


Fig.4–5. The Kondratiev pulsation in the energy consumption (USA)
We report here, amplified and detailed, the "clock" appearing in Fig.4–3. Energy consumption epitomizes the microscopic behavior of society into a single metabolic indicator. For the USA the growth in energy consumption since 1800 has been exponential (or more precisely logistic). The deviations from the best logistic fit are reported here in percentage points, both for primary energy and for electricity (Stewart, 1982). The superposed curve is a sinusoid with a 55 years period. In the rest of the paper we take the bottoms of these oscillations as the ends of the cycles (1830, 1885, 1940, 1995). The market penetration logistics of all sorts of economic indicators, be it bank deposits, GNP, or car production, tend to saturate around these low points which represent the end of the recessive branch of the cycle and the beginning of the expansion branch.

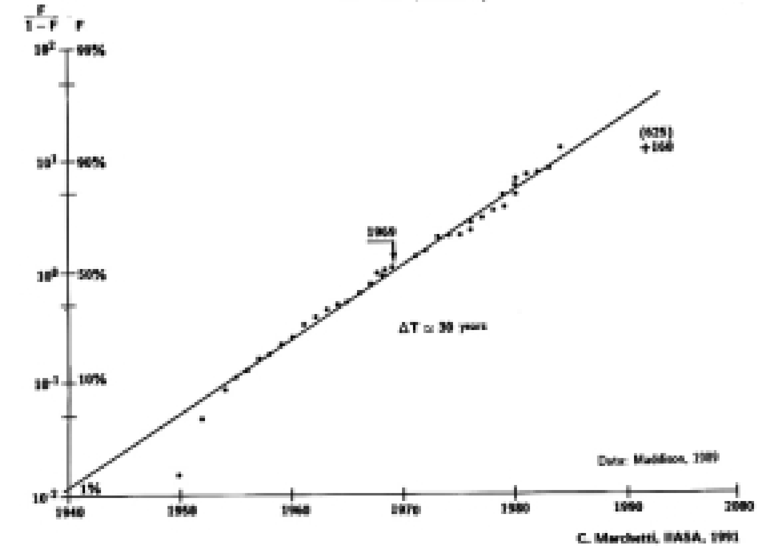


Fig.4–6. Evolution of GNP in Italy
As a first example of what we said in the legend of Fig.4–5, we report here the analysis of Italian real GNP (1913=100). GNP is the most synoptic indicator of economic activity and should feel all sorts of macroperturbations like the oil shock. However, as the chart shows, its evolution in real terms is unexpectedly regular and fits nicely the paradigms of logistic growth and Kondratiev modulation. The maximum rate of growth is actually in 1969, in perfect coincidence with the maximum of Fig.4–5 and the time constant of 30 years, boxes it nicely into the 55 years length of the cycle. The present growth sits on the preceding one (saturating at 160 in 1940) and adds 625. Data are below 1% before 1950, because GNP was below 160 due to the war. A striking result of our analysis is that wars finally leave no trace. Overactivity in the post–war years compensate for the losses and finally the secular trend is picked up again.

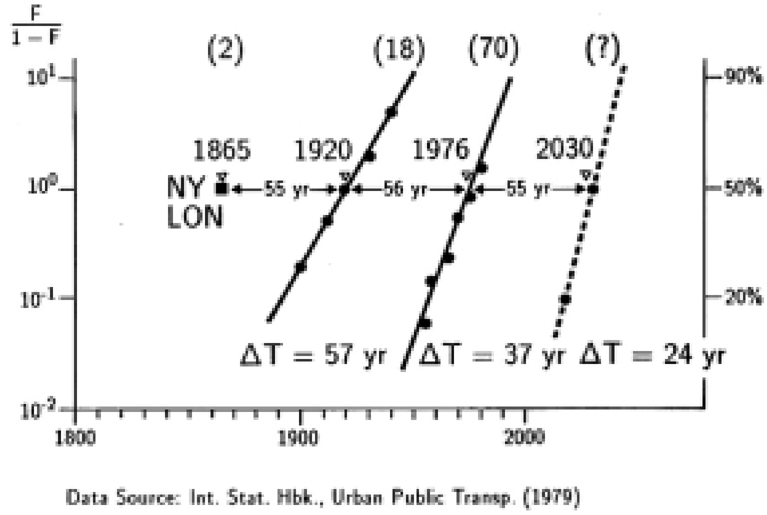


Fig.4–7. Opening of metro transport systems: The first line

In Fig.4–4 we have analyzed the evolution of transport infrastructure in the USA. Here and there in the text we observe that the world is synchronized in terms of Kondratiev cycles. In this chart we report the diffusion *at world level* of the technology of metro transport, counting the cities that have opened the first line. This is like the first stone of a building and gives a precise positioning in time for the acceptance of the technology. First–line openings in world cities organize in three pulses whose central points are spaced 55 years, one Kondratiev cycle. In this case the date of maximum acceptance rate is in the first part of the recession branch, 7 years after the maximum. It must be clear that this is the beginning of the work, and to connect the maximum intensity with the recession one has to go to analyzing network growth, city by city. Because of the regularities in the process a third wave has been calculated and reported as a dashed line.

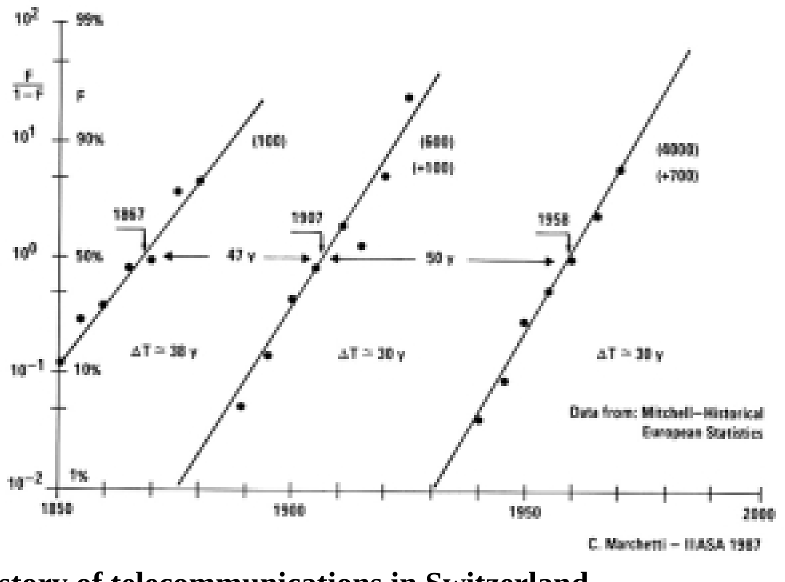


Fig.4–8. On the history of telecommunications in Switzerland

The examples analyzed in Fig.4–4 and 4–7 refer to the material activities of our society the construction of great transport infrastructures. We will examine the evolution of the *use* of infrastructures, here post, telegraph, telephone, measured in terms of number of messages sent through these information channels. Also in this case the synchronization with the cycle is good. The central point of the last two waves is in the expansion branch and precedes the maximum of the cycle by about 8 years. The ΔT are of the right order for encapsulating the pulses of growth into Kondratievs. The ratio of saturation points between a cycle and the preceding one is about 6. The explosion of telecommunications started 200 years ago, together with the explosion in transport. They move in fact almost parallel.

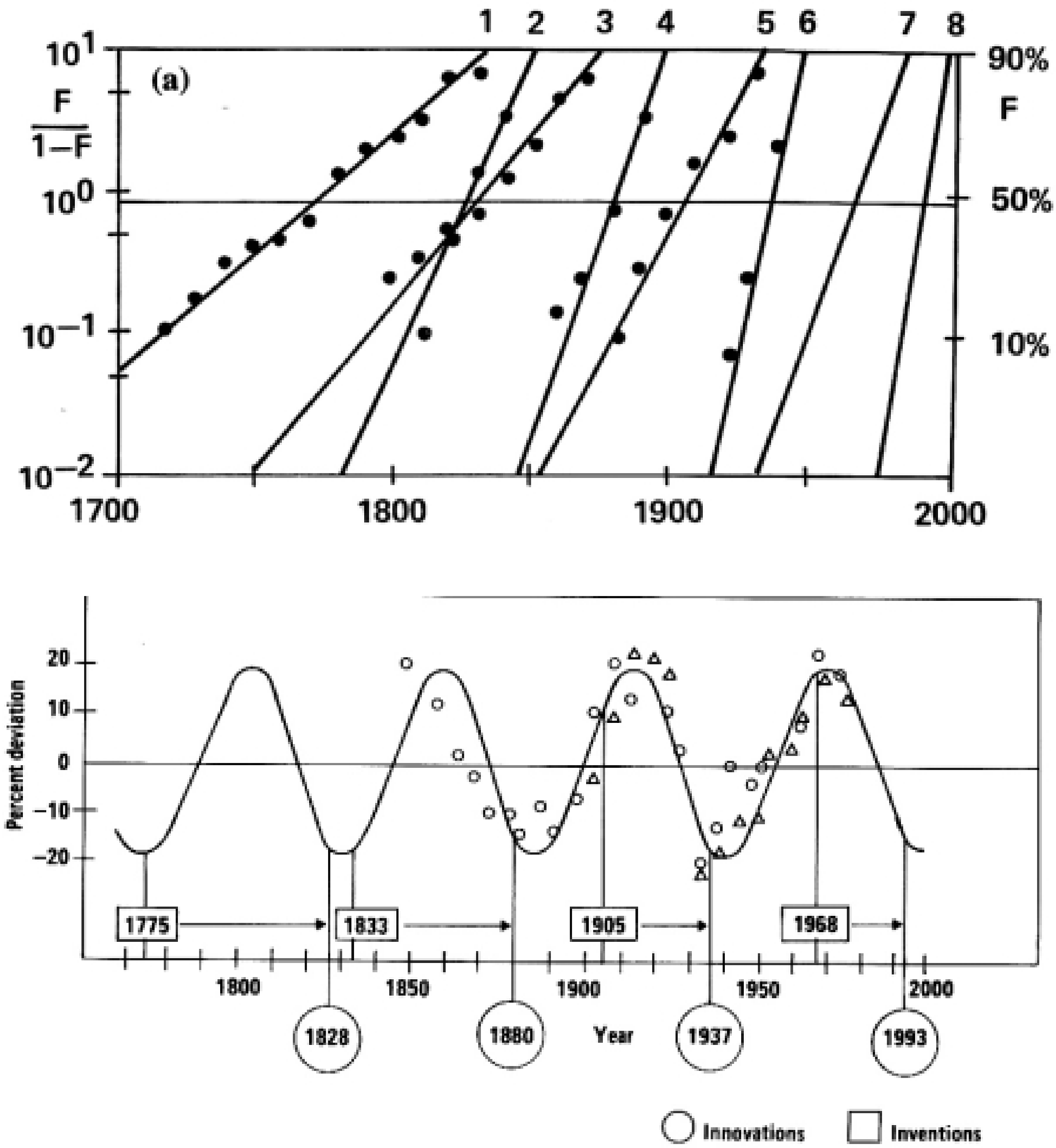


Fig.4–9a,b. Basic invention and innovation waves
Innovation, both social and technical, is the motor of Western societies. Analyzing the last 300 years, Mensch identified three waves of basic inventions and three waves of basic innovat ions. They are here analyzed in terms of cultural pulses, fitted with logistic equations (cumulative inventions or innovations in a given pulse). The numbers 1, 3, 5 mark the invention waves and the numbers 2, 4, 6 the innovation waves. The last ones are spaced 55 years in the central point and actually *precede* by two years the minimum in the cycle. We are now (1993) in the eye of an innovation wave that percolates through all the system, and not only the technological side of it. The last couple of invention–innovation (numbers 7 and 8) has been calculated on the basis of regular ties in the previous waves. Inventions have a more variable taxonomy, and their centerpoints keep approaching these of innovation waves. The time from invention to innovation keeps becoming shorter, if in a see–saw fashion. The position of the centerpoints of inventions and innovation waves have been reported in Fig.4–9b, against the energy clock of the USA.

5 – Demographic Analysis of the Populations of Savings Banks in Italy and Some Other Countries

The mathematical model we are going to use to analyze various aspects of the evolution of the Savings Banks system is again the same that we spoke before. *Human actions are explicitations of cultural paradigms that diffuse epidemically*. We shall call them *action paradigms*. A very detailed study of epidemic diffusion in the adoption of technological innovations, e.g., the telephone, through interpersonal contact has been done by Haegerstrand. He spent in fact 40 years in reconstructing the details of the friendly networks loosely defined as the grapevine. Haegerstrand is a geographer at the University of Lund in Sweden, and dedicated much attention to *territorial diffusion*. As we are usually modeling the dynamics of societal evolution, our analysis mostly concentrates on the *temporal* aspects of diffusion.

Haegerstrand's study shows evidence of the fundamental character of *verbal* interpersonal contacts inside friendly and familiar circles, normally made by about 100 people. This recalls the archetype of hunter–gatherer bands of the neolithic, interacting intensely (verbally!) inward, with reduced communication outward. The scientometric studies by de Solla Price and his pupils showed a similar organization and similar mechanisms in the social system producing and diffusing science. A robust generalization to human affairs in general, be them social or economic, is ours and the proofs are a posteriori. This means that instead of exploring the single case, interrogating who had adopted the telephone and why, we hypothetized the generality of the process and controlled that the effects were readable with the mathematical model that describe such diffusions. The cases analyzed that way in our institute are about 3000 to date, taken obviously from a most variegated set of situations in sociology and economics. This is the platform of our present work. As we shall see, the *model suits well the banking system* in general, down to the *single bank*.

Action paradigms diffuse into the heads. Transforming them into physical actions must take into account the contingencies of the context. This leads to deviations from the path prescribed by the model which usually appear as small anticipations and delays, but *without ever losing the track*. Formally they can be classified as *noise*. If a strong perturbation, e.g., a war, generates a sizeable deviation for a long period of time, once the stumbling block is removed the system normally picks back the old track. This reabsorption of the deviations was unexpected when we started our research, and produces a long–term stability in the dynamics of systems and subsystems which is a robust basis for forecasting. The analysis of the 3000 cases just quoted and the *100 cases or so referring to the banking system* reveals a social and economic world highly regulated and not, as one may suppose, through explicit and occult powers, but simply through the *mechanisms* of its functioning. The *dominance of the mechanisms*, with their intricate patterns and secular stability makes events look deterministic.

The stability of the secular dynamics that emerged in our studies since their beginning about 20 years ago, has been the basis of a forecasting activity, certainly prudent but always verified in the facts. The inevitable argument of the accidental factor finds its counterpart in the reaction of the system to compensate its effects. The biological analogy of the homeostasis is intense and quantitative. However, as in the case of a living organism, a system can always be destroyed together with its regulatory mechanisms. But this is a rare event. Normally it dies through senescence and competition. This means in a regulated and predictable form.

The process of *geographic* diffusion of an innovation follows a fixed pattern: a successful innovation consolidates and diffuses around the center where it was born historically. Measuring after a number of years the level lines of its adoption we find that they converge around this point.

After some delay the innovation can be adopted in some place far away from this historical focus, and this new point can become a satellite center of diffusion, more or less independent from the primary one. In the case of railways, the historical center was in England, the satellite ones in Lyon, Austria–Bohemia, and Naples, with a third level in Saint Petersburg (Fig.5–1). The spacial density of railway network *still reflects, after almost two centuries*, the starting mechanism. Who started first got denser networks.

In the case of Savings Banks the idea starts from Scotland and England, a very vital and innovative area at the beginning of the 19th century. For Italy Vienna can be considered the secondary diffusion center. The first Italian Savings Bank was in fact founded in 1822 in Venice, then under Austrian administration, followed shortly by Milano in 1823, Torino in 1827, and Florence in 1824. These towns where then the third level centers for the diffusion of Savings Banks in their respective regions. This process of founding new Savings Banks can be crisply described using the diffusion model as shown in Fig.5–2. A first wave of Savings Banks is centered in 1844 and includes 85 objects. The time constant is 30 years. The founding of Savings Banks in Italy is then associated with the upswing branch of the cycle (1830–1858), centered in 1844. The Savings Banks born into this wave are mostly still existing, which is a sure mark of success. A second wave with 135 new Savings Banks followed. It is centered in 1873 with a time constant of 32 years. As the downswing branch of the cycle is centered in 1871, we observe that it is associated with it. The Savings Banks born in this period were affected by high mortality, as we shall see.

Because Vienna is the diffusion center for Italian Savings Banks it may be interesting to look at what happened in Austria (Fig.5–3). The first wave is represented by a bunch of 10 objects, more or less contemporary. The second wave with 185 Savings Banks at saturation and centered in 1870, is very similar to the second wave in Italy. Austria had a third tiny wave with 20 objects centered in 1905. The financial system in Austria was deeply influenced by hyperinflation in the twenties and other economic instabilities following World War II, but the Savings Banks survived until the thirties when about 40 disappeared. The mortality curve is also reported in Fig.5–3 with a logistic downward. From a taxonomic point of view it could be interesting to look at the distribution of their births, as they died so orderly, as a population. The analysis is reported in Fig.5–4 and shows that also the birth of these Savings Banks can be represented by a single logistic pulse *as if* they were a separated population. This pulse is centered in 1885, the recessive minimum of the cycle. That a group of banks, *born to lose*, emerge in a single pulse makes one think of some common characteristic, defining an inbred weakness, and warning entrepreneurs about astrological signs. The reference star is here Kondratiev and the suspicion is strengthened by the coincidence between the mean life time of these banks, 55 years, and the length of the cycle. Incidentally, the recessive trough is also the point in time when basic innovations are launched and they too come in waves of 55 years, as seen, for instance, in the case of cars (Fig.3–6).

A sort of counterproof at a formal level can be done by looking at the set of birth dates for the banks that survived instead more or less until today. The analysis is reported in Fig.5–5. This set constitutes again a selfconsistent example of population growth, that has been fitted with a logistic. Curiously the central point (1870) of this wave of banks *born to win*, coincides with that of the second wave of the Italian Savings Banks (1974). It must be clear that we are here extracting taxonomic regularities as an instrument to describe and characterize the system. We do not have any further interpretation for this sort of behavior.

The foundations of Savings Banks reported in Figs.5–3 to 5–5 account only for the banks inside the present boundaries of Austria. We can repeat the exercise by looking at the area of the Austro–Hungarian Empire (Figs.5–6a,b). Great empires contain great peripheries and we can observe here a third wave (third level) of diffusion. The first wave has not been explicitated and is hidden in the high values of the first points in the chart of Fig.5–6a. It contains the dozen Savings Banks of the primary core. The ensemble of the chart represents the second wave. It is centered in 1870, at the centerpoint of the downswing branch of the cycle. The third wave, adding 340 new Savings Banks to the 380 already in existence, has a central point in 1900, at the center of the upswing branch of the cycle (Fig.5–6b). The second and third pulse are almost identical taxonomically and set half a cycle apart.

