

# Statistics and Politics in a “Knowledge Society”

## *Statistica e Politica in una “Società della Conoscenza”*

Enrico Giovannini

Chief Statistician, Organisation for Economic Co-operation and Development  
2, Rue André-Pascal, 75016 – Paris (France), email: enrico.giovannini@oecd.org

**Riassunto:** In una “società della conoscenza” la relazione che si stabilisce tra statistica e decisioni assume una importanza fondamentale non solo per lo sviluppo economico e sociale, ma anche per la vita stessa delle società democratiche. I modelli teorici sul funzionamento dei mercati e sul rapporto tra elettori e politici rendono evidente il ruolo che l’informazione svolge nella scelta dei punti di equilibrio. D’altra parte, informazione non significa necessariamente conoscenza. Il paper analizza la relazione che si stabilisce tra statistica, conoscenza e politica, identificando opportunità per accrescere la funzione sociale della statistica.

**Keywords:** democracy, economic theory, statistics, policy.

### 1. Introduction\*

The importance of information in economic and political processes is widely recognised by modern theories. This information, coupled with the advancements in Information and Communication Technologies (ICT) has changed the way in which markets and societies work. The availability of the Internet and other advanced forms of media have made information more accessible to citizens than ever before. Therefore, the ideal of the “fully informed decision maker” should be a reality. Unfortunately, this is far from the case. As Einstein put it, “information is not knowledge” and although citizens are bombarded by information on a constant basis, this bombardment does not necessarily bring about knowledge.

Several studies have analysed the characteristics of the knowledge society, as well as its impact on the production of “official” statistics. In this paper we will not enter into this debate, but we will try to analyse the role of statistics in building a knowledge society and improving the democratic control of policy makers. The paper is organised as follows: in the next section we analyse the relationships between information, expectations and economic theory, highlighting how the latter has emphasised the role of asymmetric information to explain the behaviour of economic agents. In the third section the euro changeover will be discussed to show the problems that can arise when a country does not trust official statistics. In the fourth section the nexus between information and political sciences will be discussed, while the fifth section is devoted to show how indicators can be useful to improve democratic processes. Various approaches to the measurement of societal progress and the role of “key indicators” in this respect are analysed in the sixth and seventh sections. Some concluding remarks will follow.

---

\* The author would like to thank T. Manfredi and E. Matthews of the Statistics Directorate of the OECD for their help in preparing this paper.

## 2. Information, Expectations and Economic Theory

The relationship between information and economic theory was first analysed by neoclassical economists. In the context of Walrasian equilibrium, economic agents are supposed to not only act in a perfectly rational way, but to also be fully *informed* about relevant economic facts, such as the quality of goods, prices, etc. This assumption has been criticised by more recent theories and models. In particular, since Nash and others developed “Games Theory”, economics has changed quite a bit. The introduction of asymmetric and incomplete information in economic models stimulated new approaches in microeconomic, macroeconomic and public economic analyses. In short, the neoclassical point of view, in which all that is needed for functioning markets and the achievement of social welfare is the presence of a price system, a government that supplies public goods and makes contracts enforceable, is now considered unsustainable.

For example, Akerlof (1970), studying the market for car “lemons” (i.e. the market in which the seller has private information about the quality of goods supplied, while the buyer has not) demonstrated that, in such a situation, the buyers have to make an expectation on the quality of the car and that, in equilibrium, only bad quality cars are sold. A few years later, Rothschild and Stiglitz (1976) applied this approach to insurance markets and the key common conclusion of these studies is that, under certain assumptions, a bad allocation of information could lead markets to failure.

To be more precise, we can have two different types of asymmetric information between two economic agents. The first is the so called “hidden action” situation. One person, called the “principle”, cannot control (at a sustainable cost) all the actions that another person, called “agent”, has to make to achieve the goals contracted with the principle. The utility of the principle depends on the results achieved by the agent, who has, however, an informative advantage, in the sense that his actions are not fully controllable by the principle. This situation is described in economic literature as the “moral hazard” problem. In equilibrium, to make sure that the agent will act as the principle wants, the latter must offer incentives to the agent, with a loss of social surplus due to the incentive scheme necessary to neutralize information asymmetry.

The second situation is the so called “hidden information” condition. In this case the principle has more limited information about some characteristics of the agent while contracting with him. For example, a potential employee is sure about his attitude on work and his productivity before starting a job, while the employer cannot observe them *ex ante*. To select the best candidate for a job the employer should propose two distinct contracts with a different mix of fixed pay and incentive schemes, asking the agent to choose among them. In this way the agent reveals indirectly the hidden information he possesses. In equilibrium this means that, in comparison with a world of perfect information, the principle has to pay an “information rent” to the agent. This “adverse selection” problem underlines the real nature of information: if the information is a private good, its owner benefits from an “extra-profit” and the amount of information disseminated is minimised.

These two examples can be seen as special cases of a more general theory, developed by J. Nash, concerning situations generated by a bargaining process with its own rules, where each agent maximizes his utility function and the information set is given. Nash argued that “the notion of an equilibrium point is the key ingredient in our theory. This notion yields a generalisation of the concept of the solution of a two-person zero-sum

game. It turns out that the set of equilibrium points of two-person zero-sum game is simply the set of all opposing good strategies” (Nash, 1951). According to his definition, an equilibrium point (since then called Nash-equilibrium and considered a fundamental tool to determine social consequences of conflicting private interests) is a profile of strategies in which each agent’s strategy is the best response to the strategy of the others. In this situation, the role of the information set available to various players is crucial. In particular, Nash assumed that, if one player is better informed about a game’s characteristics and tries to take advantage of it, the other player should rationally take into account this possibility. Therefore, in equilibrium, only a strategic profile incentive-compatible with the information set would dominate.

Information also plays a key role in the formation of expectations. When economic decisions are to be taken under uncertain conditions, expectations on future or uncertain events must be formulated, especially on events that are not completely under the control of the decision maker. In a very general sense, an expectation can be seen as a value coming from the joint probability distribution of the variables concerning the decision process. As Lucas (1977) wrote, “at a purely formal level, we know that a rational agent must formulate a subjective joint probability distribution over all unknown random variables which impinge on his present and future market opportunities”<sup>1</sup>.

The problem here is that information is costly. Therefore, it is possible that, in practice, economic agents do not act as the theory predicts, for example by only looking at mean values or variance measures. In this case, simpler decision-making procedures (so called *naïve* procedures) can be used. For example, a “static expectation”, i.e. an expectation on the future value of the variable  $X_t$  can be calculated as:

$$X_t^e = X_{t-1}$$

where  $X_t^e$  is the expected value. This simple model can be improved by considering the past trend and not only one period past value:

$$X_t^e = X_{t-1} + \alpha (X_t - X_{t-1})$$

but what is clear is that in these *naïve* models the only relevant information set is based on the past history of the variable  $X_t$  and agents learn nothing from past errors.

