An historical note on the concept of Nash equilibrium: independent quotes from Cournot, Keynes and Plato

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This short note intends to show that the idea of Nash equilibrium is recurrent in time, independently being found at least in the works of Cournot, Keynes and Plato.

1. Cournot; 2. Keynes; 3. Plato.

1. Cournot

It is well known that Cournot's model of oligopoly is an application of the Nash equilibrium concept. What is not generally known is that John Nash did not know of Cournot's work when he wrote his famous papers on the definition and existence of (Nash) equilibrium for finite games (Nash, 1950, 1951). I was told this by Nash himself in a conversation in 1985 in Princeton. It was only sometime later that Martin Shubik told him about Cournot's *Recherches*, and they wrote a piece connecting the two (Mayberry, Nash and Shubik, 1953).

I always found it fascinanting that such a fundamental text as Cournot (1838) had so little impact in economics, even after being the point of departure of Bertrand (1883), Edgeworth (1987) and Fisher (1989), after being translated into English in an edition commented by Irving Fisher (Cournot, 1927), after having strongly influenced Chamberlin (1936), and after being the object of two reviews in *Econometrica* (Fisher, 1938; and Nichols, 1938). It is clear that Nash's advisor, John von Neumann, did not know Cournot's *Recherches* since the latter is not cited in none of the three editions of *The theory of games and economic behavior* (von Neumann and Morgenstern, 1944).

2. Keynes

When arguing that nominal wages were rigid, i.e., that there is a natural resistance to decrease them, Keynes uses a Nash equilibrium reasoning. In fact, several authors notice that, in particular Simonsen (1983), and Werlang (1990). In order to show that nominal wages are rigid downward, Keynes argues that the individuals care about relative wages, instead of real wages. Thus when a decrease in wages has to happen, so that there is equilibrium in the labour market, this redution well be through the increase in the price level, since no one wants to be the first one to have his nominal wage cut. Keynes' quote is taken from *The general theory* (Keynes, 1936 chapter 2, III p. 13-4):

> *"Though the struggle over money-wages between individuals and groups is often believed to determine the general level of real wages, it is, in fact, concerned with a different object. Since there is imperfect mobility of labour, and wages do not tend to an exact equality of net advantage in different occupations, any individual or group of individuals, who consent to a reduction of money-wages relatively to others, will suffer a relative reduction in real wages, which is a sufficient justification for them to resist it. On the other hand, it would be impracticable to resist every reduction of real wages, due to a change in the purchasing-power of money which affects everyone alike;...".*

One should observe that Keynes' did not cite Cournot in *The general theory*, which means that he, at least consciously, did not make use of Cournot's idea.

3. Plato

However, something much more surprising can be found in Plato's *The republic*. There is an argument in the text which rests on the concept that a society must follow a Nash equilibrium. It is believed that Plato wrote *The republic* around 375 B.C.. His books are written in the form of a dialogue where the main charater is Socrates. It is fair to say that the Nash-like argument below is not central for what is considered now the main contribution of *The republic:* Plato's theory of knowledge. The passage is from Book Six, where Plato describes a dialogue between Socrates and Adeimantus (an elder brother of Plato). There he puts forward his idea that the ruler of a people should be a philosopher.

In the argument, Socrates says that once a society is wicked, it does not pay for anyone (unless this person is powerful), in his own, to go against it, so that wickedness is what prevails (Plato, 1974 p. 292, d):

"... and if they are not prepared to join the others in their wickedness, and yet are unable to fight the general savagery single-handed, they are likely to perish like a man thrown among wild beasts, without profit to themselves or others, before they can do any good to their friends or society. When they reckon all this up, they live quietly and keep to themselves, like a man who stands under the shelter of a wall during a driving storm of dust and hail; they see the rest of the world full of wrong doing, and are content to keep themselves unspotted from wickedness and wrong in this life..."

It is important to notice that I was not particularly looking for Nash equilibrium arguments when I first read *The republic*. Hence, it is quite possible that Plato also used a related reasoning in more of his work. Finally, neither Cournot nor Keynes explicitly base themselves in *The republic*, since Plato is not cited in either Cournot (1838) or Keynes (1936).

After putting together these three facts, I come to the conclusion that Nash equilibrium is a very powerful notion (I have to admit that this last statement has some, although not much, of my own judgement of value). It would be interesting to find out whether other authors made use of similar arguments throughout History.

Resumo

Este breve comentário pretende mostrar que a idéia de equilíbrio de Nash é recorrente no tempo, sendo independentemente encontrada pelo menos nas obras de Cournot, Keynes e Platão.

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