This foundation analysis with all connected taxonomies if made at world level could constitute a treatise *per se*, illuminating the invention, penetration, and phase–out of a soft technology, covering two centuries. Savings Banks have already gone through three Kondratiev cycles, like railways, and our analysis could provide hints about when and how fast they will be phased out, as any obsolete technology. Or perhaps functionally renovated, although mature institutions tend to become rigid and the phase–out tends to prevail on the reorganization.

As a last example in our demographic analysis we took the case of the Norwegian Savings Banks, reported in Fig.5–7. In this case we have two waves of foundations in synchrony with two Kondratiev cycles. The central points of the waves and of the cycles (1858, 1913) coincide almost exactly. This is also true for the wave of closures, centered around 1910. As we are speaking of closures, let us glance at some cases of waves of closures, where we could find reliable data. For the English case we have two waves of Savings Bank closures (Fig.5–8), both already in the last century. The first one, centered in 1864, closed 115 banks and the second, centered in 1889, closed 75 banks. The waves are very fast with time constants of about 9 years. For the Italian case, there is the case of a limited number of closures around the end of the last century (Fig.5–9). The banks included in the list had deposits larger than 10^6 current lire. The time constant is again 9 years. Closure waves tend to be precipitous. If the closure is born from functional transformations, then the process can occur at a more sedate pace and cover a full cycle, like a wave of foundations. The disappearance of 3000 private banks in the USA is reported in Fig.5–10. It must be clear that the shake–down of 1929 did not happen out of the blue. The central point of private bank phase–out was in 1922, but the large time constant extends it from 1907 to 1937 (80% central core).

Fig.5–1. On the spacial diffusion of innovations: The case of railways in Europe
Ideas seem to move on legs. Their acceptance, in fact, follows isolines centered on the primary source. Sometimes secondary sources are nucleated, producing in time their own halo of isolines. This peculiar mechanism may be linked to the personal intercourses which are at the root of the diffusion process. In the case of railways the original diffusion center was London. Subsidiary centers were in Lyon, Prague, Naples, and St. Petersburg. The isolines are traced on spacial density of railway tracks. Also for *soft* technologies, like banking or credit cards, the types of pattern are the same.

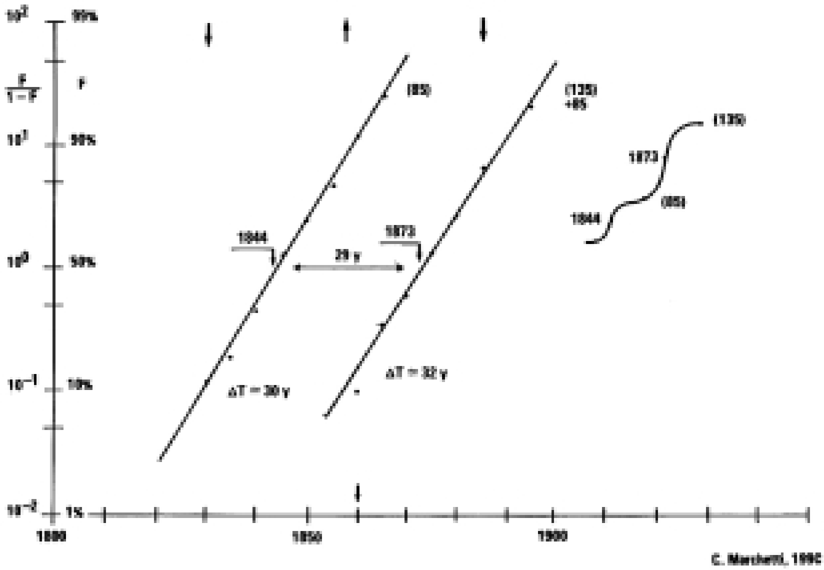


Fig.5–2. Foundation waves of Savings Banks in Italy (1830–1885)
Opening new branches for a certain activity follows the diffusive model. The example and the success are the primary stimuli which are propagated through personal contacts and observations. The "cultural epidemics" of the foundation of Savings Banks in Italy is here reported for the cycle 1830–1885. The foundation appears split in two waves, one with 85 banks centered in 1844 and the second with 135 banks, centered in 1883. There is also a small wave of closures (14 banks) reported separately in Fig.5–9. The penetration in two waves inside the same cycle is a rare occurrence. The small insert reports in a schematic form the two growth waves, with central points and saturation values.

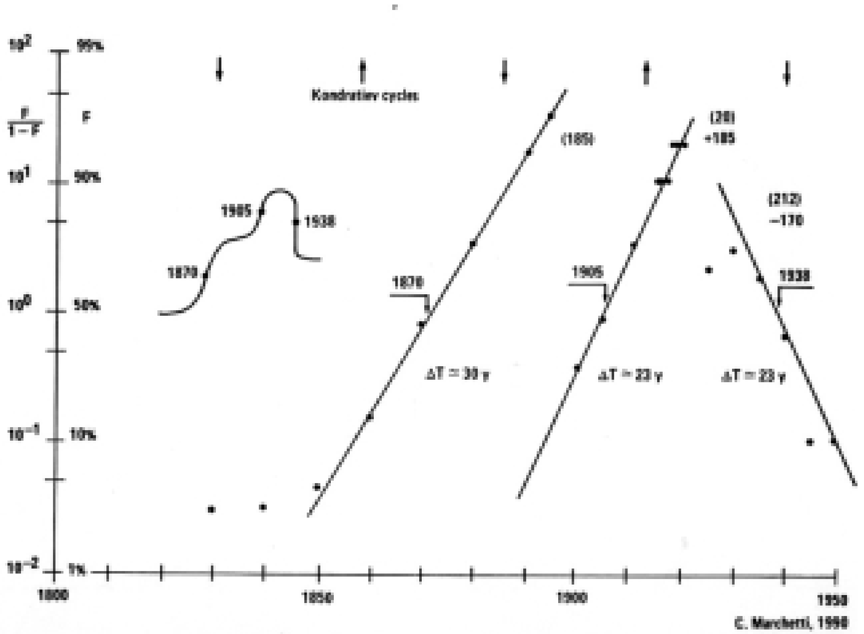


Fig.5–3. Waves of foundations and wave of closures for Savings Banks in Austria (1820–1950)
Savings Banks opened early in some large cities in Austria, but without an immediate percolation in minor centers. The diffusion actually starts around 1850 with a wave of 185 banks, and it is centered in 1870. It sits then almost entirely in the recessive leg of the Kondratiev 1830–1855. The second wave, with only 20 banks, stays in the expansion leg of the following cycle. About 40 banks disappeared a round the recessive minimum of such cycle (ending in 1940).

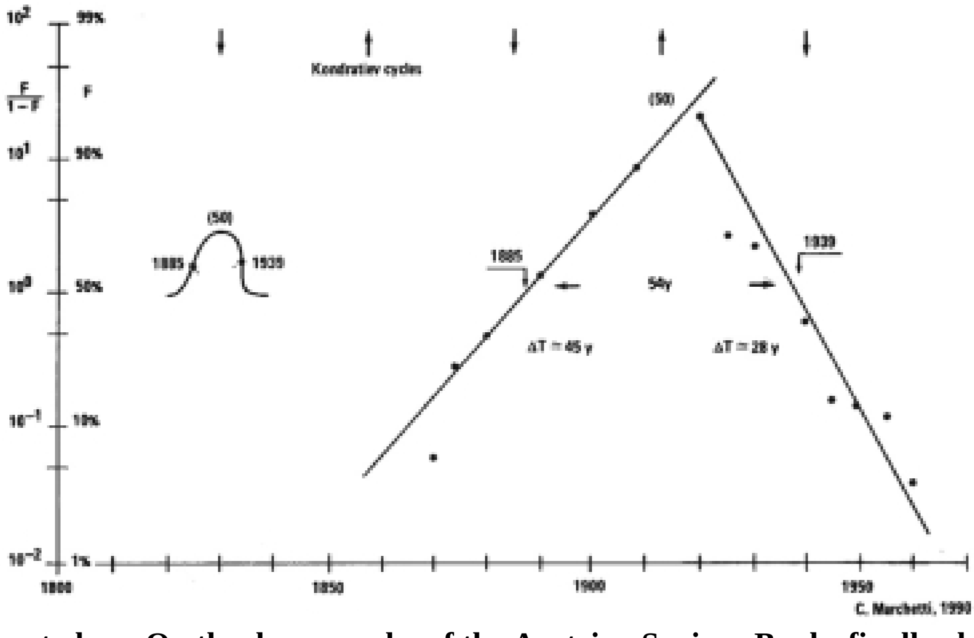


Fig.5–4. Born to lose: On the demography of the Austrian Savings Banks finally closed down
The closure of about 50 banks could be organized in terms of death of a population (a downward logistic). It was natural to ask whether this population held an identity when it was born. The exercise has brought an unexpected result. The founding of the banks "born to lose" can be represented as a logistic, centered in 1885 with a ΔT of 45 years. It contains all the banks in the second wave of foundation, and a well distributed selection of the banks in the first wave. We are not trying to build any theory, but only observe curious and sharp regularities in the taxonomy of life and death of banks. This may lead to the identification of the appropriate timing for the start of new enterprises.

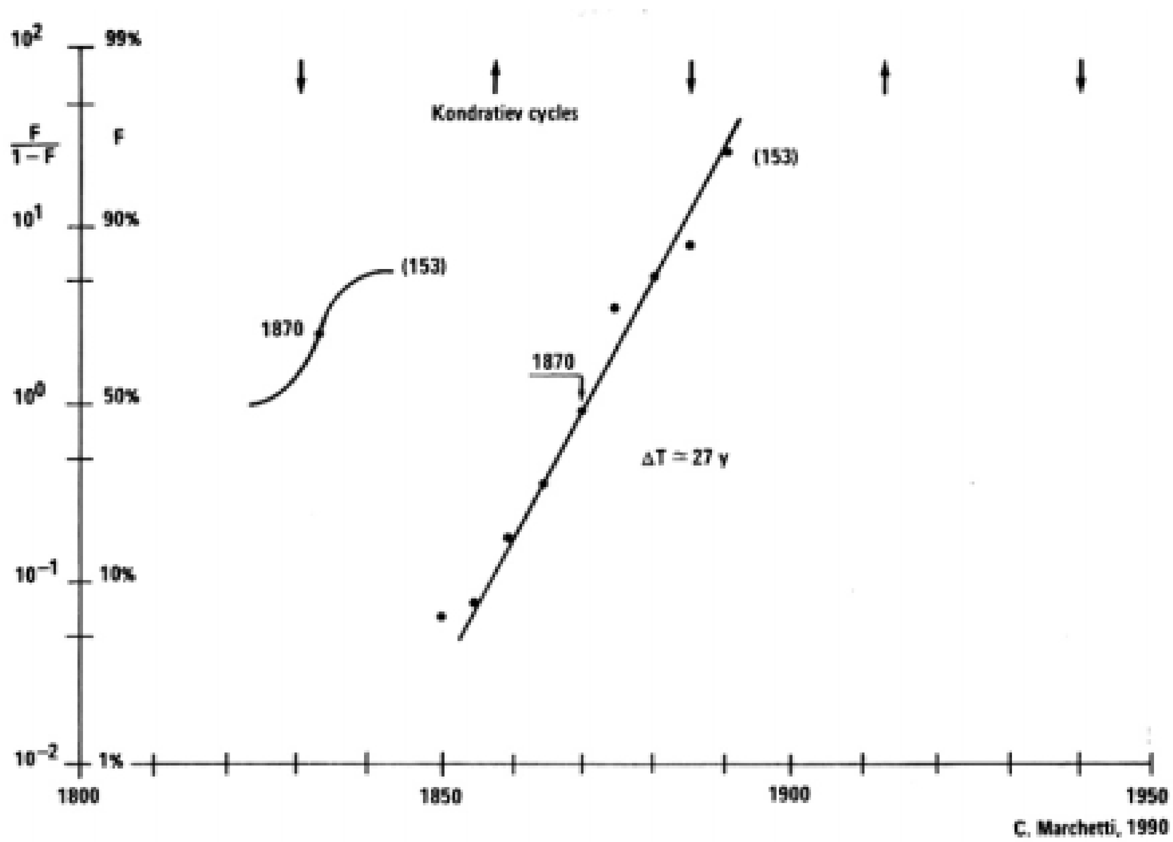
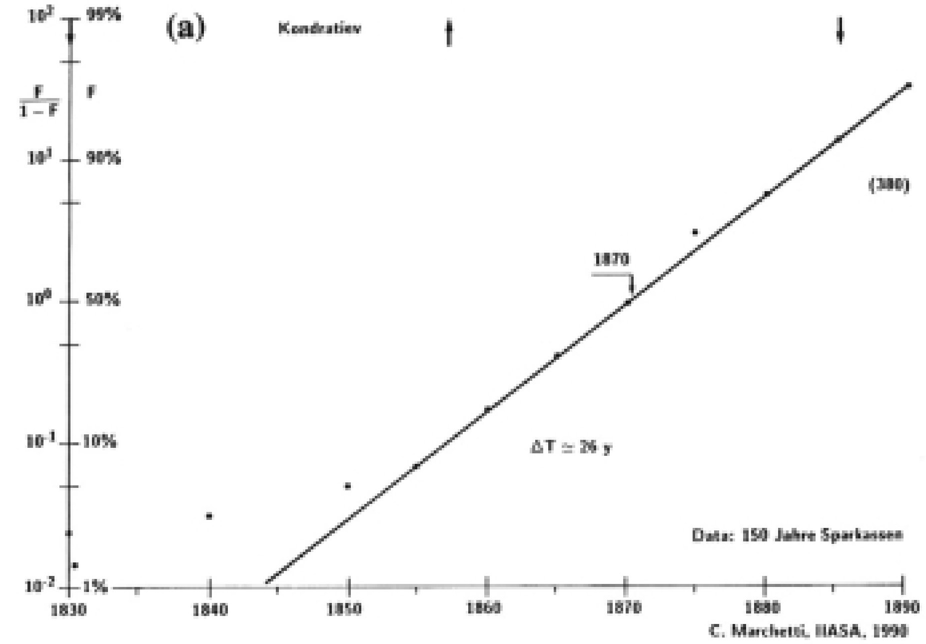


Fig.5–5. Born to win: On the demography of Austrian Savings Banks still open
This is an appendix to Fig.5–4. We can actually ask in reverse if the Savings Banks originally constituted a selfreferent group, meaning if they were born like an identifiable population. The answer is positive. Taking the foundation dates of the surviving banks one gets the annexed chart where the set can be reasonably well fitted with a logistic. The parameters are not very different from these of the first wave in Fig.5–3. The shorter ΔT means most of the banks cam from the core group, around 1870. In this case, timing is not the only factor as for the banks of the second pulse.



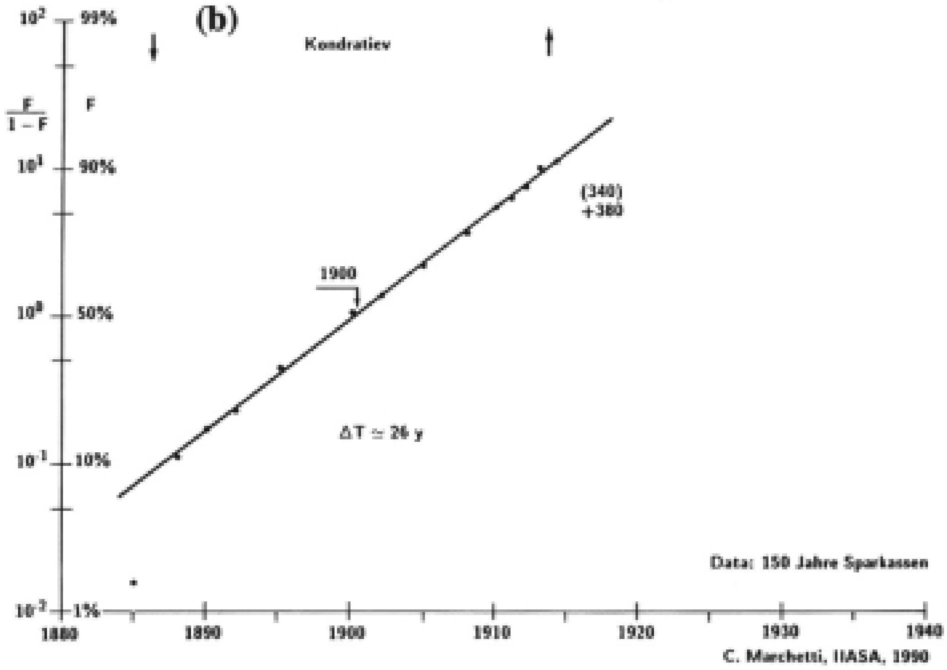


Fig.5–6a,b. Savings Banks in the Austro–Hungarian Empire

The analysis of Fig.5–3 refers to the present territory of Austria. We try now to look at the territory in the period of foundation. Although culturally subdivided it had a political unity which helps diffusion. The first wave reported in Fig.5–6a matches well that reported in Fig.5–3. The centerpoint, 1870, is in fact identical and the saturation point, i.e., the final number of banks is about double. The second wave reported in Fig.5–6b is autonomous, and presumably represents diffusion in the complex periphery of the Empire. It is also a large pulse, doubling the number of banks in operation. The center of this pulse, 1900, coincides with the center of the expansion phase (1898) of the 1885–1940 cycle.

