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Expectations over durable assets: How to avoid the formation of value bubbles

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Abstract. There is a finite set of characteristics which can be present in a durable asset adding value to it, and that are not necessarily part of it in the moment of its acquisition. We represent formally how the expectations over the possible future characteristics of these goods influence its price, and get the conditions for the formation of bubbles, which allows us to propose mechanisms to avoid this kind of instinctive collective regimes. Posteriorly we extend our analysis to consider the case of monopoly and of an m-firms oligopoly producing these kinds of goods, finding that the cardinality of the firm(s)' possible plans of production to maximize benefits is the same. We show relation between the assets' prices and the cardinalities of the sets of suppliers, assets' varieties and entry consumers, with an indirect dependence on the rent labor wages. We model boundedly an analysis of the effect of tendencies like corruption on newly informed and non-Bayesian probabilities that constitute the prices. Finally, some extra provided mechanisms to avoid bubbles focus in reverting badly programed rule of thumbs, to get back to the right great rules respect.
Keywords. Non-bayesian expectations, Price bubbles, Profit maximization, Competition, Corruption, Mechanism design.
JEL. G12, G13, G18, G28, K42.

1. Introduction

The formation of bubbles has been broadly and deeply studied, because of its importance in the living of the individuals. The need for explaining this instinctive, collective, and well legally defined behavior, has taken many authors to develop important works which could be considered either a fraudulent, or a successful contribution in the understanding of these phenomena.

Smith *et al.,* (1988) study spot asset trading in an environment in which all investors receive the same dividend from A known probability distribution at the end of 15 periods, obtaining that fourteen of twenty two experiments exhibit price bubbles followed by crashes relative to intrinsic dividend value. Moreover, they also observe that four of twenty six experiments, all using experienced subjects, yield outcomes that appear to the "chart's eye" to converge "early" to rational expectations, although even in those cases there are small price variations which invite "scalping".

Ackert *et al.,* (2009) conducted a typical bubble generating experimental environment, from designing a pair of assets that can detect both irrationality which is the probability judgement error associated with low probability of high pay-off outcomes, and speculative behavior. In their work they establish that aggregate irrationality measured in one dimension (judgement error) is associated with the aggregate irrationality measured in another (bubble formation).

Xiong & Yu (2011) examine a speculative bubble that occurred in 2005-2008 in China's warrants market, where despite being so deep out of the money that there was virtually no chance of getting back in the money before maturity, 17 put

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warrants would had been traded more than three times a day at substantially inflated prices. In their analysis they highlight the joint effects of short-sales constraints and heterogeneous beliefs in explaining the price bubble across warrants and across time-to-maturity, finding direct evidence of positive feedback effects in warrant returns at short intervals of several minutes, and indirect evidence of smart investors riding the bubble.

In the present work we deal with an objective view on the formation of prices of durable assets that can be expected to posses more valued characteristics, where the probability of presenting an extra characteristic depends on the purchased quantity of these goods. This approach will allow us to identify the conditions for the formation of bubbles, and to asses different mechanisms which can certainly avoid this collective regime. Posteriorly we extend our analysis to consider the case of monopoly and of an$m-$firms oligopoly producing these kinds of goods, where the firm(s) can choose among a vast set of different plans of production to maximize benefits. Additionally, as part of the differentiated competition, we deal with the role of social tendencies that can influence newly informed and non-Bayesian probabilities, like corruption.

2. Durable assets and its characteristics

N is the finite set of characteristics which can be present in a durable asset with cardinality $|N| = n.$ The set of characteristics of the asset is represented by a coalition $S \in 2^N$.

After an asset is acquired it could posteriorly gain new characteristics without the need of spending more to acquire them. We define the following set

$$H = \{S: S \in 2^{2^N \backslash \{N\}} \wedge |S| = 2\}$$

A function $f: H \times Q \to \mathbb{R}^+$ gives the probability of acquiring other characteristics $A \in 2^N \backslash \{N\} \cup \{S\}$ which a good with $S \in 2^N \backslash \{A\} \cup \{N\}$ characteristics has. These probabilities can depend on the demanded quantity of the good Q. Moreover, these probabilities are known to the seller and the buyers.

3. Demand, price, and expectations

What is the price of an asset with the characteristics $S \in 2^N$?