This latter element is considered in the so called “adaptive expectations”, developed first by Cagan (1956) and Nerlove (1958). In this case we have the following model:

$$X_t^e = X_{t-1}^e + \lambda (X_{t-1} - X_{t-1}^e),$$

where  $(X_{t-1} - X_{t-1}^e)$  denotes the error term of past evaluating procedure, and  $\lambda$  is the coefficient of “error learning”. So, in an adaptive expectation model the decision-maker learns from the past and his choice is sensitive to changes in the past information set. The adaptive model can be considered a step-by-step judgment correction, by continuous approximations, from a “wrong” expectation to the “correct” one. If we consider  $E^e(X)=E(X/I_0)$  as the expected value of a variable constraint to start from the information set  $I_0$ , and then we move to another richer informative situation  $Z$ , then we

---

<sup>1</sup> For example, a decision maker can look at distributional moments of prices and output level, and choose his strategies maximising his utility function and minimizing the risk beneath uncertainty.

have  $E(X)=E(X/I_0Z)$ , where  $E(X)$  denotes the new expectation. From Bayes theory we know the latter could be written as:

$$E(X) = E^0(XZ) / E^0(Z) = E^0(X) E^0(Z/X) / E^0(Z)$$

This equation shows that the final probability is the normalised product of the starting probability  $E^0(X)$  to likelihood factor  $E^0(Z/X)$  and that the higher the likelihood value, the higher the knowledge of  $X$  validates  $Z$  information set. Therefore, learning from the past is a way by which the past information  $I_0$ , including past expectations, is enriched by new information set  $Z$ , containing the true value realised in the past.

This last consideration allows us to introduce the last model of expectations formation. Starting from the work of Muth (1961), “rational expectations” were introduced in economic theory by Lucas in the seventies. Muth considered adaptive process a way of wasting information, because not all relevant facts are taken into account in that kind of “step-by-step” process. The forecast based on the adaptive model is therefore suboptimal, due to the fact that individuals persist in systematic errors<sup>2</sup>.

In rational expectations models, expectations tend to equalise, for the same information set, the objective prediction of the theory. Therefore, the subjective probability distribution, on average, is equivalent to the objective one emerging from the econometric model that describes the expectations’ formation process, because a rational agent exploits all available information, including the model which describes the interaction among variables.

The most important policy applications of this approach were identified by Lucas (1975), who included the rational expectations hypothesis into macro-economic models. His starting point was the work of Modigliani and Grumberg (1954) who suggest that public predictions could support private ones, warranting their true values. In particular, they assume that a public prediction is published by a public authority, or by a private agent with a better information position. The consequence of this distinction is that the response of individual agents to the publication of a public prediction may actually increase their predictive abilities. If individuals react to the public prediction, the event which will actually occur will be different from the one which would have occurred if no public prediction had been made. The authors also show that the assumption necessary to enforce public predictive warranty for individuals is that the forecaster includes in his model all variables relevant for the formation of agents’ expectations.

According to Lucas, if agents act in a rational way, a policy maker could not make a correct prediction of the impact of a specific decision using an econometric model based on the past economic structure without considering how the agents react to the new policy decision. In fact, agents will internalise the new policy decision in their models and will change their behaviours, therefore, making the models based on the latter totally obsolete. The inclusion of rational expectations into macroeconomic models produces very important results. For example, expectations on price level are:

$$P_t^e = E(P_t / I_{t-1})$$

i.e. as the expectation based on the information set available at time  $t-1$ . This hypothesis does not imply the absence of predictive error, but that economic agents take into account all available information, including past errors, to formulate the best possible

<sup>2</sup> As Friedman (1962) wrote, “individuals are not fools – or at least some of them are not”

expectation. Of course, this is less strong than perfect foresight assumption ( $P_t^e = P_t$ ), because what is null is not the difference between expected and actual values, but only the expected value of the forecast error at time  $t$ , constraint to the information set in  $t-1$ . For example, in Natural Rate of Unemployment models, agents are seen as “islands” in the sea of economy, every one knowing the actual price prevailing in his specific market, but not the actual average of all prices. Therefore, when an agent observes a change in his own market price, he cannot exactly determine if this change is associated with a change in relative prices or simply with a change in the general level of prices. What the agent has to do is to estimate the latter optimising the available information set. In this way, the aggregate supply curve is:

$$Y_t = \hat{Y}_t + \theta\gamma (P_t - P_t^e),$$

where  $Y_t$  is the output,  $\hat{Y}_t$  is its “natural trend” value and  $(P_t - P_t^e)$  is the predictive error on the general level of prices. Parameter  $\gamma$  is the output elasticity to prices, which is supposed to be quite stable through time, while parameter  $\theta$  measures the degree of persuasion of the agents to the fact that the variation of the demand is related to the good they supply instead to the whole economy.

According to Lucas, parameter  $\theta$  is not constant over time (“variance hypothesis”), but it is a negative function of the variation of the general level of prices, i.e. of the volatility of the aggregate demand. The more prices are volatile, the more the operators tend to ascribe it to variations on the aggregate demand, instead of guessing a change in relative price. Therefore, policies that try to exploit the trade-off between inflation and unemployment are not sustainable in the long run, because they make vain the “surprise effect” necessary to influence the value of real variables. In this case the parameter  $\theta$  tends to zero, making economic policy ineffective to stimulate output growth.

This approach lead to important recommendations for economic policies<sup>3</sup>, but the Lucas model also provides an important conclusion about the role of official statistics, which, of course, are integral part of the information set available to all agents: if there is “confusion” among economic agents about the “true” price level, both for specific products and for the whole basket of goods and services, this can bring about suboptimal decisions and produce macroeconomic effects, at least in the short run. More generally, if economic agents are confused in correctly evaluating price prevailing in existing markets or the average level of prices because they do not trust available statistics, the economic system can suffer because of this uncertainty. This connection between the credibility of official statistics and the functioning of economic markets is extremely important in modern societies, where media play a key role in influencing public opinion and expectations about future economic developments.

---

<sup>3</sup> First, economic policies cannot be based on traditional econometric models, but only on models that consider the reactions of the agents to policy changes. Second, policies based on fixed and announced “rules” are better than those based on discretionary interventions, because random choices could not be included in agents’ expectations, making econometric forecasts undetermined. Lucas then totally reverses the implications of Modigliani and Grumberg model, due to the fact that for him all agents have the same information set and the same knowledge of how expectations are formed.