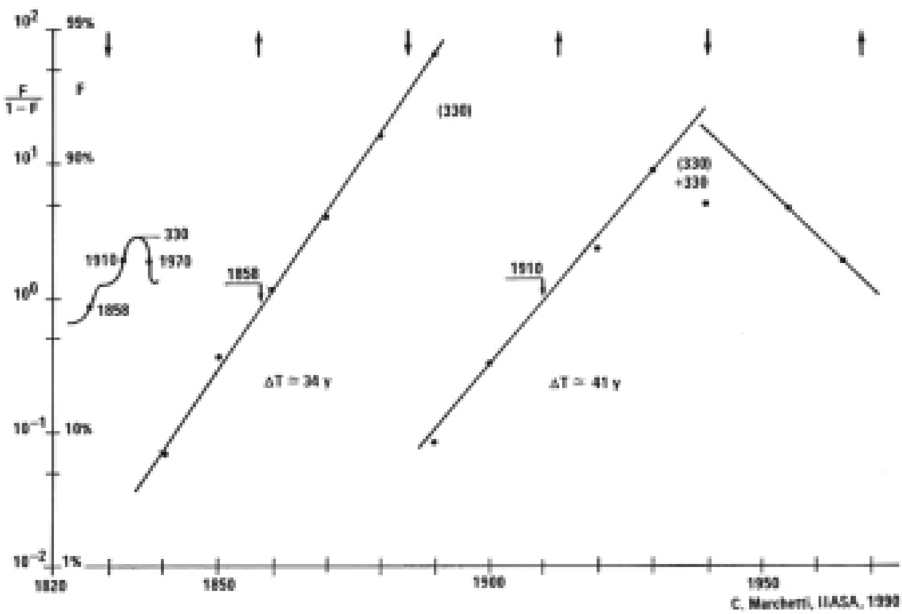


Fig.5–7. Savings Banks in Norway (1830–1970): Waves of foundations and closures

The diffusing center of Savings Banks is Scotland and this may interpret the very early start in Norway. The centerpoint of the first wave in 1858 is in fact early (Austria was 1870!) and also the number was high: double that of Austria. A second wave centered in 1910 doubled the 330 banks of the first one. The centerpoints of the foundation waves coincided with the centerpoints of the two corresponding cycles. We are now in a phase where the system seems to be in a dismantling (or transformation) course.

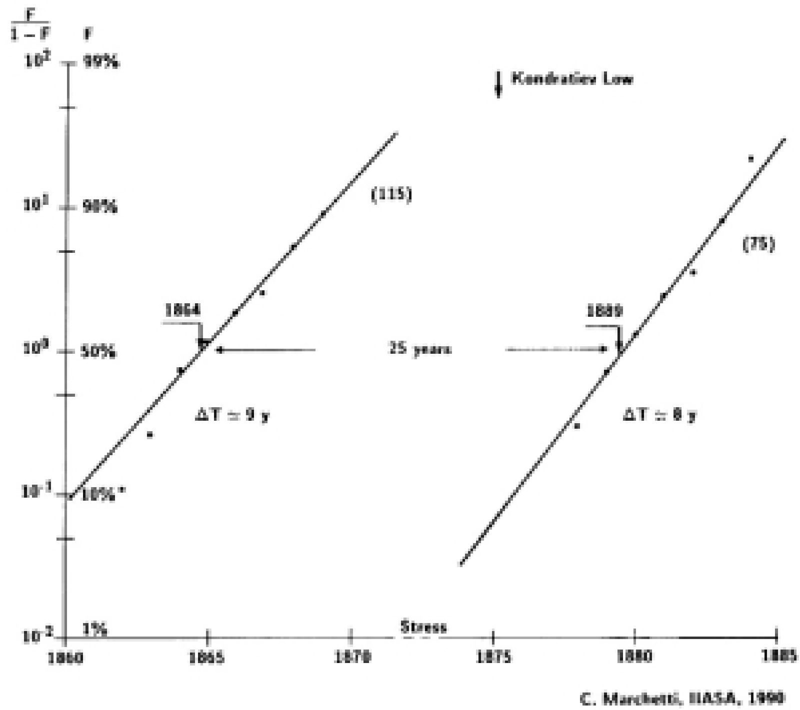


Fig.5–8. Savings Banks in England (1860–1900): The waves of closure

Savings Banks in England had a chequered success and started early to go bankrupt. We report here two waves of closure, one centered in 1864 and the second in 1884. In the first wave 115 banks were closed down and 75 in the second. What is peculiar is the runaway characteristic indicated by the short ΔT of 9 years and 8 years, respectively. The first centerpoint coincides with a maximum of the cycle and the second with a minimum. Often these coincidences lead to higher–level taxonomies, but we do not yet have enough cases to start building it.

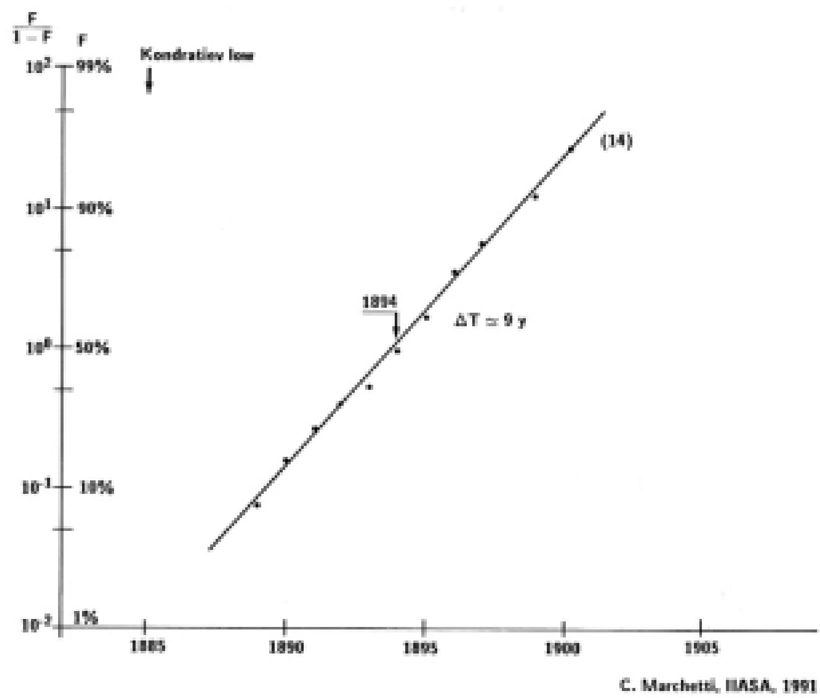


Fig.5–9. Savings Banks in Italy (1885–1905): A wave of closures
Italian Savings Banks have shown a high level of survival capacity, almost all are still there. However, after the big recession around 1885, a little number of them were closed, most of which very small and marginal. The 14 registered banks listed here had deposits larger than 1M current lire (a couple of M$). Interesting is the very short time constant pointing again at a breakaway of the subsystem, neatly described as a population.

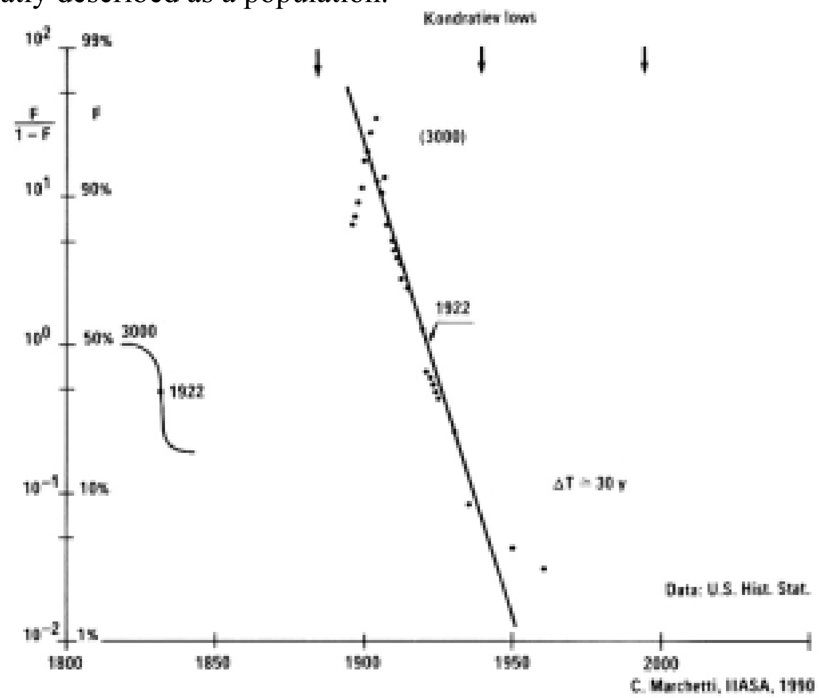


Fig.5–10. Private Banks closure in the USA (1850–1950)
3000 Private Banks closed during the first half of this century. In this case more than a runaway of bankruptcies, one should talk of the *phase–out* of a form of organization. These banks disappeared in the course of a cycle (1885–1940) with a slight displacement forward. The ΔT is correct for the fitting into a cycle, but the central point (1922) is displaced 9 years forward by respect to the centerpoint of the cycle (1913). The last 5% of the closures was also after the end of the cycle (1940).

6 – Economic Penetration of Savings Banks: The 19th century

In Fig.5–2 we saw the penetration of the idea of the Savings Banks in Italy by measuring saving bank openings. We shall now look at the process in terms of *functional penetration*. Once the bank is open, people must learn to use it, and also that is a process of cultural diffusion that we shall map with the usual instruments. Due to the high volatility of the lira in the 20th century, the *data are usually reported in constant money* (lire '89) using the ISTAT transformation tables (1990). These tables start from 1860 and we kept the value of the lira constant before that (1830–1860).

Deposits are the raw material of banking activity and we shall start from them (Fig.6–1). The global deposits in the Italian Savings Banks in the first period grew precisely following a logistic centered in 1885, the trough of the Kondratiev cycle. They do not seem to be influenced by wars or the process of unification of Italy. Historians tend to dramatize territorial conquests by political entities, but the contingent seems to be the primary drive. One could not otherwise expect diffusion processes going on for centuries with sidereal precision.

Coming back to the deposits in our Savings Banks, they amount at the end of the first pulse to about 2 10^{12} lire '89, which gives a precise idea of the penetration of these banks in the Italian economy, which was then ten times smaller than at present in terms of GNP. In the meantime, deposits grew by two orders of magnitude, and their penetration in terms of GNP increased by a factor of ten. This means that in spite of two wars that devastated the value of Italian currency, Savings Banks grew in terms of share of national wealth by a good 2% per year.

A second observation of taxonomic character is that the centerpoint of the interpolating logistic falls exactly in 1885, the trough of the Kondratiev cycle. This hints to the function of Savings Banks as an insurance for the small citizen in periods of distress. If the interpretation is correct, this function will be lost later on. As with most economic activities, Savings Banks will actually march in tune with the Kondratiev cycles, the growth of deposits having the point of maximum growth around the maximum in the cycle, in strict resonance with the growth of GNP.

Fig.6–1 refers to the total deposits of the Italian Savings Banks. We can look at the subset of the Savings Banks in Tuscany (Fig.6–2). Already during the last century, Tuscany was the second region in terms of deposits, the lion share being for Lombardy and Milan, holding about half of all deposits. For Tuscany the central point for the growth in deposits is in 1887, in coincidence with the lowest point of the recessive branch of the cycle.

Deposists can be invested into bonds, shares, mortgages, personal loans, etc. Let us now analyze how these different forms of investment evolve in time and change their shares. Bonds appear to be preferred (Fig.6–4) saturating at 1.2 10^{12} out of 2 10^{12} lire '89 of deposits. At the time the railway system in Italy was growing at a fast rate absorbing substantial shares of available capital. And also governments were attracting this money with reasonable interests, much formal safety and small preoccupations for the administrators. In France the state was in fact absorbing the totality of the deposits in the Savings Banks. Such investments – safe, but not really, as history teaches – are not in line with the original aim of the Savings Banks, to take from the widow in order to give to the orphan. This original tendency is shown in the analysis of mortgages (Fig.6–6) and of personal loans. The long–time constants show that they were important since the origins. The share of this form of investment, however, kept decreasing and reached about 25% of the total around World War I.

Savings Banks administration seems to have been quite prudent and relaxed. A representative indicator is the extreme regularity of the evolution of the assets which develops with a certain delay behind deposits. The delay is about 7 years with no effects due to disruptive events like the Italian unification. Only mortgages resented these external perturbations. For a dozen years they sit above the interpolating logistic. It could be pure coincidence but the assets and the portfolio basically coincide in taxonomic and value terms. A last look at bad debts (Fig.6–8), really small in relation to the deposits of the time and also to personal loans which are the most probable source. From a taxonomic point of view bad debts go together with the portfolio. There is a curious "excess" of bad debts in 1890 and a "shortage" of portfolio in 1900.

This analysis at national level can be repeated at regional level and for the single bank. As we said, the system is fractal and the same patterns appear at all hierarchical levels. We can look at Savings Banks in Tuscany (Fig.6–2a) or in Veneto (Fig.6–2b). The central point is the same for both: 1887. Saturation points are 250 10^9 lire '89 for Tuscany and 150 10^9 for Veneto. The phenomenon of countertrend, maximum expansion when the economy is bankrupt, occurs also in the case of the Austrian Savings Banks (Fig.6–9). The central point is exactly in 1885. And there is another one in 1838 (Kondratiev minimum in 1830). Austrian Savings Banks had started earlier than the Italian ones. Also the investments in stock are countertrend (Fig.6–10) if slightly out of phase and mortgages are centered in 1892.

As we shall see, in the following century Savings Banks will rephase on the cycle, with their maximum growths around the center of the cycle, marking also in this way their transitions from banks of the poor to banks *tout court*. To give a solid example of this rephasing, the growth of deposits in the Italian Savings Banks during the cycle 1940–1995 is reported in Fig.6–12. Data start from 1960 because only then the losses due to the war and post–war devaluation were recovered (we are working in constant money). Due to the staggering method our charts are constructed, if we have a loss due, for instance, to a war, we have to reach the saturation level of the previous wave before the curve appears in the chart. In our case, the preceding wave of deposits saturated at 17 10^{12} lire '89 in 1940.

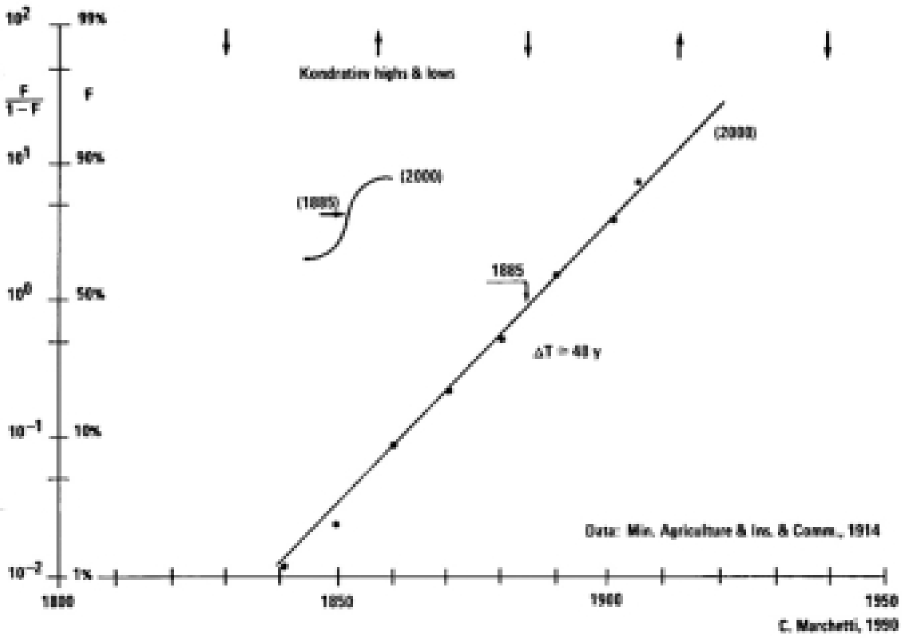


Fig.6–1. Savings Banks in Italy (1830–1940): Deposits (10^9 lire '89)

The Cassa di Risparmio di Firenze (CRF) was born at the right time, at the end of a recessive period, and its development was correctly situated into the 1830–1885 cycle. The other Savings Banks in Italy followed in sparse order, so that their aggregate development in terms of deposits was shifted forward and in fact centered in the recession point of the cycle. In the following cycle they started rephasing and in the present cycle they are perfectly in tune with the cycle. The very long ΔT also means that the spread of foundations and deposits generated a system overlapping over almost two cycles.

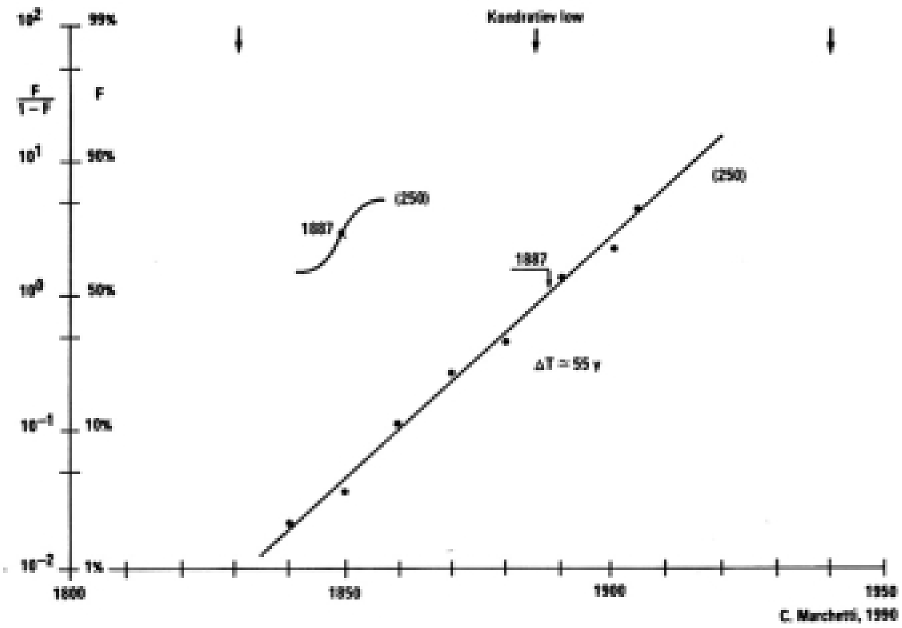


Fig.6–2. Savings Banks in Tuscany (1840–1920): Deposits (10^9 lire '89)

As we suggested here and there in the text, social and economic systems have fractal structures. For banks one can layer them geographically. In this chart, the case of the deposits in the Savings Banks of Tuscany are examined since the beginning (1840). Also here we observe, as in the case of the Italian Savings Banks, that the superposition of the growth of the number of banks and of their deposits leads to a process that encompasses two Kondratiev cycles, with the center of the development processes coinciding with the minimum of the cycle (1885).