We accept that the agents value each of these characteristics positively such that are willing to pay more for a good with more characteristics. Moreover, we accept that this price depends negatively on the sold quantity for a given set of characteristics. Therefore, the demand for these goods without considering the arrival probabilities is such that the price of an asset with the sure characteristics $S \in 2^N$ is given by a function $P(S, Q)$ who satisfies

$$P(S \cup \{i\}, Q) > P(S, Q) \forall i \in N \backslash S$$

for given quantity Q.

Given this general property we can ask to ourselves, how do the probabilities impact the prices of these goods?

Considering the agents expectations and their appreciation for these assets, the price of the good with characteristics $S \in 2^N$ is given by

$$P_{S,Q} = P(S, Q)[1 - \sum_{B \in 2^N \backslash \{S\}} f(S, B, Q)] + \sum_{B \in 2^N \backslash \{S\}} P(B \cup S, Q) f(S, B, Q)$$

when the agents take their decisions uninformed, however they could project the value of the asset by looking at the other prices[1], and the informed price[2] of the goods with characteristics S would be given by

$$P^i_{S,Q_S} = P(S,Q_S)[1 - \sum_{B\in 2^N\backslash\{S\}} f(S,B,Q_S)]$$
$$+\sum_{B\in 2^N\backslash\{S\}} P^i_{B\cup S,Q_{B\cup S}} f(S,B,Q_S)$$

which forms a system of 2^n equations with 2^n variables[3].

4. The profit maximization

The producer of the asset with $S \in 2^N$ perceived characteristics selects its quantity to maximize profits, however, before solving this problem it is important to analyze the effect of the produced quantity on the prices.

Instead of speculating about whether the decision of the buyers is informed or knowledge anonymous, we can think, how the probability of the posterior arrival of some characteristics depends positively on the sold quantity of these goods, and thus, the inverse demand which considers the probabilities can have a positive slope at least for a determined while.

This is, although the individuals who are willing to buy these assets could be expected to decrease with an increase of its price, there is another effect given by the possible arrival of extra characteristics, that could cause an increase on the willingness to pay as a response to the higher sold quantity.

The profit maximization is the followwing

$$\max_Q \pi = P_{S,Q}(Q)Q - C(Q)$$

We accept that the functions are such that there is always an optimum quantity of assets production Q^*.

5. About bubbles and its prevention

As we can see, as long as we find expectations over these assets there could be bubbles, because after its purchase, some or all of the extra indivisible characters could not arrive[4], which would leave the owners in disequilibrium, with an asset that has a real lower value than the one that they originally paid[5].

Therefore, we can write the following condition for assets when characteristics $S \in 2^N$

Possible bubbles condition:

$$1 > f(S,B,Q^*) > 0$$

at least for one $B \in 2^N \backslash 2^S$. Further, the collective and well assigned probabilities shall obviously satisfy the probability equilibrium

$$\sum_{B\in 2^\wedge\{N\}\backslash\{S\}} f(S,B,Q_{S_i}) \approx 1$$

where $Q_{S_i} \approx Q^*$ and thus with certainty $\pi_{S_i} = \pi^*$.

Notice that considering the alternative of prohibiting expectations means that the *Possible bubbles condition* would not be satisfied, however, is this condition enough to produce, the possibility of bubbles' formation under any situation? As is well known, the bubble crashes cause contagious demand crises, but not the other way around it.

Given these symptoms and core problems, in the following we allow to ourselves informally explaining, different mechanisms or solutions that would avoid the formation of bubbles.

Selling in advance: This mechanism is based on the early and simultaneous selling by the producers who initially charge the "more than a 100%" sure value $P(S,Q)$, because are able to identify the number of customers which is followed by the arrival of the sure characteristics, "just in time" for the buyers to appreciate them.

Perfect forecast selling: In this case the firm monitors the individuals reaction and demand[6], and projects the characteristics that these assets will end up having. Finally the firm sells the goods with the guaranty of the arrival of the sure characteristics[7].

Contract of gradual fair payments: In this case when the goods are purchased only the value of its present characteristics $P(S,Q)$ is charged, and the sellers and buyers sign a contract which makes the buyers formally pay for the value of any posterior arrival of characteristics. Since there could be posterior price fluctuations[8], when the probabilities can be hardly considered, the decision of each gradual fair payment could be addressed according to the evolving axiomatic approach of the cooperative game theory, where central concepts such as the core, or the Shapley value, are essential to understand the composition of a value like the one that we deal with, independently of the agents' personal incomes and risk aversion[9].