### 3. A Case Study: the Euro Changeover

As described in the previous section, the cost of acquiring information beyond what can be observed in a specific market can push economic agents to make wrong decisions, at least in the short run. Statistics have been developed to go beyond what individuals can observe at a reasonable cost and nowadays statistics produced by public institutions according to high quality standards, developed in an impartial way, disseminated to all agents at the same time are considered a “public good”. Some international organisations have a role of watch-dog to verify that key statistics produced at national level are produced according to internationally agreed standards.

This is particularly true for economic statistics. The key role of economic statistics in influencing the functioning of markets is widely recognised and media daily inform the public about the evolution of economic indicators. There is a wide consensus that the importance of official statistics for the functioning of markets is higher than ever and that their production and dissemination contribute to the improvement of social welfare. However, this role cannot be taken for granted and the recent case of the euro changeover can be used to demonstrate *a contrario*, the impact on economic behaviours of a loss of confidence in official statistics.

As is well known, in 2002 citizens living in the twelve countries participating in the European Monetary Union commenced using euro banknotes and coins for their daily expenditures. After a few months, media reported cases of large increases in the prices of goods and services, well beyond official inflation estimates. The graph A describes, for the whole euro-area, trends of “perceived” and official inflation in the period 1991-2002. Actual inflation is measured by the Harmonised Index for Consumer Prices



(HICP), while the index of perceived inflation is calculated from results of qualitative surveys carried out under the auspices of the European Commission in 20,000 households<sup>4</sup>. As we can see, the index of perceived inflation fits quite well with the data

<sup>4</sup> The survey is conducted at a national level, and the data are aggregate using weights based on each country's share in total euro area private final consumption expenditure, at constant prices. Participants in the survey are asked the following question: “How do you think that consumer prices have developed over the last 12 months? They have: 1) risen a lot; 2) risen moderately; 3) risen slightly; 4)

of HICP until the beginning of 2001: from that date the perceived inflation has an increasing trend, particularly after January 2002, while HICP falls by one point.

In some European countries, especially in Italy, Germany, Netherlands and France, a considerable political discussion began, about the increasing “poverty” of citizens due to the changeover. Even if official statistics proved that the overall inflation was almost stable (albeit with large increases in some sectors and reductions in others) people began to talk of a “real” inflation around 20-30% and several consumers’ associations launched “consumption strikes”, to underline their protests for rising prices.

Since then, statisticians and economists have spent quite a bit of time analysing both the quality of existing methodologies used for calculating consumer prices indexes and to explain consumers’ behaviour and perceptions. There is no serious evidence that statistical methods that have been successfully used to measure inflation for the past twenty or so years suddenly failed. Moreover, there is no evidence that official data have been manipulated by national statistical bureaus for political reasons. However, something happened and we can see that in some European countries the mistrust in official statistics is now quoted by the media more than ever.

But what happened and why were official statisticians not able to convince citizens about the accuracy of official figures? Several explanations have been proposed. As the European Central Bank has pointed out, the most plausible explanation for the high levels of perceived inflation is that consumers attach great importance to price developments in the goods and services they buy more frequently - for instance, prices of petrol, fresh foods and restaurant services have all been affected by various shocks. If the citizens more affected by these shocks are those with lower incomes, and if they have been more vocal than the others, this could explain differences between perceived and actual inflation. What is clear, at least for the Italian case, is that after the changeover there was a significant change in income distribution, in favour of entrepreneurs working in the services sector and of the richer segment of the population. Beyond the debate on the “true” inflation rate, it is important to note the strange relationship observed between “perceived” and expected inflation after 2002. The figure B shows perceived inflation against expected inflation over the following twelve months, measured from the same consumers’ opinion survey. The difference between the two lines shows that price expectations were not affected by the greater perceptions on actual inflation: this means that the price shock was seen as transitory and that expectations were more coherent with “official” inflation than with the perceived one.

In terms of possible macroeconomic impact of the mistrust in official statistics one could argue that, if inflation rates are perceived as being higher than they actually are, real wage developments and, therefore, purchasing power are being underestimated by consumers. This may have negative consequences on consumption. Therefore, it cannot be excluded that the slow dynamic observed in private consumption after the changeover can be, at least partly, explained by high levels of perceived inflation.

The “changeover effect” on the real rate of consumption and production could be interpreted using the Lucas model of “islands”. As we have seen, in such a model an economic agent is viewed as an island, in the sense that he knows only the price in his market, but cannot discern if a rise in the price is due to a general shock in aggregate

---

stayed about the same; 5) fallen. The results are summarized in the form of a “weighted balance” computed as a weighted difference among proportion of respondents opting for the different response categories. Indicating with  $S_i$  (for  $i = 1, 2, 3, 4$  and 5) the proportions of the five responses, the balance is calculated as  $[S_1 + \frac{1}{2} S_2] - [S_5 + \frac{1}{2} S_4]$ .

demand or to a shock on the relative price in his market. If a consumer is shown a price that in real terms is not changing, but perceives a high level of inflation in terms of the general level of prices, he would likely estimate his purchasing power to fall. So, a decrease in consumption will occur as a result of a nominal shock (the change in currency), which in turn produces a real loss of consumption.

#### **4. Information and Political Sciences**

Information plays a great role not only in modern micro and macro-economic models, but also in “public choice” models, in the so called “positive political theory”, based on rational choice modelling and on analytical conclusions reached by the economic theory. Downs (1957) first introduced rational models for the political choice of individuals, considering the election mechanism as a “market” in which politicians supply different political platforms which are demanded by voters, who have to decide whether and how to vote. To do that, the generic voter estimates a “party differential”, i.e. the difference between the expected utility derived from the choice between various (normally two) parties’ candidates. A voter whose differential between parties is non-zero subsequently takes into consideration the cost of voting: to vote, the cost of voting must be lower than the “discounted utility” of voting, calculated using the likelihood that his vote will make a difference in the election.

What is extremely important here is that one of the components of the voting cost is the cost of collecting information: acquiring information about candidates and policies can be very expensive and the value derived from this search must be discounted by the fact that the individual has little impact on the final outcome of the elections. Thus, the citizen is viewed as a “rational ignorant” and the obvious impact of missing or limited information on political issues is that the percentage of informed voters in elections could be very little - not a good thing for democracy.