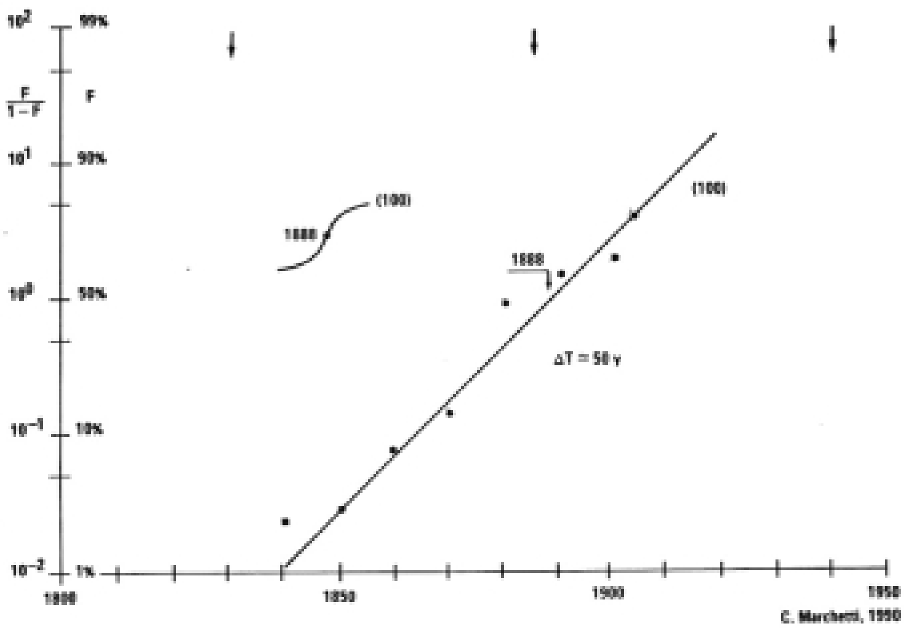


Fig.6–3. Italian Savings Banks deposits: Current accounts (10^9 lire '89)
In the initial phase these banks served the purpose of holding the savings, much more than movimenting the money. Most deposits were in fact made through savings books. We report here the penetration of the techniques of current account. It did not have much success during the last century. The saturation level, referred to the total deposits reported in Fig.6–1, represents about 5% of the saturation level of the deposits. At present current accounts run about 50% of total deposits.

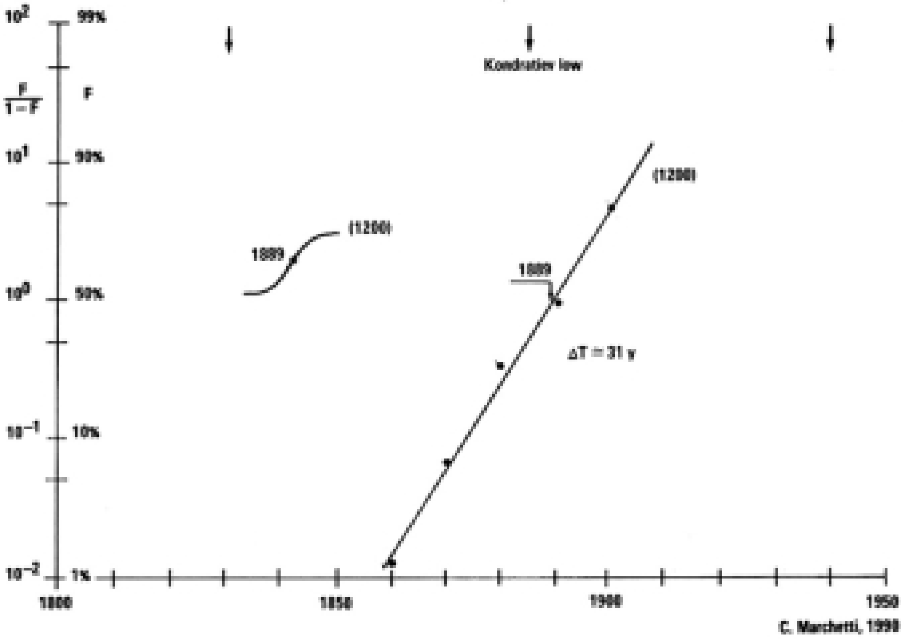


Fig.6–4. Italian Savings Banks investments: Papers (10^9 lire '89)
Savings Banks have a tendency to take the lazy course of connecting the small saver with the big lender, Public Debt. The words of Conte Capponi, before even the foundation of the CRF, point clearly in that direction. Analyzing the investments of the Italian Savings Banks during the last century we find that this type of investment corresponds to about 60% of the deposits, at saturation. One should observe, however, that it starts relatively late, at the beginning of the recessive phase of the cycle 1830–1885.

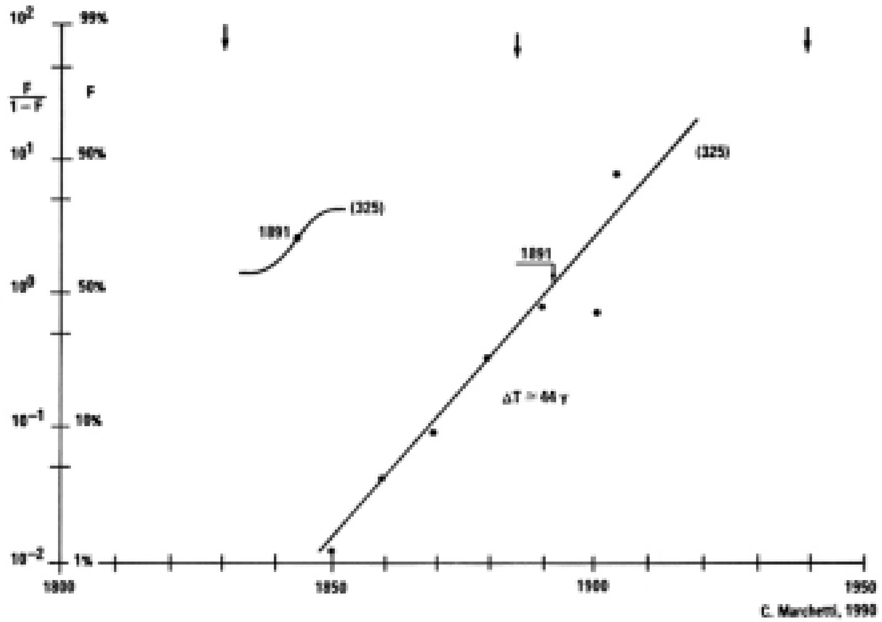


Fig.6–5. Italian Savings Banks investments: Portfolio (10^9 lire '89)

The content of these Portfolios is not transparent in the texts reporting the operation of these banks during the last century, but indirectly we can reconstruct that most of them refers to public works, e.g., railways, which absorbed much capital in this period. The centerpoint is in 1891, very near the trough of the cycle, when much of the Italian railway network was constructed. The saturation point value corresponds to about 16% of the total deposits.

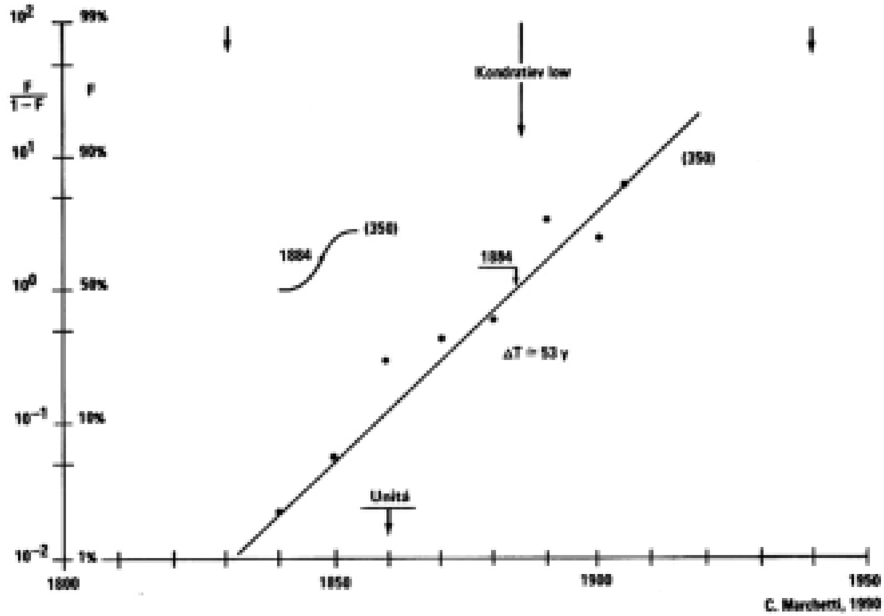


Fig.6–6. Italian Savings Banks investments: Mortgages (10^9 lire '89)

Mortgages have always been the draw horse of Savings Banks. In periods of low inflation mortgages are a slow but safe investment as it is guaranteed by an object as collateral. It can be seen as a variant of the pawnshop, which was at the origin, in Italy, of a form of Savings Bank called Monte (dei Pegni) still existing today. In periods of monetary instability and floating prices for property, mortgages can become dangerous as the case of the American Savings and Loans has just shown. In the last century Italy's situation was, in spite of the appearances and the wars of unification, relatively stable and mortgages were the second item in level of investments for the Savings Banks. They went together with the deposits with a centerpoint in 1884 and a time constant of 53 years. At saturation they were about 18% of the deposits.

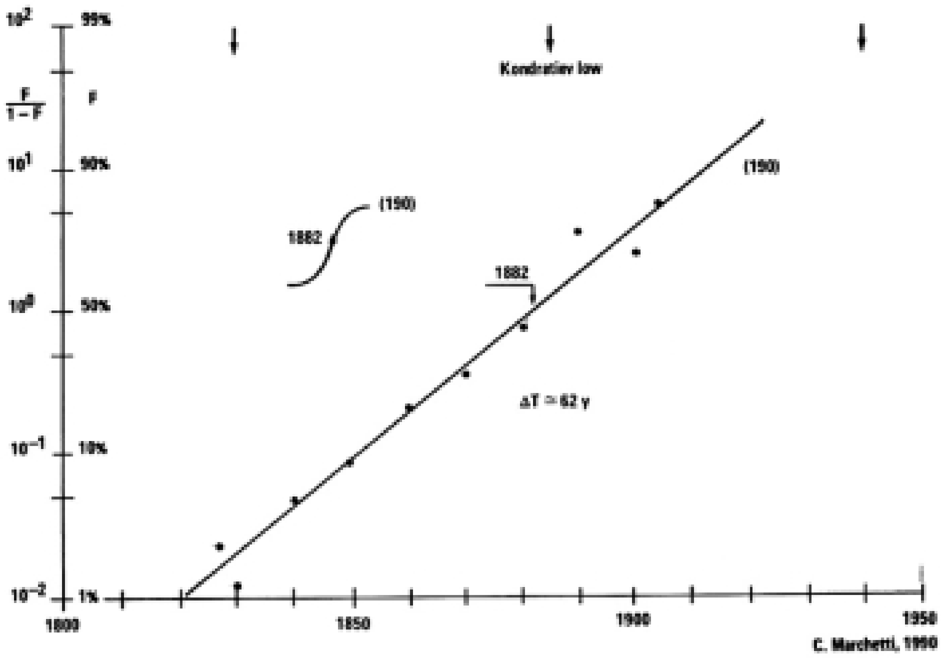


Fig.6–7. Italian Savings Banks investments: Personal loans (10^9 lire '89)
The pious intention expressed at the foundation of the Savings Banks to penetrate the social tissue and help financing personal and professional activities, found a very limited expression in quantitative terms. Personal loans moved quite in parallel with the deposits, absorbing more or less 10% of them.

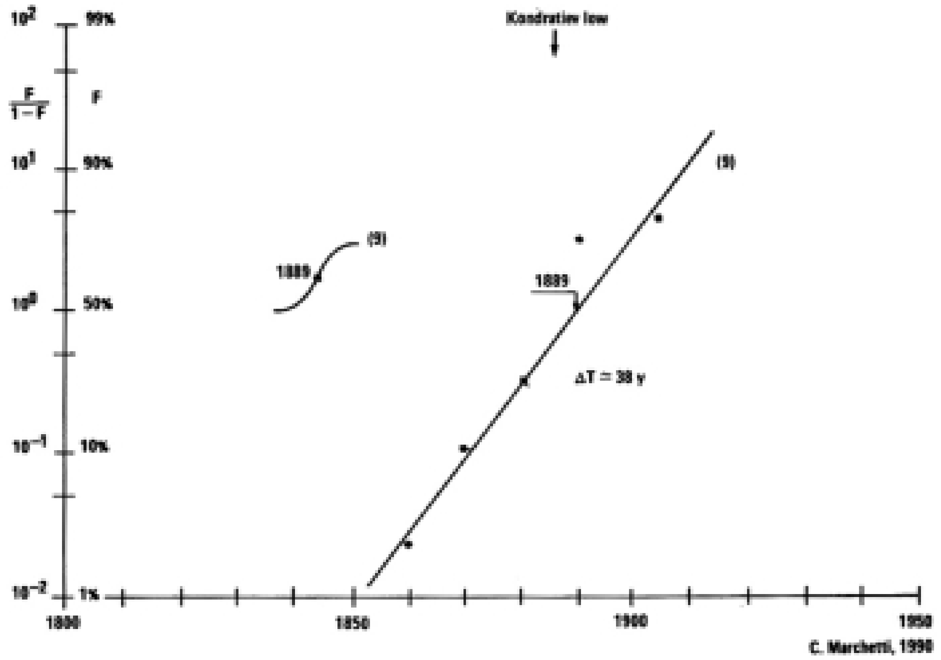


Fig.6–8. Italian Savings Banks investments: Bad debts (10^9 lire '89)
Bad debts are investments that the bank recognizes will never come back. The definition of bad debt is then somehow arbitrary. However, during the last century, bad debt for Savings Banks was very modest, about 0.5% of the deposits. Perhaps the bankers were very prudent, or rejected reality as they are doing now.

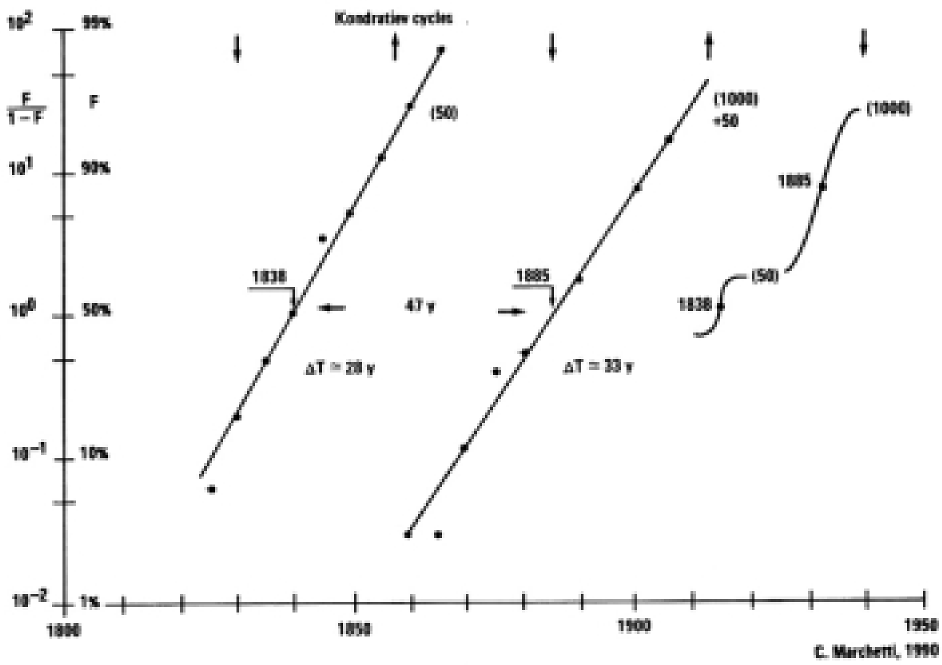


Fig.6–9. Austrian Savings Banks (present boundaries) (1830–1920):
Deposits (10^6 current Gulden)

"What the others do" is often the reference and the measure for our own actions. We have analyzed here the dynamics of the deposits of the Austrian Savings Banks for their first century. The currency being very stable we did not make any correction. What is interesting here is that the deposits are 90^o out of phase with the cycle, growing at maximum speed around the depth of the recession (1930, 1885). In the present cycle, however, the rephasing is complete, and parallel to the growth of GNP.

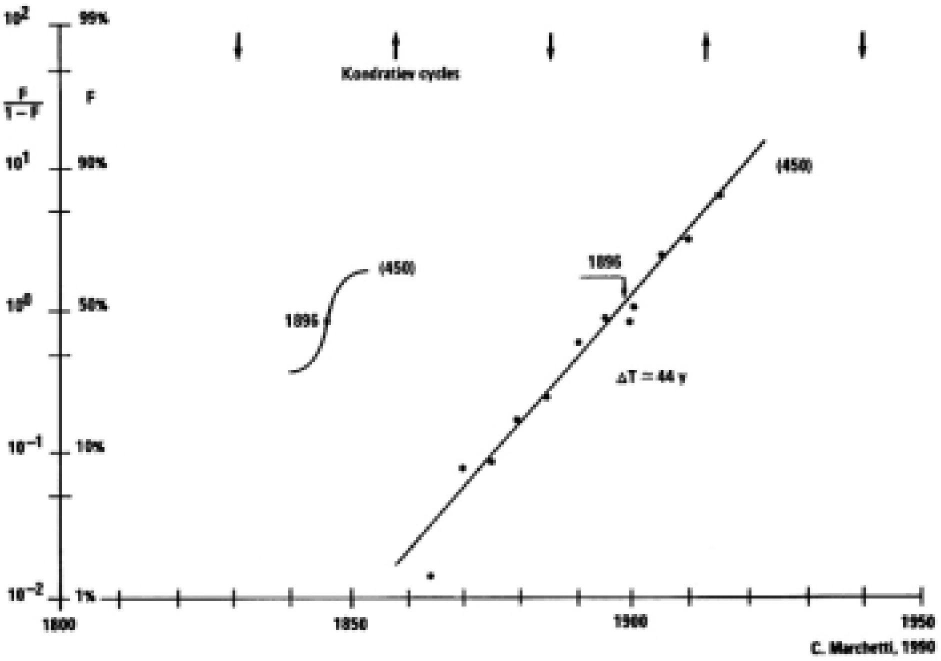


Fig.6–10. Austrian Savings Banks (1850–1920):
Investments – Wertpapiere (10^6 current Gulden)

The investment in bonds comes late and grows slowly, but finally absorbs 40% of the deposits. Also here the center is not far from the recessive trough (1875).