Example: If you were lucky enough to buy (sell) real state in Mexico in 2018 you would have found that the article 125 of the Mexican law on the tax over the rent (Ley del impuestosobre la renta), stablished that when the government estimated that an asset exceeded (was below) in more than 10% the between buyer and seller agreed price, the total difference is a buyer's (seller's) rent, of which according to the same law, had to be taxed by the government, (certain deductions at the end of the year would apply).

6. The case of monopoly and oligopoly of differentiated assets

Independently of the way in which the assets are sold, we can communicate how these goods with distinct initial characteristics are differentiated[10]. Moreover, although the posterior inclusion of any of the n aspects is not in control of the producer, it could be possible for it to initially choose to entrepreneur the production which has certain set of characteristics, another one, or the production of more than one variety of the good.

When all of the differentiated goods can be supplied by a monopoly the maximization problem of this firm is the following

$$\max_{M} \pi = \sum_{\substack{S \epsilon M \\ M \epsilon 2^{2^N}}} P_{S,Q_S^*} Q_S^* - C(Q_S^*)$$

where Q_S^* is the optimal quantity which internalizes the differentiation with the other supplied goods' varieties that are contained in M.

It is easy to see that in this case there are 2^{2^n} possible plans of financially developable production[11]. Moreover, if we consider how applying any of the mechanisms could alter the composition of the demand for these goods, then there are $(4)(2^{2^n}-1)+1$ possibilities of production for the varieties' hoarder firm, and it will choose the one which maximizes its profits![12]Finally, if the producers can supply different varieties of these assets with different mechanisms, the number of possibilities of production in terms of characteristics is the following

$$\sum_{M \epsilon 2^{2^N}} 4^{|M|}$$

If instead there are k possible consumers, m firms, and the jth firm has exclusive rights over a set of varieties of sure characteristics $S_j \in 2^{2^N} \backslash \phi$ such that $\sum_{j=1}^{m} |S_j| = 2^{\mathrm{n}}$, a single producer's decisions will depend on the ones of the other firms. The maximization of profits of the jth firm for given decisions of the other producers P_{-j} is the following

$$\max_{M} \pi_j = \sum_{\substack{S\epsilon M \\ M\epsilon 2^{S_j}}} P_{S,Q_S^*}(P_{-j})Q_S^* - C(Q_S^*)$$

where again Q_S^* is the optimal quantity of each supplied variety, which results from internalizing the substitutability between the jth firm's offered assets for a given $M\epsilon 2^{S_j}$. If the firms are able to sell each variety using different mechanisms simultaneously, each firm will be able to choose among

$$\sum_{M\epsilon 2^{S_j}} 15^{|M|}$$

possibilities of production diversifying in terms of characteristics and ways to sell to maximize profits[13].

Since each producer and consumer, considers the others firms in the market, the final taken choices are the result of a non- cooperative game where each firm projects the possible decisions of the other competitors, such that there are

$$\prod_{j=1}^{m}\left[\sum_{M\epsilon 2^{S_j}} 15^{|M|}\right] = \sum_{M\epsilon 2^{2^N}} 15^{|M|}$$

possible outcomes in the terms of final available assets, which is exactly the same number of these, recognized possible outcomes for a mainstream or monopoly that can decide among the same aspects or knowledge in the production distribution.

In an extra last addition, we must consider that, although for simplicity we have treated the variables in question in a simple way, its presence involves hidden relationships, and a perhaps more complete expression of the demand is given by

$$P(S, Q, k^u(m(n), S), k^i(m, w), S)$$

where the free entrepreneurship m that is determined by the available options n, at its time determines the entry of the uninformed consumers k^u, and also participates with the wages w to attract informed consumers k^i, from what we deduce the innovative relation between the competitive income factors P and w,[14] with the agents determining the financial state of the economy, and not the other way around, . Moreover, the participation of k can denote behavioral collective regimes coming from the consumers[15], where given the obvious importance of the social institutions treated by the evolutionary game theory[16], as putt by Tseng (2006) for the financial applications, concepts like bounded rationality in terms of knowledge or computability charge an important role. Furthermore, this mentioned role is the reason behind adding the dependence of P on the suppliers of varieties m, and on the personal resources w. And the constraints in question and the dependence on n avoid one or the other relation to become an informed binding surprise

Example: The firm "∞ Apartment of the rising sun" produces residences and owns land in a place which has a mall close to it, and another one with a gym close to it. Its competitor "Happy residence" owns land close to a park, and another close to a gas station. The set of these aspects is

$$N = \{mall, gym, park, gas\}$$

We accept that not producing residences at all would have zero benefits. The payments' matrix (*matrix 1*) contains the profits considering the optimal quantity choices taken by these firms on each different scenario, without considering the absence of production as an option.