Downs’ conclusions are not only important to understand individuals’ behaviour, but also to evaluate the nature of political outcomes in a democracy. Hotelling (1929) had already demonstrated that two political parties competing for the votes of citizens, whose preferences were spaced along a one dimensional policy space, will converge on the median voter’s ideal point. Building on this, Downs observes that a large measure of ideological consensus is necessary for a stable and effective two-party democracy, because a lack of information could encourage several parties to take up positions favoured by large clumps of voters, resulting in political instability.

Wittman (1973) better specifies this process, considering the fact that voters cannot perfectly monitor and sanction candidates, so the ability of politicians to adapt their own preferences in response to the voters’ seems to be a negative function of the voter’s awareness. Alesina (1988) argues that convergence between parties’ electoral programmes depends on their ability to commit to campaign platforms, which may depend on the presence of indicators that permit citizens to hold politicians accountable for their campaign promises. Once they are elected, in the absence of indicators to monitor if their actions coincide with their campaign platform, parties’ commitments during the campaign can be totally ignored afterwards.

McKelvey and Ordeshook (1986a, 1986b) show that the presence of some uninformed voters does not change equilibrium behaviour. When voters are totally uninformed, the democratic process ensures equilibrium as if they were totally informed, in the sense

that median voter behaviour will emerge from elections even with limited information sets. This could suggest that the democratic mechanism is a way to minimise information costs, in the same way that the perfect market does. As an economic agent only needs to know the prices of goods he wants to consume or produce, a democratic voter only needs to know the candidates and the election mechanism<sup>5</sup>.

The case of incomplete information leads to the introduction of the principle-agent theory into the political process. Political elections are seen as incomplete contracts between a principle less informed (the voter) and an agent (the politician) who has to achieve the principal's goals in an incomplete information structure. If a representative democracy is a form of state in which people have the control of government choice, through elections voters have the opportunity to achieve four major objectives: aggregate their personal preferences, making clear to politicians their welfare function; aggregate dispersed information about the correct political decisions; solve an adverse selection problem by selecting the best candidates; mitigate moral hazard problems by holding elected officials accountable for their actions.

The major problem is that, contrary to the principle-agent link in a market, the principle does not have a proper indicator at a reasonable cost (such as price), that can drive the politician's actions. The most politicians can commit is an input (public expenditure, tax rates, etc.), not an output (economic growth, low inflation, etc.), a programme not a result. They can commit themselves on variables they control, but the promised results depend on the reliability of the commitment and the solidity of the theory used to identify instruments and evaluate expected results<sup>6</sup>: for example, in 1994, Italian citizens believed to the promise done by one of the candidates to the political premiership to create one million of new jobs and this belief largely contributed to the recovery of consumers' confidence observed after the latter won the elections, which in turn had some influence on consumption expenditure.

The sticks and carrots (i.e. the sanction of no re-election, the premium of being re-elected) mechanism only works if there is a proper measure of outputs/outcomes delivered by a certain policy. Of course, information plays a great role in this process: in fact, in a world of costly information, rational citizens will spend more time informing themselves about their own private purchases than about public policies, for which their efforts will have little effect. Therefore, voters, like shareholders of a large firm, face the difficult task of monitoring the activities of large hierarchies staffed by people who have information and expertise that is unavailable to the average voter<sup>7</sup>.

---

<sup>5</sup> This consideration comes out from Condorcet theorem, demonstrated in the 18<sup>th</sup> century. Condorcet assumed a group of voters facing a binary judgment problem, such as: he is accused - is he innocent or guilty? Each voter is supposed to be correct with a probability of  $p \geq 50\%$ . Assuming that the voting mechanism is the majority rule and that voters vote *independently* (i.e. without being informed of others' ballots), then a majority will be correct with a probability greater than  $p$ , and the probability that the majority is correct approaches 100% as the size of the group tends to infinite. Judgment accuracy is improved merely by using majority rule. The most critical hypothesis here is that voters vote independently: however it is clear that someone votes together with positive correlation, and this correlation is a positive function of information lacks. In this case majority rule out-performs the average individual judgment as long as this correlation is low. But if public information is not available for all voters, probably the less informed voters will follow opinion leaders, or public polls, or eventually will not vote at all, with a clear degradation in the democratic process.

<sup>6</sup> If the theory (i.e. the process through which political inputs generate outputs/outcomes) is weak, there will be incredulity about the results that are supposed to be provided.

<sup>7</sup> A similar relationship exists between politicians and bureaucrats (see Niskanen, 1971 and Holmstrom, 1979).

## 5. Indicators and Democratic Processes

If elections are seen as a particular kind of contract, where voters delegate their inner power of choice because it would be too costly for them to take care of all the decision-making processes involved in complex political structures, specialisation allows for the maximisation of efficiency. In political organisations politicians specialise in offering the service of policy making, through collecting information and making decisions needed to “produce” the best services possible. In this delegation mechanism information flows in two directions, from voters to elected politicians and vice-versa: politicians use elections as a way to gather individual preferences in a social welfare function, trying to maximise it to be re-elected in the future; voters observe political outputs/outcomes and decide if their objectives have been achieved, re-electing the good politicians or changing their preferences.

However, voters are in a weaker position, because at the beginning of the process they cannot discriminate between good and bad politicians, especially in a majority system of elections, where political platforms are very similar. Moreover, when elections have taken place, politicians use their information advantage to maximise their rent, without accomplishing the goals preferred by citizens.

In economic terms we have here both an “adverse selection” and a “moral hazard” mechanism. The first could be mitigated through a mechanism by which good politicians, through high-cost actions, do their best to demonstrate that they are superior to the relatively bad politicians in terms of better achieving citizens’ goals. The second, instead, could be addressed with an incentive mechanism, by which the politicians who do not attain voters’ goals are punished with no re-election. To do this at least one performance indicator is needed to evaluate if voters’ goals have been reached. Of course, voters should be able to constantly monitor such an indicator.

Swank and Visser (2003) have analysed the role of information both in the political process and in elections. As already mentioned, one of the functions of elections is to provide incentives to office holders to act in the preferences of citizens. The threat of losing office discourages incumbent politicians to abuse their power and encourages them to take appropriate action in favour of voters’ priorities, but in most cases voters cannot evaluate the effect of policy decisions, also because policy-makers usually face complicated, multi-faceted problems (unemployment, poverty, crime, etc.).