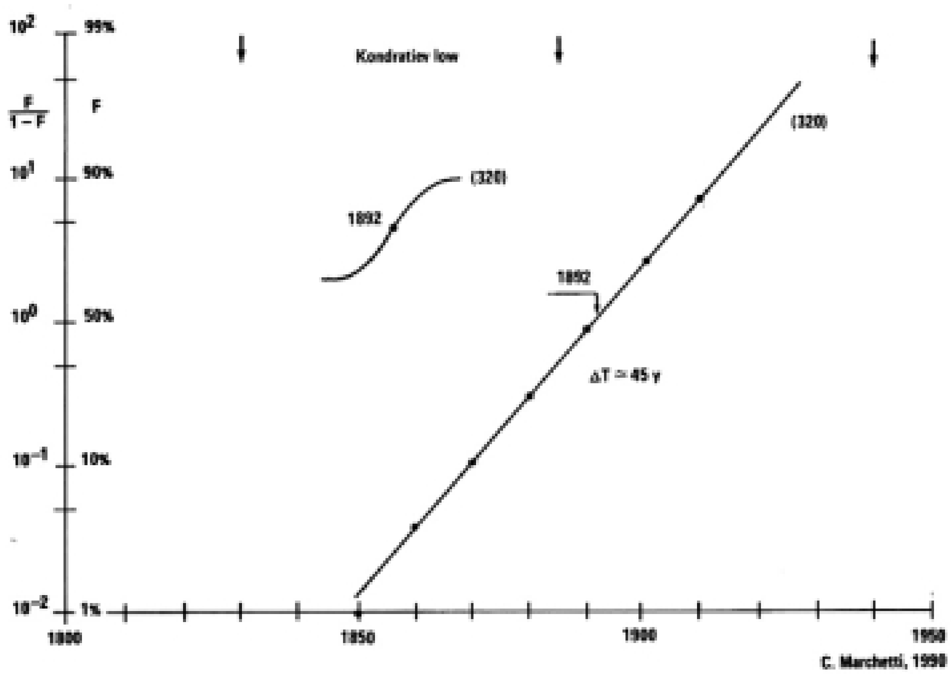


Fig.6–11. Italian Savings Banks (1850–1920): Assets (10^9 lire '89)
Assets are important as a safety net, but mostly as visible indicator of welfare and solvency. It is interesting to note that the many vicissitudes of the political and economical Italy did not touch its very smooth evolution. Assets dynamics parallel that of deposits with a delay of a few years.

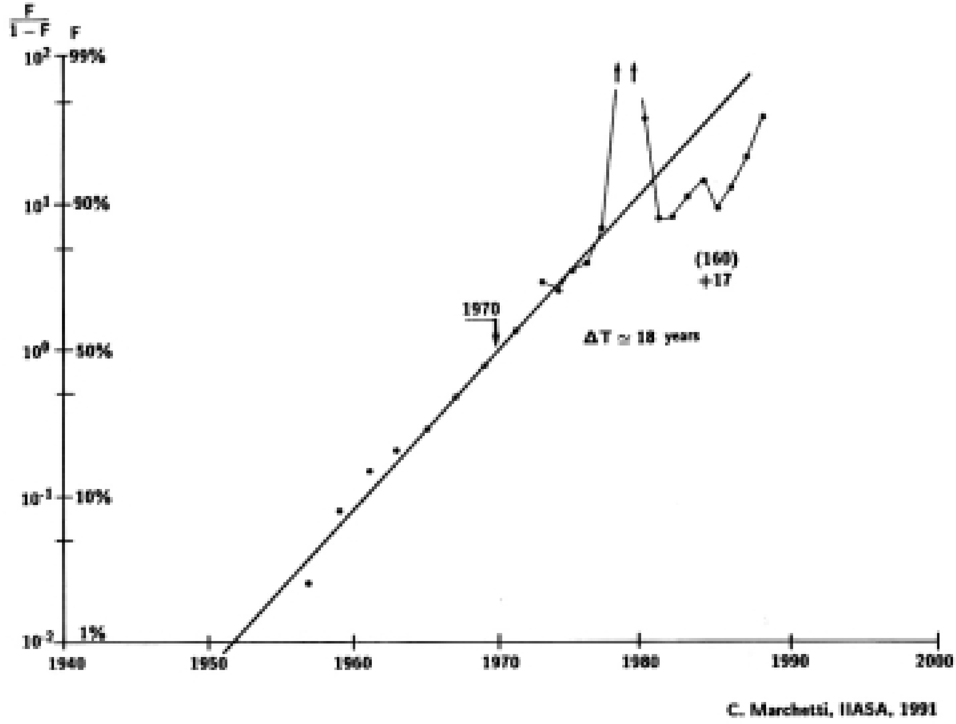


Fig.6–12. Italian Savings Banks (1940–1995): Deposits (10^{12} lire '89)
In the previous comments we noted that Savings Banks progressively rephase over the cycle. In this analysis of the deposits in the system of Italian Savings Banks, the rephasing is almost perfect (1970 versus 1968, center of the cycle). The saturation point is 160 10^{12} lire '89 that came from this cycle, plus 17 10^{12} lire '89 reported from the previous one. Toward the end of the cycle there is a tendency for a system to oscillate around the asymptotic values.

7 – The Cassa di Risparmio di Firenze and her Context

We will not enter here into the history of the foundation of the Cassa and her development during the last century, described in a very detailed and fascinating way in the book of G. Martini–Bernardi. The idea of the Savings Banks coming to Italy from the diffusing center of Vienna, explains how Florence, then under the rule of the Lorena was one of the first cities to start one. Padova, Venezia, Verona, and Milano were geographically nearer to Vienna, and innovation travels overland. And they also were under direct Austrian rule. In Florence, the Accademia dei Georgofili had already started to move in 1819, but the constructive decision came only ten years later.

As said in a previous chapter dedicated to Kondratiev cycles, economic systems undergo pulsations of about 55 years, both at the aggregated level and at that of the individual. Half period is an upswing of about 28 years when almost everything flourishes and expands, and the other half is a downswing, a reflexive period of consolidation with a limited growth in consumption and investments. This stalemate is dubbed recession or depression, depending on the intensity of social effects, e.g., unemployment. In fact, saturation of consumption together with increase in productivity gives a reduction in employment in the leading industries. People tend to become prudent and pessimistic. The deepest recession points can be localized around the following dates: 1830, 1885, 1940, *and* 1995. The foundation of the CRF in 1929 occurred then at the lowest point in the cycle, a period when it is easy to collect money but difficult to invest it properly. The problem had been clearly identified by the founders. In a letter of 16 April 1829 by the Marquis Gino Capponi to the Abbot Raffaello Lambruschini it is said "The Cassa di Risparmio had already been proposed by the Georgofili and fought and not more defended when they had to answer on the difficulty of the investments". The letter is constructive, however, and adumbrates a solution "But one makes Casse di Risparmio where are well credited public bonds". The next cycle is located around 1995 and the atmosphere looks very similar. Government bonds are equivalent today to 1.4 times the Italian GNP, although "well credited" is a personal opinion.

The CRF was then opened precisely in the eye of the recession which is optimal from the point of view of deposits. And also of investments if bonds are chosen, because governments are very avid of money in order to cushion the social tensions deriving from the recession. The mechanism got an academic paludation by Keynes, but always existed. Following the intuition of Gino Capponi, the Cassa began to invest the deposits by "public administrations or of the community, or contractors of public works, already liquid creditors of the communities", as it appears in the budget speech of 31 December 1829, held by the president of the CRF, Cosimo Ridolfi. The evolution of deposits during the cycle 1830–1885 is reported in Fig.7–1. For the translation of Florins into Italian lire we took the tables of Martini–Bernardi. Due to the remarkable stability of the currency at that time, we transformed current lire to lire '89 at a fixed rate (that given by ISTAT tables for 1860). The analysis shows again that the diffusive model matches well the facts and that deviations by respect to the fitting equation are elastically reabsorbed, i.e., without leaving any trace in the long term. The model then not only provides a basis for robust long–term forecasting, but a reference to estimate "were we stand", very useful for short–term decisions.

Also the second paradigm, that the Kondratiev cycles tend to operate as containers for development waves, is here respected. The interpolating logistic saturates in 1885. Incidentally, with the economic dimensions of Italy at that time, the 43 10^6 current lire, equivalent to 200 10^9 lire '89, are a respectable sum. The centerpoint of the curve, when the growth of the deposits is highest, is in 1862 very near to the center of the Kondratiev cycle (1858), when all parts of the system, in particular GNP, also have their maximum growth. We could not find a logic for the "rush to deposit" between 1871 and 1878 (but reabsorbed already in 1880). At that time the Italian capital had been just moved from Florence to Rome and the city administration, a large debtor of the Cassa, was in a bankrupt state.

Taking again the general line of reasoning, we see the system of constraints that channels the development of an enterprise to an obligated trajectory. The possibility of identifying such trajectories gives a feeling of determinism in such developments. At least for the ones who met success. Infant mortality for new enterprises is very high.

Another element in the analysis of Fig.7–1 is the *time constant* ΔT which measures the time for the wave to go from 10% (43 million current lire) to 90% of the saturation value. For the CRF in this first pulse of growth, ΔT ≅ 36 years, meaning that a part of the tail is going beyond 1985 (*F* = 99% at 1868 + 36 = 1904), mixing with the second pulse of growth reported in Fig.7–2. This period appears very regular up to the beginning of World War I, and then is subject to wild fluctuations until the beginning of World War II. As we have shown in another study, and historians have detected through other logics, World War II is a *continuation of World War I* (not a repeat) and the years between were really war periods, if formally a truce. Deviations here are not a form of noise, but just violent oscillations as it happens during wars. The interpolating logistic fitted using pre–war data is caught back only in 1930. In the period 1930–1935 the value of the deposits in '89 lire go out of scale, but this is due to the violent deflation of the lira. The amounts deposited do not change much if measured in current lire. The taxonomy of this second pulse is characterized by a central point in 1907, anticipated by respect to the central point of the cycle (1913). Deposits added 420 10^9 lire to the 220 10^9 lire coming from the previous saturation level (formally in 1885). This increase, spread over 55 years, does not appear particularly brilliant, but it is slightly better than the evolution of GNP, going from an index of about 60 in 1885 (1913=100) to an index of 160 in 1940 (Maddison).

The parallel evolution of the deposits in the Italian Casse di Risparmio is reported in Fig.7–6. Also here the war brings havoc into the system, and a dozen years will be needed to plug this hole and to go back to the pre–war trajectory. Also here the wild revaluation (up to 60%!) of the lira leads, in constant money, to an overshooting in the period 1931–1937. To note the central point in 1913 (Kondratiev 1913) shows a perfect rephasing of the Casse with the cycle. That coincidence will hold also for the 1940–1995 cycle.

Let us look now at the behavior of CRF during this last pulse. This chart is interesting for a number of reasons. First the Italian GNP that grew by a factor of about 3 during the cycle 1885–1940, grows by a factor of 5.5 in the present cycle (1940–1995). The deposits in the CRF which had grown more or less like the GNP, during the first cycle grew by a factor of 14, during the present overperforming the GNP. The ratios are calculated between saturation points. This ratio then does not take into account the destruction of value of the deposits due to the war (roughly 80%). The pre–war level is actually picked back only in 1952 and the reference level in 1960. As said before losses due to wars and other causes are normally reabsorbed through hyperactivity until the secular trends are reached again. For CRF the deposits at saturation should reach the value (in lire '89) of about 9 10^{12} lire, of which 0.64 10^{12} reported from the previous saturation in 1940 and 8.4 10^{12} added in this cycle. This is the level "perceived" by the system. Usually near saturation there are oscillations around this level, plus naturally some imprecision coming from the estimation of the parameters in the fitting procedure.

The time constant of 24 years is relatively short. The canonical value in order to fit snugly into the cycle is 27 years. The centering is good. It is 1968 for the cycle, 1969 for the Italian GNP (Fig.4–6) and 1971 for the CRF. Most probably all the shifts are to be attributed to the recovery process after the war. Deposits are slightly above trend in 1972 and 1973 but the deviation is rapidly reabsorbed.

What is *really extraordinary* is the anomaly that appears in 1979. Deposits in constant money decrease rapidly until 1982, to take later a normal growth process *without an elastic reabsorption of the loss*. In the thousands of cases we have analyzed, this behavior appears only for some global statistics of France and Japan. The years of the "occupation", i.e., the loss of sovereignty, are lost forever by these systems. In other words, it is *as if* the clocks would stop during these periods and with them all evolutionary processes. It must be clear that nations half destroyed by wars pick again the trend with an elastic reabsorption of the losses. Examples are Italy and Germany after the second World War. In the case of the CRF, the 1979 anomaly meant a *stop of about 7 years* in the growth of the deposits in constant money. This is the distance in time between the previous logistic and the present one. The interpretation of such a phenomenon is good matter of study for the experts of banking, finance, and money. The anomaly is not restricted to the CRF, but more or less involves all Italian banking system. Putting together all deposits of the Italian Casse and Monti (Fig.7–4) we see a situation very similar to that of CRF. The central point of the logistic is the same, as the "lost" years. The same result again appears if we analyze the Banche di Credito Ordinario (Fig.7–5) and the Istituti di Credito di Diritto Pubblico (Fig.7–7). The logistics are well centered by respect to the Kondratiev (1968) and the ΔT is what should be expected for homing into it (28 years). A different behavior is presented by the Banche di Interesse Nazionale (BIN) reported in Fig.7–8. The peak in deposits that the other banks show in 1978–1979, extends for them down to 1970 and is more pronounced. To pick a point, in 1973 deposits in constant money are 30% above the fitting logistic. In 1977 this deviation is reabsorbed, in 1980 there is a fall in the deposits like for the rest of the banks, *but without any recovery* if delayed in time. Deposits remained in fact the same from 1980 to 1990. The BIN have a limited weight in the credit system and their peculiar behavior does not reveal in the global statistics where the *escamotage* of the CRF deposits is neatly reproduced.

The simplest connection to the *escamotage* could be a contingent fall in the growth of GNP, which however shows no ripples (Fig.4–6). Another line we explored was the Public Debt which competes very strongly with the banks and in Italy absorbed to date more than the double of the deposits in the whole banking system. The taxonomy of this debt reported in Fig.7–9 is very interesting because it can be split into two separate logistic waves of growth, a slow one (ΔT ~30 years) centered in 1977, with a saturation level of 850 10^{12} lire '89 and a very fast one with a time constant of only 5 years, centered in 1985 with a saturation level of 340 10^{12} lire '89. The position in time could be correct to identify it as the cause of the *escamotage*, but the numbers do not fit the deposits "missing" in the banks in 1984, which were calculated using the logistic pre–1979 are about 80 10^{12} lire '89. The fast pulse of public debt in 1984 had absorbed 160 10^{12} '89.

Bank's clients got short legs and tend to favor the banks with counters next to their homes. In other words, it may be interesting to observe these phenomena in micro, i.e., to analyze the evolution of government bonds, BOT and COT deposited at the CRF and presumably owned by its clients. The sums in question might be considered as subtraction of potential deposits in the bank. The result of the analysis is reported in Fig.7–10 and shows that the global process is mirrored in the local one but the parameters differ substantially.

The pulses are again two, one long–term and one short–term. The long–term pulse runs faster than the national one (ΔT of 15 years instead of 30 years) and it is smaller at saturation than the short–term one. Summing the saturation points of the two pulses we get the remarkable sum of 7.7 10^{12} lire not much different from the total deposits in the CRF. At national level, however, the debt is more than double the total deposits (three times if we consider that part of the deposits are invested in the debt).

The second pulse with a ΔT very near to the national one (4.5 years versus 5.2) is, however, centered at a later date (1987 versus 1985) and *cannot* have had an influence on the *escamotage* of the deposits, too late for the dip between 1979 and 1982. We moved in rounds about this problem, because it is very interesting methodologically and important for the banks. They, in fact, lost an estimated 500 10^{12} lire–year of deposits. In spite of the fact that we could not find a plausible correlation with other phenomena, the taxonomic analysis eliminated various hypotheses that were presented during discussions. Economic practice is plagued by plausible but non–testable interpretations: our taxonomic filter can chose the ones nearest to reality.

In a competitive system the most important measure comes from comparison. We will report a series of analysis, concentrating on deposits in constant money, for the Cassa di Verona (Fig.7–11), Milano (PPLL; Fig.7–12), Lucca (Fig.7–13), Volterra (Fig.7–14), Pisa (Fig.7–15), and for Asti since its foundation (Fig.7–16a,b,c). These analyses provide a *detailed identikit on the evolution of each of these systems for 50 years*, providing the bank analyst of a reference base to help determine the deviations and construct cause–effect relations that may help improve the rules for running a bank. A certain number of comments is contained in the extended legends. However, it is clear that the Kondratiev paradigm operates down to the smallest units as for the global envelope, the GNP. This strict boundary condition for the banking system as for the single bank permits a strong long–term planning at all levels. The saturation values are the asymptotes of the fitted equations. Apart from the inevitable imprecision in the fitting procedure, most systems become turbulent toward the end of the Kondratiev. In other words, deposits may overshoot and undershoot the asymptote oscillating around it (with basically zero sum).

To close our broad view, we can look at the Italian credit system as a whole, again concentrating on deposits in constant lire after 1940 (Fig.7–17). The 1973 *escamotage* appears here in full force. A prudent estimate is that about 500 10^{12} *lire–year were lost by the system.* We also analyzed the penetration of public debt into the vaults of the Italian credit institutions (Fig.7–18). It seems that they are prudently moving out of it. As the European money markets are progressively opening, it may also be interesting to examine the evolution of the outside funds collected under various headings by Italian banks (Fig.7–19). They will reach 140 10^{12} lire '89 at saturation and appear as a modest opening into foreign financial markets.

Most analysis are made on deposits because statistical time series are complete and reliable. Coming back to CRF, we close with an analysis of the evolution of reserves (Fig.7–20) and savings books (Fig.7–21) since the foundation of the CRF. Our methodology is very general and that permits prying a system through all sorts of indicators. The Chinese box construction of the system permits to reassemble these partial analyses in a holistic view.