Table 1. *Matrix 1*

Happy resi,∞ App of the rising sun	{mall}	{gym}	{{mall},{gym}}
{park}	1,2	1,1	2.5,1.9
{gas}	.9,2	2,3	2,2.9
{{park},{gas}}	.95,2	1.2,3	3,4

as we can see in the matrix (*matrix 1*), there are three equilibriums of best responses correspondence. Moreover, from the payments we could intuit how even though these goods are substitutes, supplying more varieties can attract more agents to the market. Finally, employing all the possible payments if the firms also choose mechanisms to sell each variety, would result in a greater and more complicated matrix, and we leave such design as a meaningful activity for the reader.

We can find a specific social tendency that results either from local or universal cooperation motivated by decentralized interests, namely corruption. As it was exposed in Accinelli & Sanchez-Carrera (2012), there are many examples that show how this so imitated behavior can harm a society. In particular applications that this one, we must take into account how the information that is available could get corrupted due to the so mentioned interest conflicts, given the social tendency. This is, the probability function should consider a dependency on what now the newly informed and uninformed individuals believe. A perhaps more accurate probability function is thus given by

$$f(S(k(m(n))), Q) \qquad \text{P}$$

The probability (P) thus captures the effect of non-Bayesian persons and newly informed agents[17] k, that certainly depend on the firms which are determined by the acquirable entries of its assets.

Despite the obvious difference in the probabilities, we shall label a corrupted one with the supra index F, and a corruption free one with a supra index A.

A mechanism $P(.)$ that performs as it follows

$$P(f(S(k(m(n))), Q)^F = f(S(k(m(n))), Q)^A$$

has an evident implicit domain, and is called anticorruption. If any, $P(.)$ results of obvious importance for the individual pay-offs. Verifying we get that the differential is

$$\Delta f = \frac{|(f(S(k(m(n))), Q)^F, f(., Q)^A) - f(., Q)|}{f(., Q)^A}$$

From this we know that

$$\frac{f(S(k(m(n))), Q)^F}{f(S(k(m(n))), Q)} = (1 + \Delta f)$$

By looking at the "big picture", we can deduce that we have what is the complex system (S) with corrupted equations where is obvious that the corruption mechanism it exists.

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$$f(S(k(m(n))),Q)^A = P((1+\Delta f)f(S(k(m(n))),Q))$$

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$$(1+\Delta f)f(S(k(m(n))),Q) = P^{-1}(f(N(k(m(n))),Q)^A)$$

S

From (S) we draw that the number of equations is related to how strong the corruption is, because as we mentioned, it depends on the competitive agents k and m, which depend on n. This result literally means that the available possibilities or characteristics that can be reached by the firms, could innovatory determine the number of corrupted equations, given the domain of this tendency. The equations in (S) depend all on the consumers k and it is straight forward to observe that are linearly dependent! Finally, notice that the producers could again internalize the externalities of their production to maximize benefits.

From here A simple mechanism would be given by a simply additive strategy, i.e. $P(.)$ could just compensate the effect of the corruptive mechanism $P^{-1}(f(k,Q))$ such that

$$P(.) = f(.)f' + \lambda f(.) + (1-\lambda)f(.)$$

A

where $\lambda = ((k^i)/k)$. Notice that we are implicitly assuming certain continuity on the consumers k. Although a little bit formal, the additive strategy (A), contextually denotes how the "bad information" or "corrupted expectations" more less exampled by actions like government bribing to get an illegal permit or commit fraud, could it be compensated, leaving always the already seen uninformed and non-bayesian probabilities of the $3rd$ section. Subjectively, the particular information associated with the probabilistic points' quantities, can.