To address these problems politicians normally act following a multi-step process (design alternative projects, hire experts to investigate and predict consequences, select a project and implement it) about which voters have only limited information. At best, they can observe outputs/outcomes, but for many political actions voters are not able to evaluate their consequences, especially if they only become fully visible in the long run. Modelling this situation in game-form, Swank and Visser consider a representative voter, who derives his utility from specific implemented projects. His preferences are described by the following utility function:

$$E [\sum \delta^t X_t (p + \mu_t)]$$

where  $E$  is the expectations operator,  $t$  is time,  $\delta$  the discount factor,  $X_t$  is a variable with  $X_t = 1$  when a new project is implemented and  $X_t = 0$  when the *status quo* is maintained,

$p$  is the expected net benefit of the project and  $\mu_t$  is a stochastic term, uniformly distributed over  $[-h, h]$ , with  $h > |p|$ <sup>8</sup>.

The incumbent politician has the responsibility of three distinct actions:

- his first decision is whether to design a project ( $D_t = 1$ ) or not ( $D_t = 0$ ). The cost of designing is  $C \geq 0$ .
- The second decision is whether to examine the benefits of a project ( $B_t = 1$ ) or not ( $B_t = 0$ ). The cost of examination is  $W > 0$  and it could be viewed as the effort a politician needs to understand the project's quality<sup>9</sup>. By paying  $W$  the incumbent, *but not* the voter, knows the value  $\mu_t$ .
- Finally if the project has been designed, the incumbent has to decide whether or not to implement the project<sup>10</sup>.

His pay-off is therefore

$$E [\sum \delta^t (\lambda - D_t C - B_t W) + \phi X_t (p + \mu_t)].$$

According to this function, the incumbent cares about social welfare and the weight  $\phi < 1$  represents the degree to which he internalises the effects of project implementation on citizens. He also cares about personal rents, captured by the value  $\lambda$ , which could be seen as “ego rents”, as monetary remuneration plays a limited role in motivating a politician.

The information asymmetry is due to the fact that only the incumbent politician can observe the value of the stochastic term  $\mu_t$ , by paying  $W$  to the examining office. The voter, instead, can only observe  $(p + \mu_t)$  with probability  $\alpha$ , while with probability  $(1 - \alpha)$  he ignores the outcomes of the implemented projects. At the elections he just knows whether a project has been implemented or not, but he does not observe if a project has been examined or not.

Analysing various alternatives, the main findings can be summarised as follows:

- a higher probability of observing the policy outcomes narrows welfare losses needed to give the right incentives to the incumbent politicians for examining projects and enlarges the range of examined policies. This suggests that it is in the interest of the citizens to improve the likelihood of observation.
- Elections are not an appropriate “stick and carrots” mechanism to enforce an effective political process. Information, instead, plays the main role. As long as indicators about concrete actions and achieved results are a right measure of policy and properly publicised, they may help society to achieve better goals with less resources.

Referring to game theory, indicators about policies' outcomes allow for a shift from a game with incomplete information to one with complete (shared) information. Because voters do not have the actual information on the situation in which they are living, they are supposed to have ex-ante expectations on the kind of candidates put before them (or on elected politicians' behaviour) and assign a probability distribution to each “state of the world”.

In equilibrium (known in literature as Nash-Bayesian), the strategies chosen by each player are subjected to updates based on the new information available during the

<sup>8</sup> This implies that voter benefits from implementation depend on the value of  $\mu_t$ .

<sup>9</sup> Alternatively, one could think of  $W$  as the wage bill of a government department charged with the analysis of the project.

<sup>10</sup> Of course, he can implement the project also without examining it, i.e. without paying  $W$ .

strategic interaction. In this case, not only is each player in an uncertain situation, but he can even supply information to others in his own interest. For example, if the game is repeated (that is a realistic assumption, because of new elections), politicians can reveal private information on the state of their actions to increase their expected utility. Therefore, in this incomplete information environment, information is an endogenous variable for policy makers, but indicators shared among all participants could have an impact on the information structure of the game. Given a common information set, voters need only to choose the best action to maximise their expected utility, without being constrained by the update of the information set. Due to this consideration, the game changes into a complete information one: in the Nash-Bayesian equilibrium position a Pareto improvement would appear, because of the better definition of incentive constraints and the higher ability that the voter would have to influence the politician.

## **6. How to Measure the Progress of a Society?**

The results both of the economic and political models described above underline the importance that better information plays in increasing social welfare. Of course, to obtain this result, information needs to be turned into knowledge and concrete behaviour. If this happens, knowledge can improve the functioning of today's economies and societies, as well as the relationships between citizens and policy makers.

Information is assumed as a space of data (and related metadata) correctly structured and communicated. Knowledge, on the other hand, is a 0-1 affair: you either know something, or you do not. To reach this state of mind, each person has to process, distil, digest and internalise available information and transform it into an idea or principle, subsequently used to take decisions. Our society/economy is often defined as "knowledge" based, i.e. a system where knowledge has become the most important factor of production and the basic form of capital. Of course, information is produced as a pre-requisite for knowledge, but today we are "bombarded" and almost buried by such a great amount of data and information that it is difficult to focus our attention on the information we really need. Nowadays, attaining information can be done at a low cost but selecting the "right" information and turning it into knowledge comes at a rather high cost.

As we have seen, in the relationship between voters and politicians, especially with those who have been in charge of the government for a certain time, one of the key issues is to provide citizens with accurate information about the result of past policies (i.e. economic and social outcomes) or the expected results of the policies foreseen by the opposition before the elections. Of course, there are various ways to measure economic and social outcomes and it is quite common that the various parties participating in elections make reference to different data. Therefore, the question is: is it possible to have all parties agree on a "shared information set", i.e. a shared space of data and metadata referring to the overall progress of a nation, delivered to citizens and used by all parties involved in the policy debate? If such a data space existed, the political game would change from a game with imperfect information to one with perfect information, resulting in unprecedented improvements in social welfare. But what should the "data space" contain, how should it be defined and by whom?

The most commonly used indicator of economic performance is the Gross Domestic Product (GDP) growth, measured in both absolute and per-capita terms. However, as said above, collective decision making is a multi-dimensional process, with multiple objectives: if it were known that the GDP growth over several years was obtained through the disruption of the environment, large social inequalities, reduction in available assets, etc. citizens would probably punish the government responsible for these outcomes. This is just one example to demonstrate that, in modern societies, economic wealth is only one dimension of well-being and available literature shows that as a country reaches higher levels of income, the more it cares about other life satisfaction dimensions (leisure, environmental status, health, etc.).

Looking at the behaviour of OECD countries, it is quite clear that citizens want to reach a higher and sustainable level of well-being. In several countries, this aspiration has been turned into concrete policies: for example, more and more countries have designed their policies to achieve so-called “sustainable development” (SD), i.e. the capacity to satisfy the current generation’s needs without affecting the capacity of future generations to satisfy their needs<sup>11</sup>.