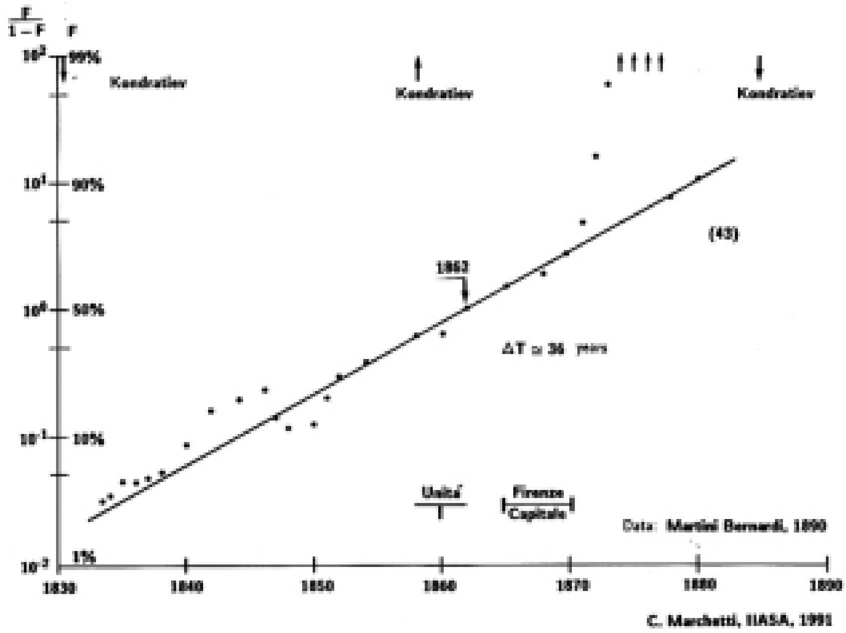


Fig.7–1. Cassa di Risparmio di Firenze (1830–1885): Deposits (current lire): The first wave
The evolution of the deposits in the CRF has been analyzed here for the first Kondratiev cycle 1830–1885. In spite of the turbulences in the Italy of last century, the trend is fairly regular. We use here current lire. The central point of the logistic, when growth is maximum, is in 1862 and the saturation point of 43 10^6 lire corresponds to 200 10^9 lire '89, a very remarkable sum for the economy of the time. A very curious fact is that the deposits increased above trend for a few years after the Italian capital was moved from Florence to Rome.

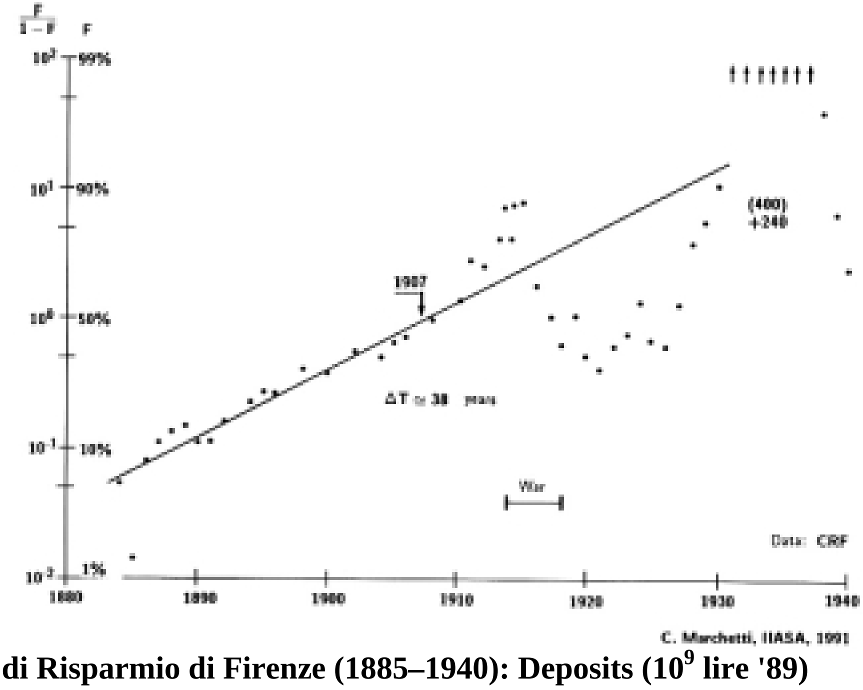


Fig.7–2. Cassa di Risparmio di Firenze (1885–1940): Deposits (10^9 lire '89)
This second go in the evolution of the deposits of CRF (this time in constant lire), moves regularly till the beginning of World War I. During the war there is a remarkable overshooting in deposits, and a big fall after. It must be noted, as historians have finally perceived, that World War I and World War II are the same object, intercalated by a truce. In fact, all indicators we have examined show instabilities characteristic of war time during the period 1918–1939. The overshooting in deposits during the Thirties is due to the savage re-evaluation of the lira. In current lire deposits stayed the same.

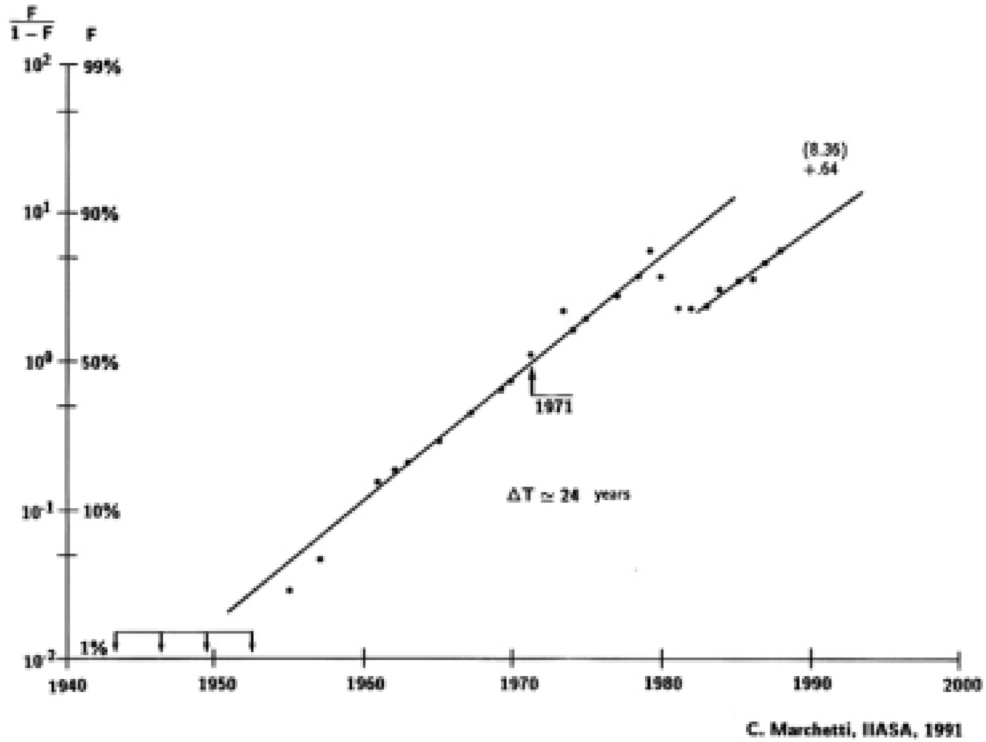


Fig.7–3. CRF (1940–1995): Deposits (10^{12} lire '89)

This interpolation starts on a basis of 0.64 10^{12} lire reported from the previous logistics (1940). Because the war destroyed most of this value through inflation, the amount had to be reconstructed through a period of hyperactivity, as it usually happens. The long–term trend was caught up again around 1955. The coincidence of the middle point (1971) with the center of the cycle (1969) is very good. The growth of deposits during this cycle has been 2.5 times larger than that of the Italian GNP, a good mark of aggressivity. The time constant is slightly shorter than the canonical one (24 vs. 28 years), but the two years of delay indicated by the central point almost compensate. The really extraordinary phenomenon is the break in 1979 which will be recouped only 7 years later. This "stopping of the clocks" (where curves can become continuous by suppressing a number of years) has been observed only in France and Japan during the loss of sovereignty consequent to occupation by Germans and Americans, respectively. There is a fast growing branch of Government Debt in that period, but dates and numbers do not match.

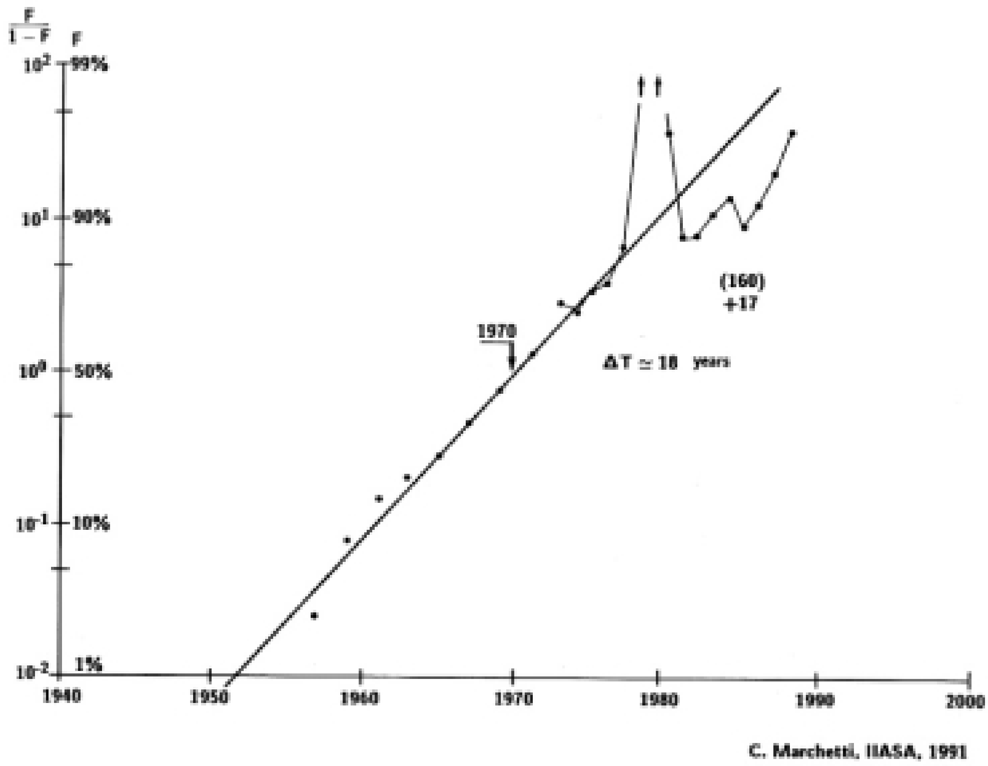


Fig.7–4. Italian Savings Banks (1940–1995): Deposits (10^{12} lire '89)

To put the *escamotage* of the Eighties in perspective we have analyzed the deposits in the whole of the Italian Savings Banks, and found that the phenomenon is general, mirroring the case of the Cassa di Firenze. As will be shown later, some Savings Banks of small size could manage to escape the *escamotage*, but their weight is too small to influence the totals. What appears strange in the Casse system is also the excess of deposits before the *escamotage*. The reason for these very large movements in and out (in constant money!) are unknown. Oil sheiks may have the capacity to manoeuver the necessary sums.

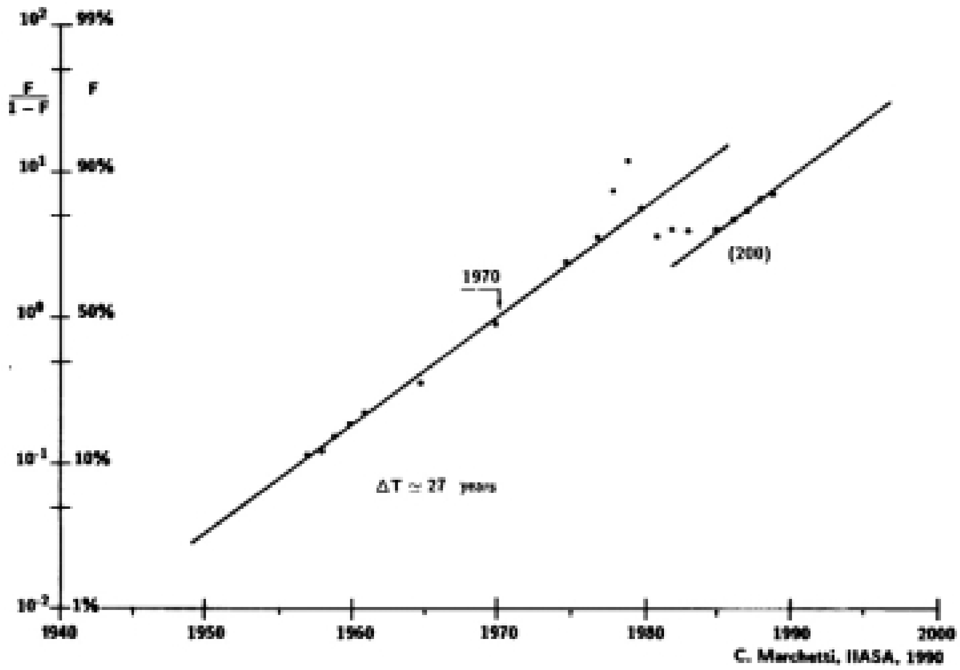


Fig.7–5. Italian BCO (Banche di Credito Ordinario) (1940–1995): Deposits (10^{12} lire '89)
Going to a different class of banks and looking at their deposits, we find again an *escamotage* similar to that of the Savings Banks with a peak in deposits in 1969 and the sink in 1981.

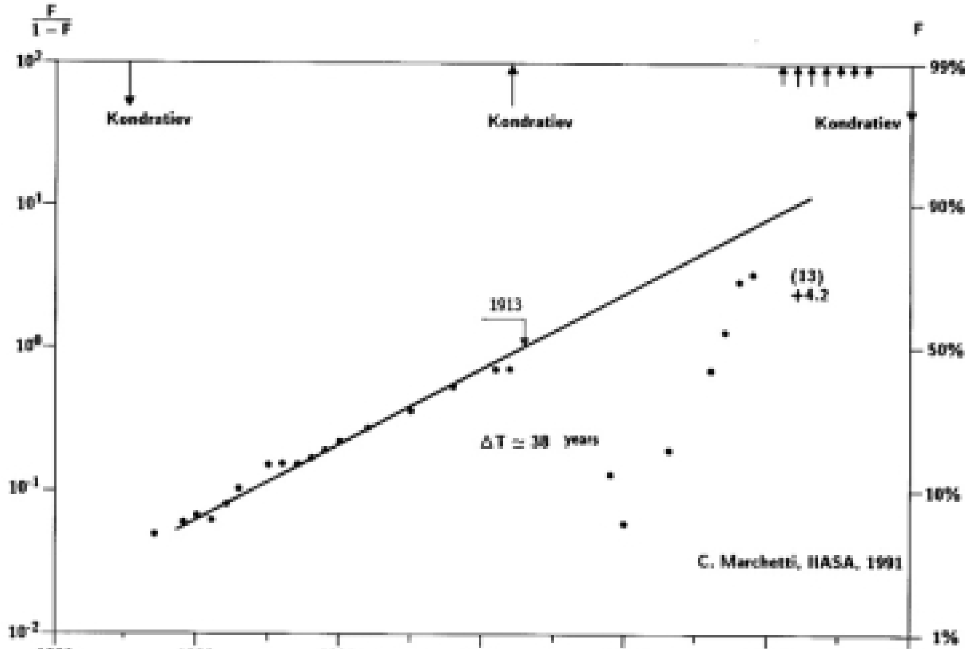


Fig.7–6. Italian Savings Banks (1885–1940): Deposits (10^{12} lire '89)
With this analysis we come back to Fig.7–2, and bring a reference to the irregular behavior of the CRF between the two world wars. Again we have a very regular development until 1914, and then the system enters into a mega perturbation that will be reabsorbed completely only after 1945. The ratio for the deposits in 1940 and that of the preceding pulse (4.2 10^{12} lire '89) is about 4, substantially better than the ratio of the CRF (2.7) over the same period of time.

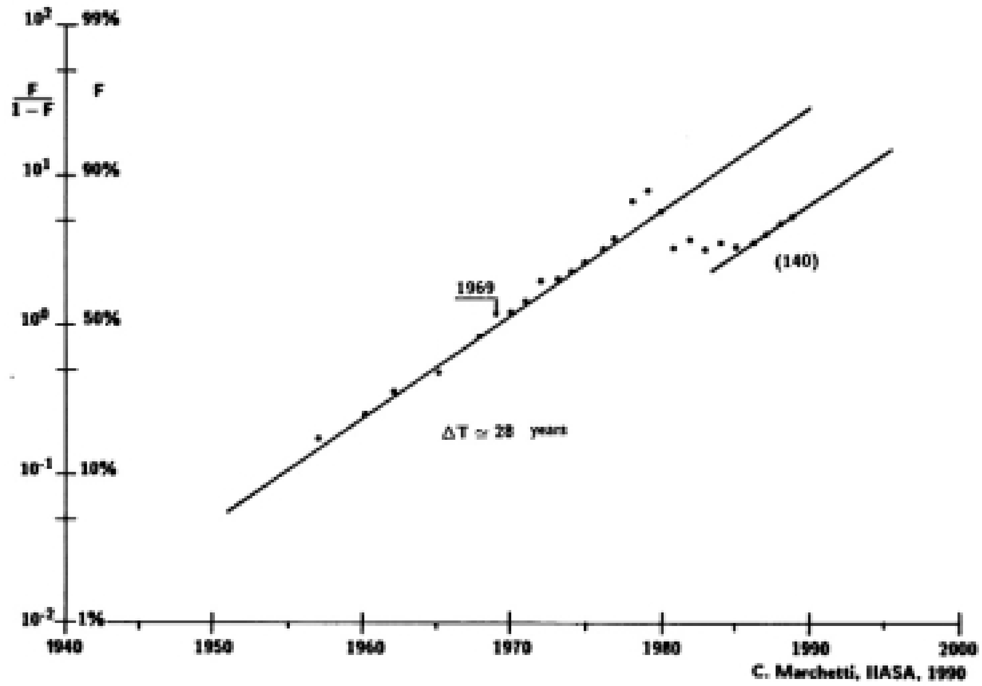


Fig.7–7. Italian banks: Istituti di Credito di Diritto Pubblico (1940–1995): Deposits (10^{12} lire '89)

The analysis of this subset of banks has been done with the objective of identifying the presence of the 1980 *escamotage*, present also here in full force.