As seen before, the right proportion of equally skilled rival agents could be such that the probability equals the corruption free one! However, we shall not focus in those cases that we consider un likely to happen. Taking into account that the corruption mechanism P^{-1}could not be linear, we shall propose the common pool information strategy. This mechanism consists in taking each of the smallest associable factors, and solving them as additive units one by one, until the components are no more, to posteriorly leave the developed "techniques", if not institutionalized, at least publicly available in a common pool, where the possibly affected agents can see it. A simple example is appreciated in the following

Example: Given

$$P^{-1}(f(.)) = (1/m)\sum_{r=0}^{2^{\frac{nw}{\lambda P}}}[f(.)^A]^r$$

$2^{\frac{nw}{\lambda P}}$ units or "techniques" would be developed[18]. After this tailor made matching productive of anticorruption factors are assigned to its duty, they take care of the potential damages and we are left logically with $\frac{2^{\frac{nw}{\lambda P}}}{m}f(.)^A$. Then a final technique to divide would leave us with a free of corruption system of equations (for $n=1$).

As an additional observation, it can be noticed that given the possible heterogeneity of the "ingredients" of the terms, less units do not imply a lower difficulty, where exploring the correlation between the difficulty of solution and the individuals' harm would be an interesting exercise. As the matter of fact, solving one unit does not necessarily involve a single developed procedure, because more additive units can be contained in it. Finally, the pool will contain elements that can allow certain pathologies recognition and strategies design.

As a final characteristic appropriate to mention standing in this point, we must recognize that affirming that the corruption is always wrong is analogous to affirming that the rules are always great.

Another characteristic comes from the capacity to slavishly develop all the necessary units to reform this way of looking at probabilities.

7. The non-rival agents

As it is usually classified in the field of economics, there are two kinds of goods, the rival ones that can only be used by one agent in a given period of time, and the non-rival ones, which can be used at the same time by many agents.

In this case our concern goes to the presence of agents that can be used by many at the same time, or non-rival agents, and exclusively to the ones that gain this denomination due to the availability of their working anticorruption mechanisms. If the population is given by the set H, we can intuit that the conditions for agents $k \leq |H|^m \leq 2^{|H|}$ must be satisfied[19]. Non-rival agents, could be at certain degree anonymous and randomly assigned to its duty[20], with likely their successive supervision mechanisms. However we must consider that there are implicit minimal and perhaps alternating requirements, and with this we of course mean that they should be willing to develop "the best possible" mechanism, and that there are minimal cardinalities of $S \in 2^H$ them, for an anticorruption mechanism to be effectively implemented. And this is the difficulty given by the randomness and anonymity tools in the mechanisms against corruption, when looking for the non-rival agents.

8. Who fears who?

The particular way of acting of the corruptive additive terms that modify the information, and the newly informed and the non-Bayesian probabilities, may evolve given the provided weather.

Focusing on the individuals, if the programed rule of thumb $R^x: H \times \Omega \to L$ of the individual $i \in H$ with a surrounding environment $I \in \Omega$, is such that if the individuals have been programed to corrupt $x = C$, and $x = A$ otherwise[21]. An uprising characteristic of this function is that L is the set of all the available to corruption "ingredients". In this way, the collection of ingredients that make f' is given by

$$(P^{-'}, f') = \bigcup_{i \in H} R^x(i, I) - \bigcup_{\substack{i \in H \\ I \in \Omega}} R^{-x}(i, I)$$

and would ideally form part of the pool.

A hybrid way to look at a mechanism P is therefore looking for the rightbest $I \in \Omega$. A Pareto unanimity would be reached if $x = -x$.[22]

Verifying game symmetry in the Nash (1950) sense would be analogous to empathy development, and thus reflexively the human i in the right to, certain point could be programed equally to any $j \in H$.

If the required acting of the units does not show a simultaneous entry to action, the non-solved terms may evolve or even modify its cardinality. Therefore as in a non-cooperative game, randomizing the election, of the non-rivals would not be smart, because the ones with a less bounded rationality or a higher $R(i, I)$ are needed.

Facing this last by the model suggested characteristic, the best-possibleless-punished entry of non-rival agents is threatened by, still anonymous and uncommunicated corruptive terms. In other words, a required arising characteristic of a right permutation of optimal pure and mixed strategies. A lucky programed population would enjoy the will advantage, of well institutionalized strategic common pools.

9. Conclusions

It is likely to have value bubbles definition in these markets despite a given quantitative comparison between the cardinality of the consumers' set and the number of suppliers.

Prohibiting expectations would leave us without a production of bubbles, and considering different mechanisms like perfect forecast selling or selling in advance could avoid this collective regime that we, deal with, although its implementations could imply a costly and very specific design.

It is intuitive how the absence of bubbles would be beneficial for the producer(s) of these assets, and of course for the customers who dislike this collective phenomenon independently of the particular wage income levels and risk aversion.