These developments have served as an impetus for national statistical authorities and other data providers to design new theoretical frameworks to measure the overall progress of a country, as well as to enlarge the coverage of statistics, mainly on social and environmental phenomena. Of course, the use of indicators is just one way to measure the overall progress (well-being) of a country. From a philosophical point of view, we can follow three different three ways of defining the “well-being”:

- the first, which can be thought of as “objective”, is based on the belief that judgments about correctness of behaviour, and therefore the good life, come from rational thought. It depends neither on the subjective experience of people nor on the fulfilment of their wishes;
- the second approach is based on the satisfaction of individual preferences. The assumption is that people, within the constraint of their available resources, select those things that most enhance the quality of their life;
- the third one, purely “subjective”, depends on the experience of individuals. If a person experiences her life as good and desirable, it is assumed to be so. In this approach factors such as feelings of joy, pleasure, contentment, and life satisfaction are paramount.

The OECD has recently published a review of various approaches to the measurement of well-being/progress. In a nutshell, the following approaches are envisaged:

- the extension of the basic national accounts schemes to cover social and environmental dimensions;

---

<sup>11</sup> For example, the initiative launched several years ago by the United Nations Commission for Sustainable Development to design a set of SD indicators has been complemented by similar attempts carried out by the OECD and, more recently, by the European Commission. These projects have a common aim to draw up lists of indicators able to inform policy makers and public opinion about changes in historical paths of economic, social and environmental phenomena. Moreover, proposals have been put forward to assess the overall sustainability of single countries’ positions and trends through the development of “composite indicators”. Similar attempts have been made by the United Nations Millennium Declaration, which identified precise goals for the improvement of economic, social and environmental conditions in developing countries, and by the European Union with the “Lisbon strategy”. In all these cases, statistical indicators have been developed to monitor the evolution towards the chosen goals and to reinforce evidence-based policy debates.

- the use of a wide range of indicators referring to economic, social and environmental dimensions. The use of composite indicators to summarise them in a single number is also possible;
- the use of “subjective” measures of well-being, life-satisfaction or happiness.

The first two approaches make reference to an “objective” way of defining the well-being, while the third is linked to the “subjective” one.

*The extension of national accounts* is, of course, a very attractive approach, but it requires a large investment, both in terms of data collected and of resources necessary to make them coherent. Notwithstanding the most recent developments (especially, the System of Environmental and Economic Accounts and Social Accounting Matrices), it still encounter theoretical and practical difficulties in expressing some aggregates in monetary terms, such as environmental resources. And while this approach may be very powerful analytically, for example to simulate economic, social and environmental effects of various policy alternatives and evaluate trade-offs, it is hard to see how such an approach could be used by citizens.

To provide an overview of the progress of a country that includes non-monetary aspects of well-being, *sets of indicators* have been developed in several countries. In recent years improvements in statistical systems have made possible the implementation of “key indicators” which involve economic, social and environmental goals. They are statistical measures that reflect people’s objective circumstances in a given cultural or geographic unit. The hallmark of these indicators is that they are based on objective, quantitative statistics rather than on individuals’ subjective perceptions of their social environment. As a result, it is very easy to make comparisons over time and/or countries, using them as “benchmarks”. On the other hand, key indicators can suffer from several weaknesses: first, they can provide a misleading view of certain phenomena (for example, it is known that rape incidents are underreported to the police and therefore crime indicators based on administrative data can be misleading). Second, looking at a multiplicity of indicators it is not easy to derive a synthetic view about the overall progress of a country (normally, some indicators improve, other worsen).

*Composite indicators* aggregate “sectoral” indicators using weights and aim to provide a comprehensive picture of a country, comparable over time and between countries. They allow the ranking of countries as well (very appreciated by the media), making it possible for the public to evaluate overall policy results. However, composite indicators suffer from important weaknesses and can be misleading for policy evaluations, pushing people to draw simplistic conclusions. For example, the construction of a composite indicator involves stages where judgments have to be made (especially concerning the weights structure, the selection of sub-indicators, the aggregation method, etc.), thus uncertainty and sensitivity analysis are needed to test the robustness of results, but this complicates their presentation to non experts (Giovannini et al., 2005). In addition, in order to be representative of society’s point of view, the choice of the weights structure cannot be delegated to statisticians or to politicians. Therefore, the use of composite indicators for measuring the overall progress is largely criticised.

Finally, *subjective indicators* are based on the assumption that well-being depends on the degree of utility that individuals perceive in their social environment, i.e. how people react to and experience the events and situations in their lives. Several studies recognise that there is little correlation between objective measures of well-being and subjective ones and this may be due to several factors: for example, people can adapt themselves to their living standards, or can adjust their cognitive attention and

expectations to external circumstances in ways that are advantageous for themselves. When the prospects of social comparison are not favourable individuals often rearrange their scale of satisfaction, redirecting their attention to tasks and situation that are better for them. This concept has to be underlined if subjective indicators are used in political processes: if they are “endogenous” they lack the necessary link to actual outcomes and politicians could be tempted to spend more resources to try to change citizens’ perceptions using propaganda rather than to change the social well-being itself.

## **7. The OECD World Forum “Statistics, Knowledge and Policy”**

As we have seen in the previous sections, reliable statistics are fundamental to modern democracies. Citizens, as well as politicians, need data on which to base their decisions. Every day, millions of individual and collective decisions are taken on the basis of statistics. Without a comprehensive and articulated knowledge-base founded on robust evidence and agreed by the various components of society, many of those decisions will inevitably be flawed. But in the “information age”, the availability of information can no longer automatically be equated with increased knowledge. Disinformation spreads rapidly via the Internet. Data based on shaky methodology can be quoted in public debate as “fact”. Even correct information can be incorrectly reported, resulting in what some in the trade call “mutant statistics”.

In the search for more reliable “common knowledge”, sets of indicators, rather than single composite indicators or subjective indicators, seem to be the best tool to support policy making systems and to allow citizens to make more informed decisions. In fact, they cover a wide area of political subjects (economy, environment, society, etc.), are not subject to the problem of establishing weights, can take into account the complexity of modern societies and the multiplicity of societal goals and can provide a manageable picture of a country’s overall performance. Of course, their quality will depend on the professionalism of the people that run them, in turn conditioned by the institutional arrangements under which they work and the resources available to them<sup>12</sup>. Moreover, the choice of “key indicators” has to be done in a very transparent way, involving statistical experts, civil society, subject-matter experts, media and policy makers. This is the approach followed by several OECD countries, where commissions are established by governments involving various components of the society to select the list of key indicators: once the selection is made, the statistical office is then put in charge of producing a periodic report, widely disseminated to citizens. From the available experiences it is clear that the strength of key indicators lies in their capability to address three fundamental issues: present a simplified, but reliable, view of society, contribute to a shared knowledge among citizens, and make politicians accountable for their actions.