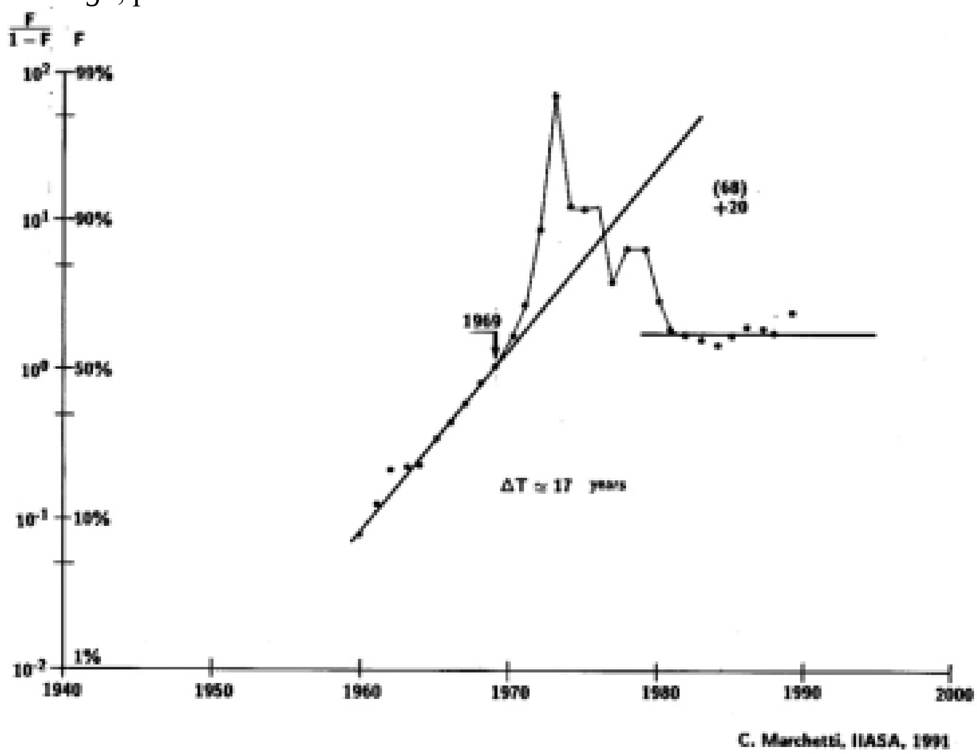


Fig.7–8. Italian banks: Banche di Interesse Nazionale (BIN) (1940–1995): Deposits (10^{12} lire '89)

The evolution of these state–owned banks proceedes regularly until 1969. Then in 1970 appears a pulse of over–deposits culminating in 1973. In 1977 the deposits are back on the long–term trend, but in 1980, together with the rest of the banks, the deposits drop *and stay constant since then*. In other words the BIN did not have any *escamotage* because they did not have any appreciable recovery after 1980.

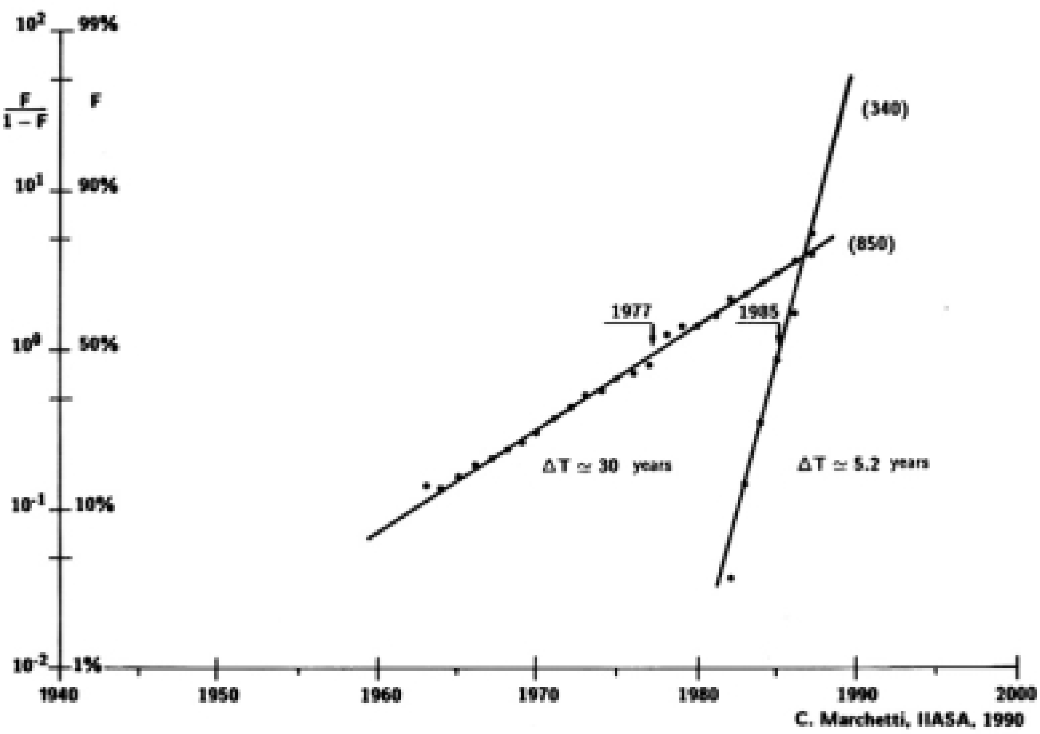


Fig.7–9. Italian Public Debt (10^{12} lire '89)

Public debt is competitor number one of the banks because it takes away from the market sizeable amounts of savings that could be deposited. It can also be seen as their ally because it raises interest rates and also banks buy state bonds when investments are hard to get or risky. French Saving Banks, as said in the text, originally invested in bonds only, so that they were basically bond brokers for the poor. State bonds may become funny money because there is no corresponding investment when the money is spent and they operate in the hypothesis that the state will levy enough taxes to service the debt. Extinguishing it is something else, and in fact practically never happens as we showed in Fig.4–1 and Fig.4–2. Servicing huge debts, like the ones Britain and the USA occasionally had, larger than one year GNP, requires three things, stiff taxation, low current expenses, and a growing GNP. Britain had the three requisites to the point that in the middle of last century 70% of the state income was devoted to the servicing of debt. Building up empires is extraordinarily expensive. Coming to Italy we found unexpectedly that Public Debt grew in two pulses, a slow one centered in 1977 and a fast one centered in 1985. We have techniques to splice logistics when they are partially superposed as here. The total sum at saturation, to be reached before 1995, is 1200 10^{12} lire '89, higher than the total GNP at saturation. Servicing such sum is beyond hope as primary need is almost but not yet covered by taxes (1992) and interests formally paid to keep such a mass of credit at bay are larger than 5% in real terms. On the other hand, GNP will not grow until the year 2000 or so, as we are just at the trough of the Kondratiev cycle.

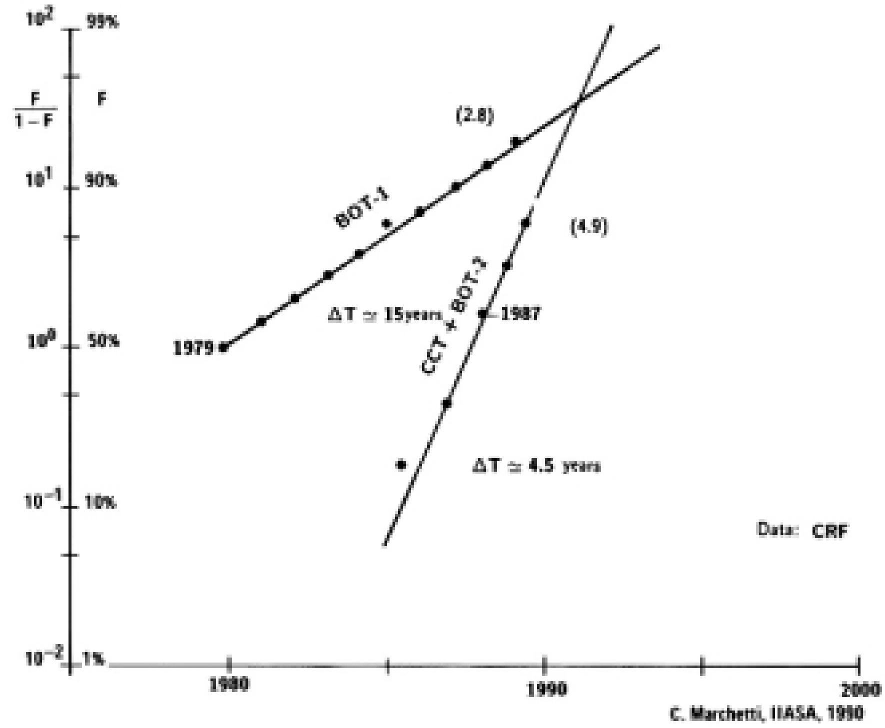


Fig.7–10. CRF: Government Bonds in deposit (1960–1968) (10^{12} lire '89)

The analysis of the bonds let in custody by the clients to the CRF, was done with the idea that they represent financial activities done by the same people that put deposits in the bank. So that a possible cause for the *escamotage* could be seen more microscopically. Also here money spent in bonds organizes in two pulses, but with different parameters for the first pulse and quite similar for the second. Bonds deposited by clients are more or less equivalent to their deposits in the CRF. Ratio of Government Bonds to bank deposits in general in Italy is almost a factor of two.

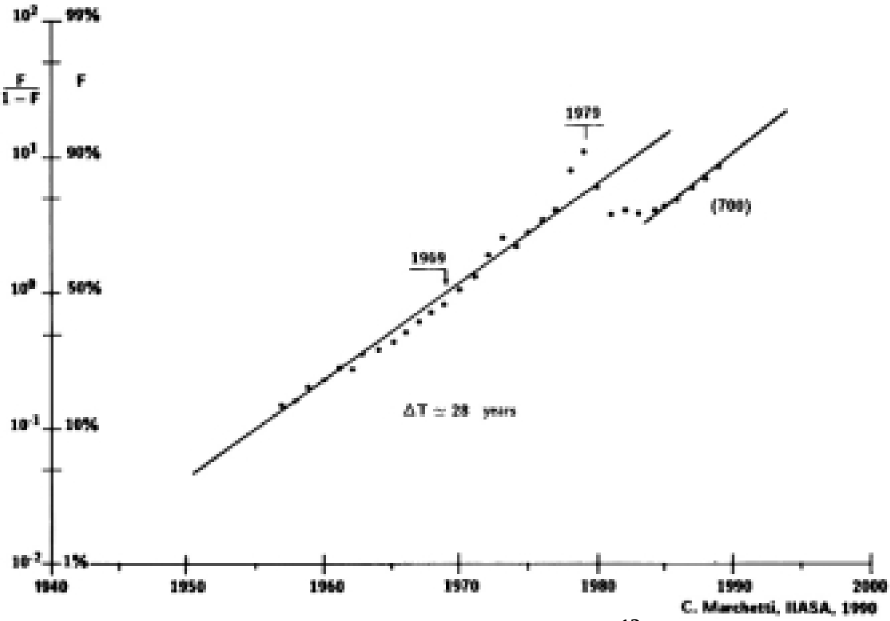


Fig.7–11. Italian Credit Institutes (1940–1995): Deposits (10^{12} lire '89)

After having zoomed at various classes of banks let us now look at the total Italian credit system. Also here the *escamotage* is evident and coincides with that of CRF. It is interesting to note that at saturation the system will contain 700 10^{12} lire '89, a relatively small sum if we compare it with the public debt that will reach 1200 10^{12} at saturation (practically attained in 1993) (Fig.7–10), with GNP reaching 1000 10^{12} lire '89 at saturation (it oscillates above that value at present).

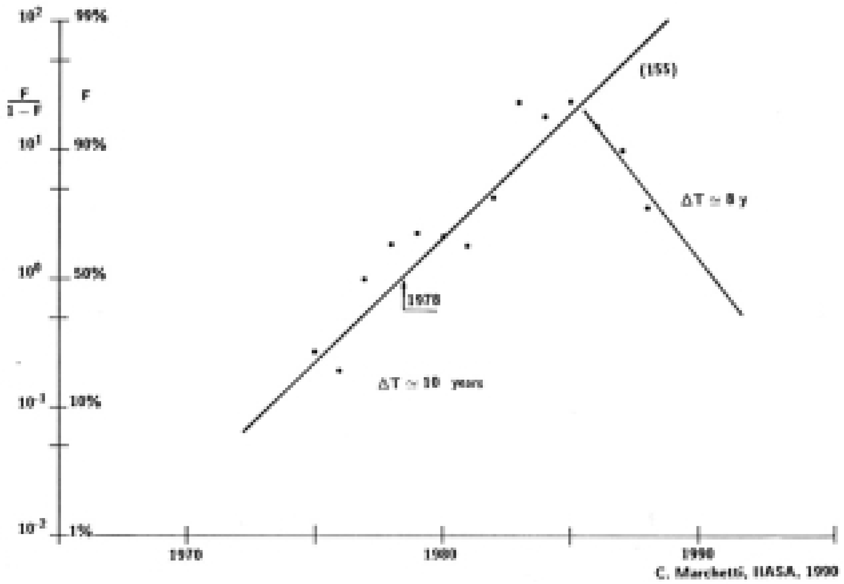


Fig.7–12. Italian Credit Institutes (1960–1988): Deposits in Governments Bonds (10^{12} lire '89)
Deposits in Government Bonds can be an easy way of running a bank or making an industry profitable, although in the general hydraulics of the system no real wealth is created. In the Italian system the operation carries a risk which can be more or less delayed. Looking at the sums invested in Government Bonds we see a fast growth to saturation in 1985, with 155 10^{12} lire '89 pegged on top. They constitute about 20% of the bank deposits. After 1985, however, we see a fast decrease in the amount of Government Bonds held. Projection of a logistic based on three points is not to be encouraged, but it looks as if for the end of the century the banks will have shed the load.

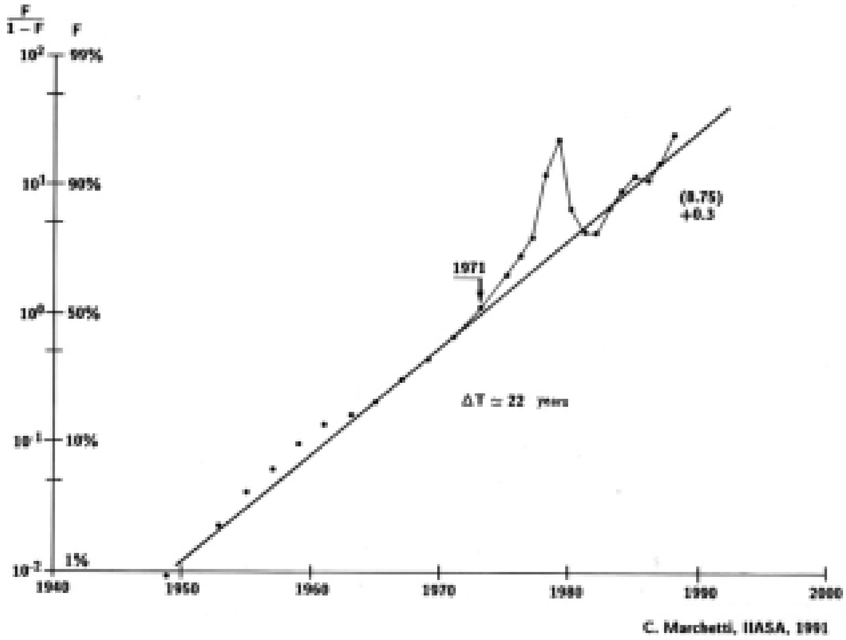


Fig.7–13. Cassa di Risparmio di Verona (1940–1995): Deposits (10^{12} lire '89)
The Cassa di Verona is interesting because by dimensions and structure it is fairly similar to that of Florence. The analysis of the deposits for this last cycle shows a jagged structure, with a strong deviation upward in the 70s. Again we have a peak in 1979, and a sudden fall in deposits in 1980–1981, *but no escamotage*. The central point is in 1971, a good fit with the cycle (1969). The time constant is somehow short and brings deposits to full saturation at the beginning of the 90s. The ratio of deposits between the present saturation and that of last cycle is about 30, a splendid growth, beating all other Casse. The 9 10^{12} lire '89 of deposits classifies the bank between the medium–large.

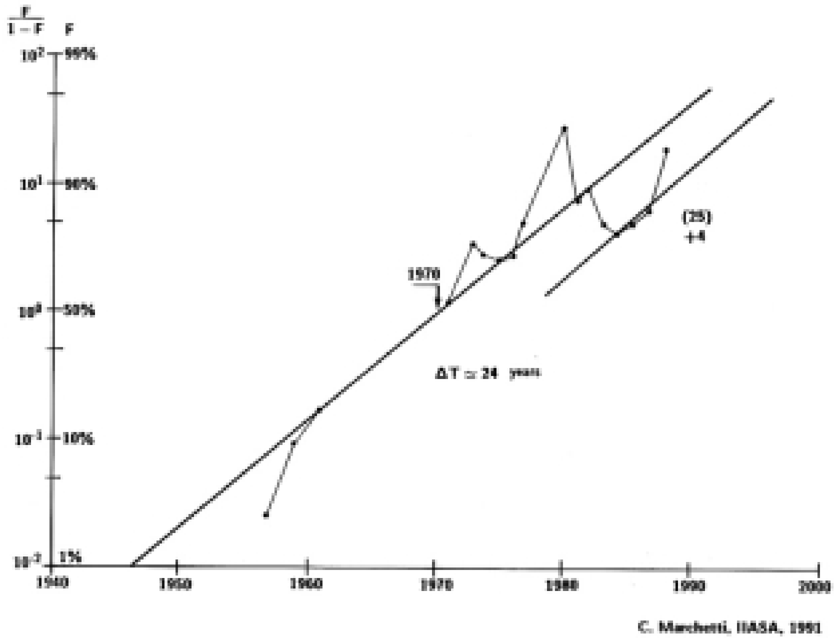


Fig.7–14. Cassa di Risparmio di Milano (Province Lombarde PPLL) (1940–1995): Deposits (10^{12} lire '89)

The Cassa di Risparmio delle Province Lombarde has always been number one in Italy, by prestige and dimensions. The analysis of deposits, however, gives a more articulated picture. The Cassa was late in resuming speed after the war and the deposits have been irregular (but upward during the 70s). In 1980 it got the fall and the *escamotage*, but it seems it might reabsorb it. The central point in 1970 and the time constant of 24 years place it snugly into the cycle. The ratio between deposits of saturation at the end of this cycle and of the previous one is a little above 7. The same ratio for Italian GNP is 5. The PPLL conquered ground, but not much, over these 55 years.

