Level K Thinking

Introduction

"For it is, so to speak, a game of Snap, of Old Maid, a pastime in which he is victor who says Snap neither too soon nor too late, who passes the Old Maid to his neighbour before the game is over, who secures a chair for himself when the music stops." - John Maynard Keynes, General Theory of Employment, Interest and Money

Investing is - in this author's opinion – about profiting from what will become *eventually obvious*. A thesis which is already understood by the market contains no alpha, but one which it will never understand (or it will understand too late) will never realise in the form of tradeable prices. This is to say, it is fundamentally psychological, *it* is the result of the decisions of thousands of participants, and the predominant strategic and psychological characteristics of the participants will be felt in the behaviour of the market. This is true in a money weighted sense, of course Bill Gross' psychology tends to move markets a little more than your local contrarian's, it should be noted however, that this is additive; a single WSB participant has little impact but a critical mass of them gives you 2021 Jan. GME.

The Framework

Player (market participant) types are drawn from a hierarchy of levels of iterated rationality. The hierarchy begins with some very naive type. This completely non-strategic "level-zero" (L-0) player will choose actions without regard to the actions of other players. An L-1 type believes the population consists of all naive types, this slightly more sophisticated player believes that the other players will act non-strategically; his or her action will be the best response consistent with those first-order beliefs. The next level believes the market participant population consists predominantly of L-1 players, so the L-2 player acts on the belief that the other players are level one. This pattern continues for higher-level players, but each player has only a finite depth of reasoning, meaning that individual *players have a limit to the depth to which they can reason strategically*. If all players had unlimited capacity for strategic reasoning, we'd have an infinite regress, however, this is not the case, so what matters to a player wishing to outperform due others' bounded rationality is simply to identify the depth of thinking and think one level higher.

L-0: What do I think?

L-1: What do I think others think?

L-2: What do I think others think others think?

And so on…

An example: The Keynesian beauty contest. In the Keynesian beauty contest, participants are asked to choose a number that will be as close as possible to some fraction of the average of all participants' guesses. Suppose there are many players, each attempting to guess ½ of the average from the range 1-100.

A level zero player will select a number non-strategically without reference to the other players' thought processes (these can to some degree be thought of as noise traders.) A level one player will choose the number consistent with the belief that all other players are level zero. If all other players in the game are level zero, the average of those guesses would be about 50. Therefore, a level one player will choose 25. A level two player will choose the

number consistent with the belief that all other players are level one. Since a level one player will choose 25, a level two player should choose 13 etc.

The standard solution to the Keynesian Beauty Contest is determined by iterated elimination of dominated strategies. Using the example above, a fully rational player will observe that the most the number could be is 50. This player will also predict that the other players know that as well and will behave accordingly, so the maximum feasible number becomes 25. But, again, other players should know that, too. This process repeats indefinitely, and concludes with all players selecting 0, the Nash equilibrium for this game. This solution is inconsistent with experimental evidence, which finds that most players choose numbers around either 25 or 13. These guesses are consistent with first- and second-order depth of reasoning. A small proportion of players exhibit depths of reasoning greater than second order.

In a simpler version of the beauty contest, people are independently asked to say which out of a set of faces is the most beautiful. The face with the most votes is declared the most beautiful, and anyone who voted for the most beautiful face is eligible for a prize. Keynes thought that this was a useful way to think about how stock markets behave, except that we substitute beautiful companies for beautiful faces.

This is relevant because picking winning investments means identifying both *which* investments will be chosen by others, but also *when* they will be chosen. It's a beauty contest in time, you want to be last-in before the pump and first-out before the dump, perfectly riding the tide of your chosen security's salience. This is exemplified by many hyper nihilistic and self-aware quasi-ponzis in the crypto space like OHM (3,3) but is also evidenced in the language that can be found around many online trading communities that trade more financially sound products based on the salience of narratives and beliefs of participants, terms like "diamond hands", "WAGMI/NGMI" and so on.

Focal Points

In pure coordination games, like in the beauty contest, it does not matter to anyone what they choose if they are L-0 and if they're L-1 or higher they just want to choose the same as everyone else. If people are not allowed to communicate with each other, then it can seem a hopeless task to coordinate, but an analysis by Thomas Schelling demonstrated the idea that people are able to coordinate much better than randomly by using focal points.

For example, when asked for a time and place to meet someone in New York, without being able to communicate with the other person, most people said noon at Grand Central Terminal. In particular situations it can be 'obvious' to most people what the focal point is - there is nothing that makes Grand Central Terminal a location with a higher payoff (you could just as easily meet someone at a bar or the public library reading room), but its tradition as a meeting place raises its salience and therefore makes it a natural focal point.

The problem is that, to make good economic predictions, we need to abstract away from particular situations to get a more general model. It is hard to say in general why, and when, 'things stand out' or 'seem obvious' and the idea of a focal point may be something that equations are not best suited to capture.

The primary (L-0) salience hypothesis is that people choose the option that is most salient to them, and, because the same option is salient to many people, people coordinate by accident. For example, most people might have said Grand Central Station simply because it is their favourite place in New York. The secondary salience hypothesis is that people expect others to use primary salience and so choose the option they think will have

primary salience for other, for example, your favourite place might not be Grand Central Station, but you choose it because you expect it to be the most favoured one among people broadly (L-1).

The Schelling salience hypothesis is that people ignore what is primary or secondary salient and look for some clue on how to coordinate. For example, Grand Central Station may not be anyone's favourite place, but it somehow stands out as the best choice. We can think of it as assuming that people will be of type L-1 but that someone of type L-0 would likely choose the focal point anyway. In some situations, we can coordinate with others because there exists some focal option, but to predict what people will do we need to be able to predict the focal point.

These principles could explain why some trading strategies like technical analysis could work. The fact that price action tends to repeat shapes, one of the assumptions of technical analysis, is often attributed to market psychology, which may be predictable based on emotions like fear or excitement. Technical analysis uses chart patterns to try to analyse these emotions and market movements to understand trends. This can be closely related to the importance of focal points, considering the stock market as a coordination game between thousands of participants. The concepts of support and resistance zones, horizontal lines on a chart which are the effect of market "memory" and herd perception, are focal points at which many investors decide to buy or sell, creating coordination between a group of traders without direct communication. For example, many technical traders will place a stop-loss order below the 200-day moving average of a certain company. If many traders have done so and the stock reaches this price, there will be many sell orders, which will push the stock down, confirming the movement traders anticipated. Then, other traders may see the price decrease and sell their positions out of fear, reinforcing the strength of the trend and perpetuating the market conditions which prompted their sale in a self-fulfilling way.

There are many critiques of technical analysis, and it is difficult to imagine that technical traders largely drive prices over the long run, but narratives and psychology matter, and technical analysis may help identify regions of psychological importance like Schelling points and allow us to better coordinate our investment decisions from Level K+1.

TAGS: game theory, behavioural finance