One of the first countries involved in developing “key indicators” was Australia. In 2002, a publication of the Australian Bureau of Statistics (ABS) called “Measuring Australia’s Progress” presented a comprehensive framework for the measurement of

---

<sup>12</sup> Unfortunately, in several OECD countries, institutional and budget constraints are weakening the role of national statistics institutes and the quality of official statistics. In others, governments exercise pressures on statistical agencies, subjecting the release of important statistics to political control, or changing the national chief statistician when a new government is elected.

well-being and a rich set of key indicators. In ABS's view, progress is closely related to these three concepts:

- *well-being or welfare*, which is generally used to mean the condition of being well in life. It typically includes material, physical, social and spiritual aspects of life;
- *quality of life*, which is linked to well-being, but with the difference that here what is highlighted is the capability of society to respond to people's wants and needs;
- *sustainability*, which considers whether an activity or condition can be maintained indefinitely. It is mostly been used to describe the impact of human activities on environmental and social systems.

The domains of progress were chosen during initial phases of the project and after consulting government, civil society, experts, academics, business councils, community organisations and individuals. The choices were tested through several further rounds of consultation, to make the final selection taking into account of the full spectrum of views. External advisors were present in an expert reference group, comprised of academics, scientists, and the heads of two prominent civil society organisations, one who seek to combat poverty and inequality, and the other an independent public policy research institute. This suggests that the focal point was not the policy making process or international benchmarking, but primarily the expectations and opinions of citizens.

The Australian experience is just of the several initiatives that are underway in OECD countries and beyond. To analyse and compare them, the OECD organised in 2004 the first World Forum on Key Indicators "Statistics, Knowledge and Policy". The Forum, held in Palermo (Italy) and attended by over 540 participants from 43 countries (see [www.oecd.org/oecdworldforum](http://www.oecd.org/oecdworldforum)), confirmed that various approaches are possible to develop "key indicators" and that each country should choose the best approach taking into account differences in cultural and institutional environments.

Actually, the Palermo Forum was just one of initiatives taken by the OECD to foster the use of "key indicators" to analyse overall countries' performances. Extremely important in this respect has been the creation of the *OECD Factbook: Economic, Environmental and Social Statistics*. The *OECD Factbook* presents, in an integrated way, a carefully selected range of 150 indicators covering broad thematic areas: Population and migration, Macroeconomic trends, Economic globalisation, Energy, Prices, Labour market, Science and technology, Environment, Education, Public policies and Quality of life. In addition, every year, the *OECD Factbook* includes a special section focusing on a current "hot topic".

Each theme is covered by tables and graphs illustrating in a user-friendly manner trends over the past 10 years and the relative ranking of each of the 30 OECD member countries<sup>13</sup>. Alongside them, text gives definitions of the indicators used and comments on the extent of comparability of data from different national sources, thus enabling users to evaluate for themselves the relevance and value of specific data. Finally, the *OECD Factbook* guides readers to other OECD statistical and analytic publications which can assist them in their research and understanding. An online version of the *OECD Factbook* is also available (see [www.sourceoecd.org/factbook](http://www.sourceoecd.org/factbook)) where all data are accessible for free.

Data contained in the *Factbook* have also been used to prepare individual *Country Statistical Profiles* that have been made available in the new "country pages" developed in the OECD Web site. While the *Factbook* provides tables and charts organised by

---

<sup>13</sup> In the 2006 edition, released in March, data for large non-OECD countries (Brazil, China, India, Russian Federation and South Africa) are also included.

topic, *Country Statistical Profiles* present the same information by country, comparing the performance of each country with that of other countries using comparable data covering economic, social and environmental domains and produced according to international definitions and classifications. Both initiatives have been extremely successful. The paper version of the *Factbook* is already a best seller<sup>14</sup> and its web site is the most popular among the OECD “special” web sites.

## 8. Conclusions

The functioning of a modern democratic society needs a common knowledge base about its economic, social and environmental characteristics. The comparison of the evolution of these characteristics over time and *vis-à-vis* other nations can highlight risks and opportunities and inform the public debate about policy actions.

A strong demand for the statistical measurement of the progress of a society is emerging both from policy makers and the civil society. Various approaches can be used to provide this overall view of progress and the establishment of sets of key economic, social and environmental indicators seem to be the most feasible and useful approach, although there are inherent risks that should not be downplayed. One must keep in mind that indicators systems are subject to the Heisenberg’s principle which states “if you observe a system, you are modifying it”. This is especially true when the indicators are associated to targets or used for administrative purposes. In these cases, once a reference indicator is chosen, it is likely that policy makers will pay particular attention to it and take actions to improve the indicator, which may or may not actually ameliorate the actual situation that the indicator is supposed to measure<sup>15</sup>. Sometimes indicators distort reality because they are not technically sound or because they are based on inaccurate or incomplete information. Sometimes, the fault does not lie with the indicators but in their inappropriate use - because the message provided by them may be misinterpreted by the audience to which they are addressed. A superficial use of indicators may also bring about overconfidence on the precision of indicators. We know that statistics are subject to measurement errors and ex-post revision, so whereas this may often be unavoidable, such a risk should always be very clear in the minds of policy-makers and citizens.

Under these circumstances, statisticians face a considerable challenge in providing relevant and accurate data, maintain their independence from political powers, and communicate in an effective way statistical results to policy makers and citizens. The experience of some countries shows that institutional setups can be established to make official statistics a trustworthy source and key indicators systems a reference for decisions-makers. In this way, the accountability of public policies and the democratic

---

<sup>14</sup> The 2005 edition was published in English and French and then translated in German and Japanese, while the 2006 edition should also be translated in Spanish and Portuguese. In the first week after its release, the number of orders for the 2006 Factbook has been higher than that registered for the 2005 edition over the previous twelve months.

<sup>15</sup> For example, in United Kingdom some financial supports to hospitals are established using an indicator based on waiting-lists. Therefore, as the waiting-list indicator only takes into account waiting time spent within the walls of the hospital, some hospitals have built a tent outside of the hospital where patients are welcomed and requested to wait for the first visit.

control on politicians' decisions can be improved and statistics is put at the centre of the public debate.

Of course, the existence of a key indicators sets can be a necessary, but not a sufficient, condition for an improved democratic game and for a better informed citizenry. As seen above, acquiring and processing information, as to enrich the knowledge, is a costly process and OECD countries are characterised by very different levels of "statistical culture", both at policy level and among citizens. Statisticians, especially those in charge of producing "official" figures, have a special role to play in bringing statistics closer to citizens, not only through media, but also by fostering statistical culture. Over the last few years, statistical offices have invested quite a bit to improve their dissemination platforms, but not much has been done to improve their communication strategies<sup>16</sup>.