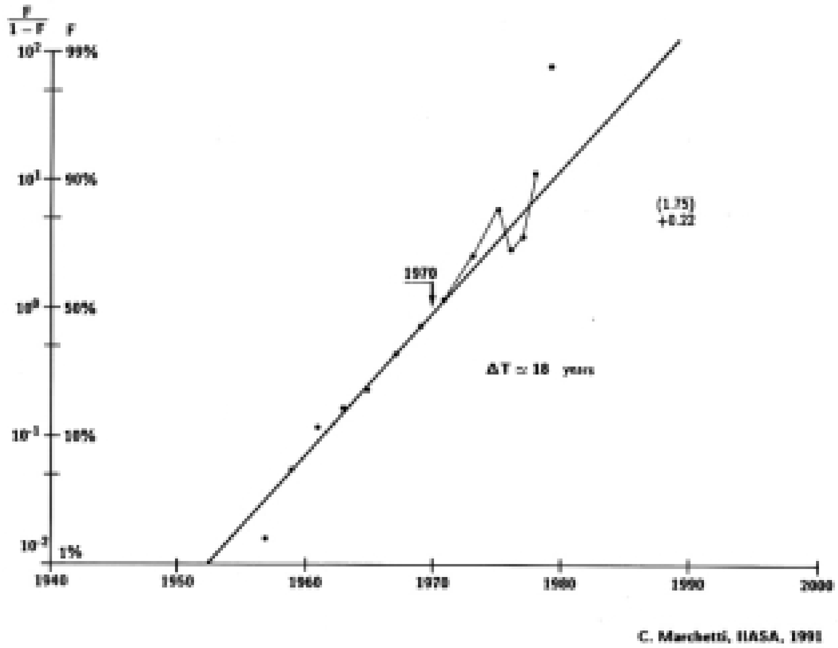


Fig.7–15. Cassa di Risparmio di Lucca (1940–1995): Deposits (10^{12} lire '89)

The evolution of the deposits of the Cassa di Lucca appears quite regular until 1970. Then a certain turbulence begins but there is no fall nor *escamotage*. The centerpoint in 1970 is normal, but the ΔT very short. It seems to have reached saturation. The ratio between the deposits at the end of this cycle and of the preceding one is good, about 9 (the same ratio for Italian GNP is 5), more or less like the CRF and the Italian Casse altogether.

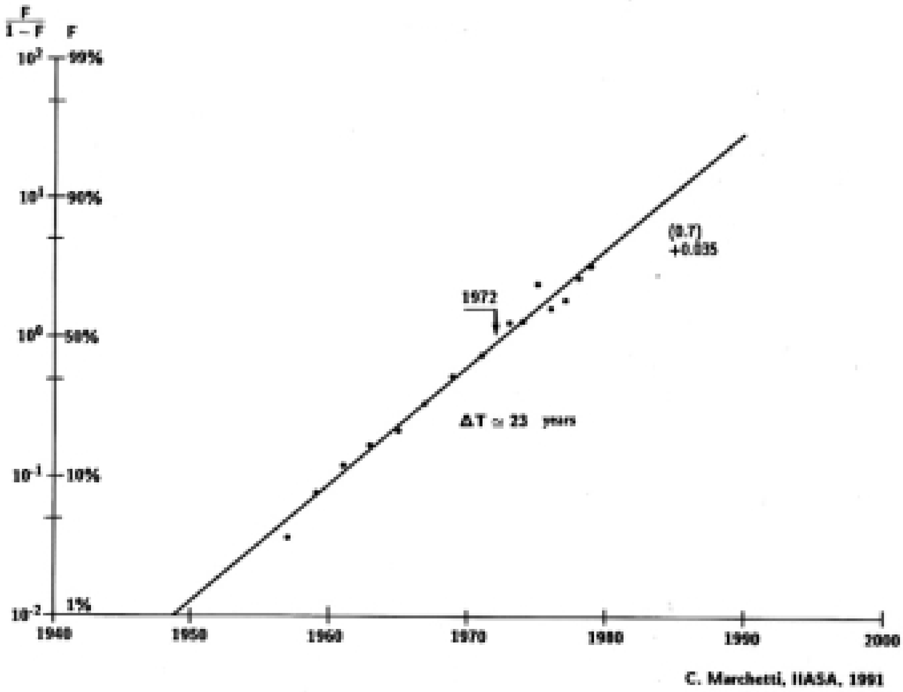


Fig.7–16. Cassa di Risparmio di Volterra (1940–1995): Deposits (10^{12} lire '89)
The Cassa di Risparmio di Volterra is about 40 times smaller, in terms of deposits, than the PPLL in Milano. The concept of Casse can obviously accommodate a large scale of viable sizes. The behavior of this Cassa, from a taxonomic point of view, is very orthodox. The centerpoint is correct, 1972 vs. 1969 for the cycle, the time constant slightly too short, presumably due to after–war rush, the ratio of 20 between the saturation levels at the end of the cycles is excellent, the double of the mean for the Casse and 4 times the ratio for GNP.

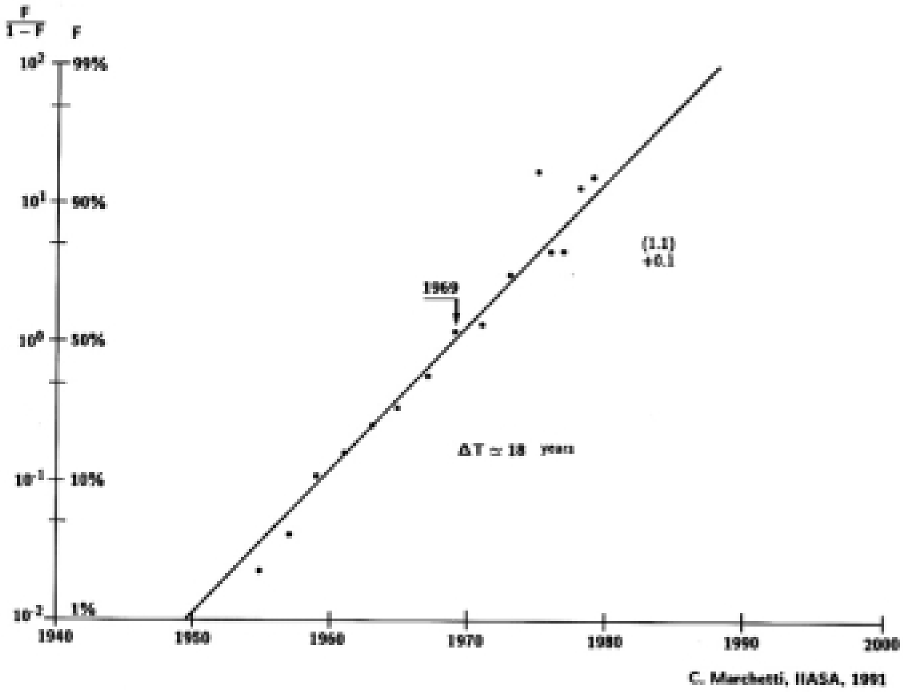


Fig.7–17. Cassa di Risparmio di Pisa (1940–1995): Deposits (10^{12} lire '89)
The regularity of the development of the deposits in this Cassa is remarkable. A certain excess of deposits at the end of the 70s has been reabsorbed, and no *escamotage* is present. The ΔT is very short, which brings saturation at the beginning of the '90s. The centerpoint in 1969 fits exactly the cycle.

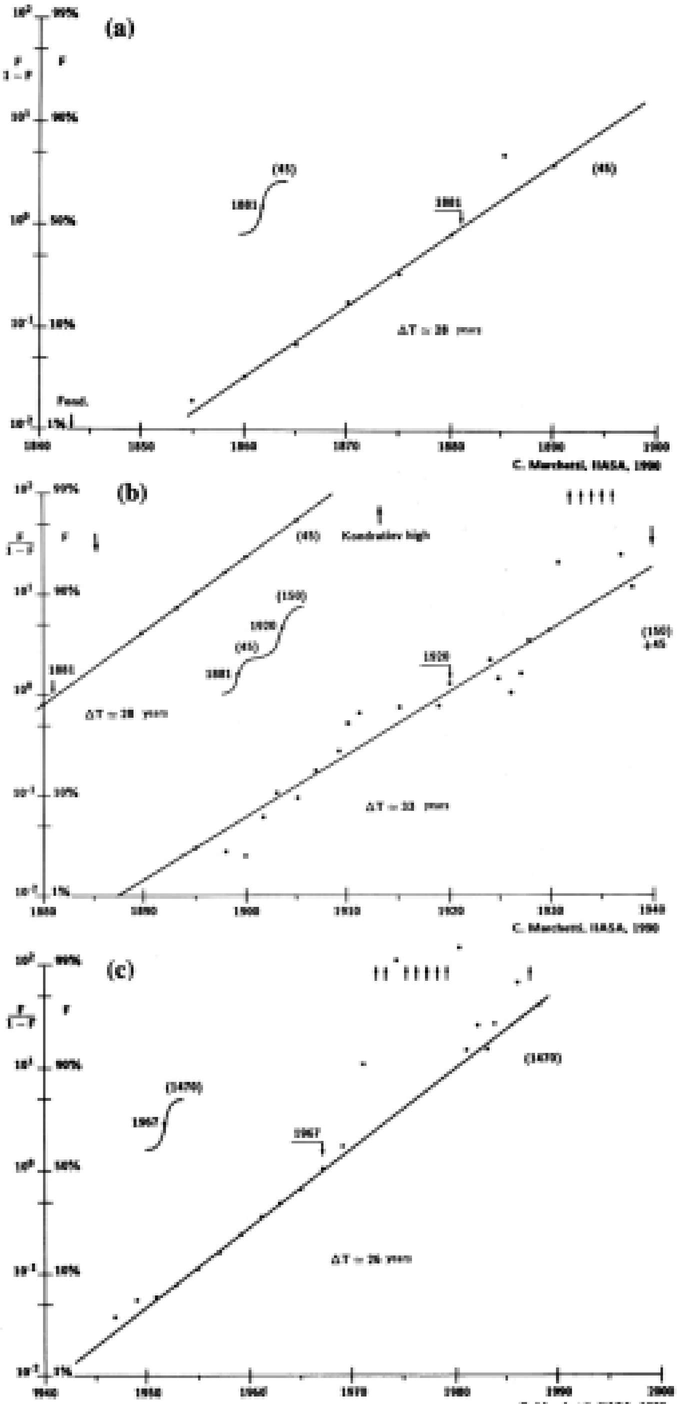


Fig.7–18a,b,c. Cassa di Risparmio di Asti (1830–1885): Deposits (10^9 lire '89)

Having data for this Cassa since its foundation, we made a life–long analysis of the deposits, like in the case of CRF. It may serve as comparison for the previous cycles. (1) For the first cycle the Cassa moved in convoy, with a centerpoint near the bottom of recession (1885), but a time constant correct for the fit in a cycle (it was, however, out of phase by 90^o). (2) For the second cycle, which is at the beginning superposed to the first, we have a centerpoint in 1920, with an out–of–phase of 20^o and a long ΔT of 33 years. Although jagged, this period does not resent of the big slump between the wars that hit most of the Casse (and the economy, by the way). (3) For the third cycle we have a perfect rephasing of the level of deposits with the cycle. The growth of a factor of 9 is in the norm with the Casse system. The overshooting of deposits in the 70s is very high, and there is no *escamotage*. Why a number of smaller Casse escaped might give a key to the interpretation of its mechanisms.

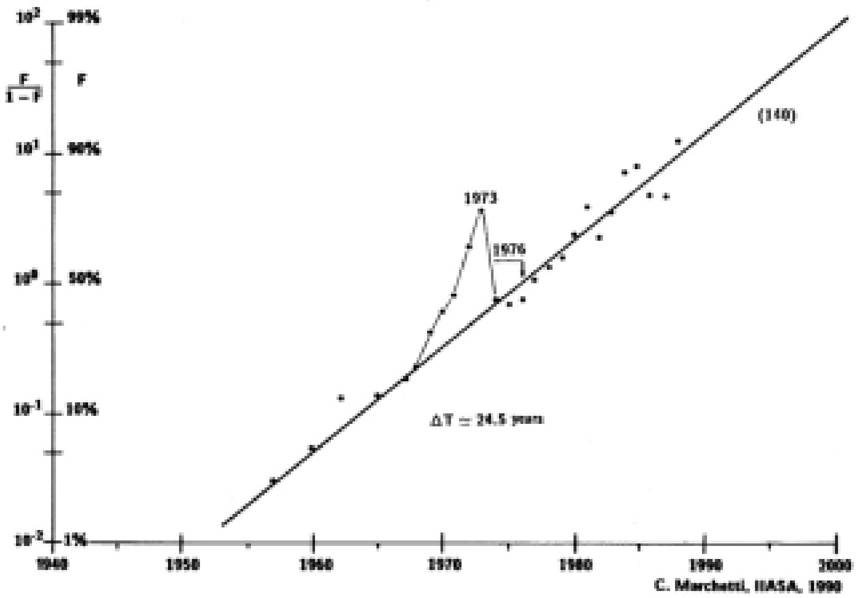


Fig.7–19. Italian Credit Institutions (1940–1995): Foreign deposits (10^{12} lire '89)
Italian banks do not have an international vocation, perhaps as a late reflex to the burns Italian banking had in the renaissance, when it was *the* international system. We see here the evolution of deposits (and papers) issued in foreign currencies. The growth of these deposits follows the orthodox lines. There is an upward deviation, between 1968 and 1974, completely reabsorbed and no sign of other deviations except for a high–level of noise, i.e., oscillation of the date around the trend line. The sum of 140 10^{12} lire '89 should be evaluated in relation to the 700 10^{12} lire '89 representing the total of deposits in the Italian banking system.

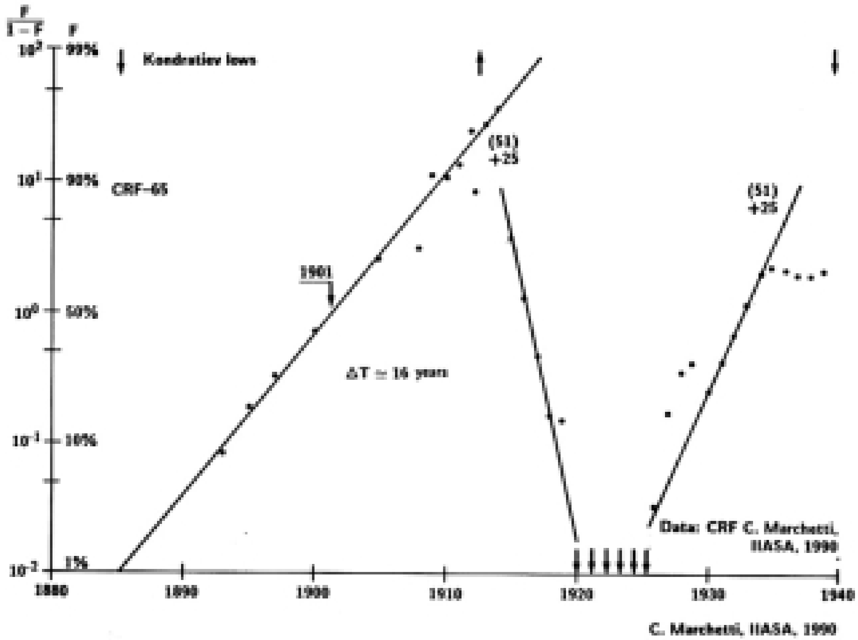


Fig.7–20. Cassa di Risparmio di Firenze (1885–1940): Reserves (10^9 lire '89)
As we have said at various points, the fractality of the system permits zooming into details, or raise to generalities keeping the same model. Here we analyze the evolution of *reserves* for CRF in constant money, for the last cycle. These reserves move along a very curious course, growing to saturation at the top of the cycle (1913), then disappear with the war and start resuming speed at the end of the 20s. The saturation point at the end of the previous cycle (1883) was 25 10^9 lire '89. The 51 10^9 lire '89 that we calculated for the first go, was kept also for the second, after the almost complete loss of the reserves. However, the fitting procedure is not yet sufficiently sophisticated to take care of such perturbated cases.

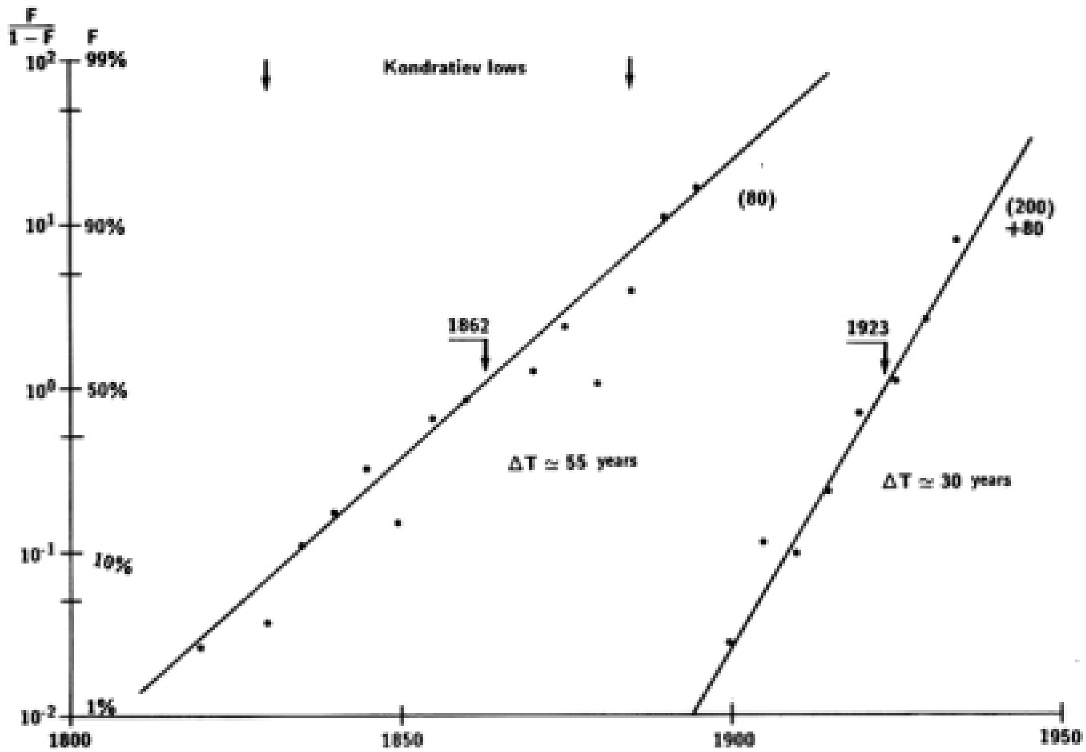


Fig.7–21. Cassa di Risparmio di Firenze (1830–1940): Savings Books (.000)
The dynamics of the number of clients is a good indicator of the penetration of the idea into the social web, and a measure of its success. We took here the number of savings books as an indicator of the number of clients. The first wave is centered in 1862 in tune withy the cycle, but with a very long time constant, meaning this wave spreads its tail over two Kondratievs. The oscillations are strong with two falls in number around 1850 and 1870, when the capital left for Rome. The analysis provides hints, however, but not explanations. The second wave of growth has the right ΔT for being incorporated in a cycle, but a centerpoint displaced forward by 10 years by respect to the cycle.

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