The extension to the case of the monopolist and of the m −firms oligopoly of these kind of assets, was helpful to represent the control variables of a producer, and the possible outcomes in terms of the final supply independently of the number of competitors m and k, where the number of possible outcomes could change depending on the available varieties for the producer(s), and the final supply results from the profit maximization which considers the diversifying possibility and demand for these assets.

Finally, as an allowance, we leave open the question about which properties should a demand for these goods' function have, in order to represent better different examples, because it implies a complex challenge that could not be avoided by concluding based on usual empirical observations, like for example an observed monopsony of very elastic financial assets caused by a very skilled consumer.

10. How can we turn F in to A?

WILL social agreements perform weakly when facing costly payoffs? It becomes an uncertain due to the randomness of f' pressurizer challenge, to look for the right channels that would enhance badly permuted non-rivalry reversion. We leave it common, where punishment is implied as part of the randomly static and so continuously evaluated contract, pointing anonymously monitoring.

Noting that the rent distribution i.e. w does not enter in the programed rule of thumbs, the non-rival agents will thus be found anywhere, where their certain capacity constraint R charges importance in a world that presents now international links, at least through markets that show particular contagious equilibrium behaviors like on whether while on the way and once there, social preferences show and thus are substitutes or complements with economic incentives[23] The challenge of the proposed mechanisms thus becomes dealing smoothly and effectively with these tendeny crashes, and. our found results on the variables dependency just can be considered when expanding the pool and varieties n to reach a peaceful Pareto unanimity rule.

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Notes

[1] If are available in the market.
[2] We induce that the price is informed with the supraindex i.
[3] An example of the probabilities can be given by each single extra aspect j having the probability $1-1/e^{c_j Q}$, where c_j is a positive constant. Moreover, notice that this is implicit how many of the probabilities given by the defined function f are zero, and that could we define a different f to consider applications where there is a possible loss of characteristics.
[4] If there were positive and negative expectations, these ideas could compensate each other without winners, and the price of an asset would coincide with its real value!
[5] For simplicity we do not consider time differences, and the possible arrival of extra characteristics would occur right after these assets are purchased. A more complex trade ex-ante analysis with uncertain delivery and private state verification, where it is verified how when the individuals are prudent, the equilibrium is characterized by the fact that the agents consume bundles with the same utility in states that they do not distinguish, can be found in Correia-da-Silva & Hervés-Beloso (2007).
[6] Which could be costly.
[7] To study an analysis on markets' equilibrium with perefect foresight see Petri (2013).
[8] For example due to a gain of popularity.
[9] To study factorial decompositions applied to other quantitative concepts namely income and opportunity inequality, see Lasso de la Vega & Urrutia (2003), and Sánchez-Pérez & Rosas-Martínez (2012) successively.
[10] Strict ways of the market communication are related to probably the implementation of certain mechanisms independently of the present competitivity tendency.
[11] It should be noticed that the asset without characteristics $\emptyset \in 2^N$ can also be produced.
[12] As it has been putt by Rochet & Tirole (2001), in their Ramsey pricing problem applied to the two sided markets, for a firm with a different objective, or when regulating one, the externalities of its production plans can be taken into account.
[13] $2^4 - 1 = 15$.
[14] $k = k^u + k^\backslash$
[15] e.g. Rosas-Martínez (2015).
[16] e.g. Bowles (2006), Barreira da Silva Rocha *et. al.,* (2011), Accinelli & Sanchez-Carrera (2012) and Sanchez Carrera (2012).
[17] The term non-Bayesian expectation has been previously employed by Shleifer (2000)
[18] Considering that the additive strategy has already been developed, such that the units without any $f(.)^A$ in them can be eliminated from the equation.
[19] In this vision the government is a firm
[20] Jackson & Sonnenschein (2011) point out how Salvador Barberà showed that the randomizations can attack manipulations, in this way uncovering what can do in social decisions.
[21] The notion of programmable individuals has previously been revised and employed by Banerjee *et al.,* (2012).
[22] A social rule that satisfies a Pareto unanimity satisfies an order relation that is preferred by each individual. In order to read more on social choice see Plata Pérez (1999), Condorcet (1785), Ostrom (1990), Arrow *et al.,* (2002), Arrow *et al.,* (2011).
[23] Verify Bowles & Polania-Reyes (2012).

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