On the contrary, Non-Governmental-Organisations (NGOs) and some research institutes are doing a much better job of presenting statistical data and indicators to the lay public, although they do not have, by definition, the necessary political independence to be seen by the society as a credible source. Moreover, they have developed new communication channels (i.e. Internet blogs), that heavily influence a large part of the society, especially new generations. The information coming from NGOs is often considered more reliable to certain sectors of society than that which is provided by governments and official sources, including official statistics<sup>17</sup>.

If it is true, as several sociologists argue, that the society is changing its organisation in favour of NGOs and other similar institutions, and that official sources are not necessarily recognised as credible, then official statisticians must develop an intense dialogue with this emerging part of the society. Otherwise the objective of developing a "shared knowledge" based on statistics will remain just a dream.

More generally, statisticians must become more aware of their fundamental role for the development of democratic societies. If a society does not know where it stands, it is quite difficult to decide where to go and statisticians have a key role in helping policy makers, businesses and citizens to understand facts and design their future strategies. In an age of fast changes and new societal challenges the main role of statisticians is to develop "maps", as cartographers did over the past centuries, both for single countries/regions/communities and at the international level. In fact, globalisation is making the measurement and assessment of a country's overall progress an issue that requires statistical and analytical approaches that go beyond national borders.

The success of the first OECD World Forum on key indicators has confirmed the importance of these issues and convinced the OECD to establish an ongoing World Forum project built around a series of bi- or triennial world conferences. In particular, the mission of the OECD "*Statistics, Knowledge and Policy*" World Forum is to foster the development of sets of key economic, social and environmental indicators and their use to inform and promote evidence-based decision-making within and across the public, private and citizen sectors, at sub-national, national and international levels. The

---

<sup>16</sup> It was quite disappointing that at a 2005 meeting of Presidents and Directors-general of European statistical offices dedicated to "The challenge of communicating statistics" almost all papers were about the dissemination of official figures and not about communication.

<sup>17</sup> According to the New York Times, the blog managed by Beppe Grillo is one of the top ten blogs worldwide in terms of credibility and number of accesses. L. Brown, a famous ecologist and president of the EarthLink Institute recently reported that some time ago the Internet site of the Institute was put down for one week by the excessive number of hits, just because Beppe Grillo's blog had quoted it.

Forum is open to all sectors of society, building both on good practices and innovative research work, organised by the OECD in co-operation with national and international organisations. The second World Forum will take place in June 2007 in Istanbul and will be prepared through “regional” Forums in Latin America, Asia, Middle-East and Africa.

The Forum will seek to be perceived as credible, transparent and inclusive and will rely on the quality of statistical and analytical work carried out by the OECD and other organisations supporting the Forum. It will bring together a range of stakeholder groups who too often work in isolation of one another. The World Forum events will be true “knowledge experiences”, using innovative communication and visual tools, to engage people both inside and outside the conferences to increase their knowledge about the progress of different world regions and countries, and to interact through electronic means.

In this way, we hope to foster a global conversation about what progress actually means and bring statisticians at the centre of this discussion, which will not only benefit anyone seeking to measure progress at the sub-national or national level, but will also be an important contribution to the international conversation in the run up to 2015 when a replacement set of Millennium Development Goals will be introduced.

## References

- Australian Bureau of Statistics (2004) *Measuring Australia's Progress*.
- Akerlof, G. (1970) “The Market of Lemons: Qualitative Uncertainty and the Market Mechanism”, *Quarterly Journal of Economics*, 89, 488-500.
- Alesina, A. (1988) “Credibility and Policy Convergence in a Two-Party System with rational Voters”, *American Economic Review*, 78, 796-805.
- Cagan, P. (1956) “The Monetary Dynamics of Hyperinflation”, in (M. Friedman ed.) *Studies in the Quantity Theory of Money*, Chicago, 37-39.
- Downs, A. (1957) *An Economic Theory of Democracy*, Harper & Row, New York.
- Friedman, M. (1968) “The Role of Monetary Policy”, *The American Economic Review*, 58, 1-17.
- Grunberg, E. and Modigliani, F. (1954) “The Predictability of Social Events”, *The Journal of Political Economy*, 62, 465-478.
- Holmstrom, B. (1979) “Moral Hazard and Observability”, *Bell Journal of Economics*, 10, 74-91.
- Hotelling, H. (1929) “Stability in Competition”, *Economic Journal*, 39, 41-57.
- Lucas R.E. jr. (1975) “An Equilibrium Model of Business Cycle”, *The Journal of Political Economy*, 83, 1113-1144.
- Lucas R.E. jr. (1976) “Econometric Policy Evaluation: a Critique”, in Brunner, K., Meltzer, A.H., *The Philips curve and Labour Markets*, Carnegie-Rochester Conference Series on Public Policy, 1, 19-46.
- McKelvey, R. and Ordeshook, P. (1986a) “Sequential Elections with Limited Information: A Formal Analysis”, *Social Choice and Social Welfare*, 3, 199-211.
- McKelvey, R. and Ordeshook, P. (1986b) “Information and Elections: Retrospective Voting and Rational Expectations” in Ferejohn and Kuklinski *Information and Democratic Process*, Urbana of Illinois Press, Urbana 1990, 281-312.

- Muth, J.F. (1961) “Rational Expectations and the Theory of Price Movements” *Econometrica*, 29, 315-335.
- Giovannini, E., Hoffman S., Nardo, M., Saisana, M., Saltelli, A., Tarantola, A. (2005) “Handbook on Constructing Composite Indicators: Methodology and User Guide” *OECD Statistics working paper*, OECD.
- Nash J.F. (1951) “Non-cooperative Games”, *Annals of Mathematics*, 54, 89-295.
- Nerlove, M. (1958) “Adaptive Expectations and Cobweb Phenomena”, *Quarterly Journal of Economics*, 72.
- Niskanen, W. (1971) “Bureaucracy and Representative Government”, Atherton, Aldine.
- Rothschild, M. and Stiglitz, J. (1976) “Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information”, *Quarterly Journal of Economics*, 90, 629-649.
- Swank, O.H., Visser, B. (2003) “Do Elections Lead to Informed Public Decisions?”, *Tinbergen Institute Discussion Paper*.
- Wittman, D. (1973) “Parties as Utility Maximizers”, *American Political Science Review*, 67, 490-498.