HOW PHYSICS IS VALIDATING THE LABOUR THEORY OF VALUE

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When I was a student my economics professor told us that whilst the labour theory of value had been an important historical stage in the development of economics, it was now known to be fatally flawed. 20th century economists such as Sraffa and Samuelson had shown that it was unnecessary to accord labour any special place in our understanding of prices. Instead, the structure of prices could be perfectly well understood as the result of the monetary costs faced by firms and the behaviour of profit maximising entrepreneurs. If there was in reality no such thing as labour value, it followed that Marx's theory of exploitation was an invalid incursion of moral prejudices into the 'positive science' of economics.

The professor who taught us this, Ian Steedman, was actually quite left wing, an active member of the Communist Party.

This is just an anecdote, but fact that even a prominent communist intellectual believed that the central component of Marx's theory was scientifically worthless is significant. In retrospect it gave an indication of how poorly prepared the intellectuals of the communist movement were to be, when faced with the very intense ideological attacks on socialism which unfolded in the 1980s and 1990s.

But 25 years ago help came from an unexpected source. Two mathematicians Moshe Machover and Emanuel Farjoun, wrote a book called the Laws of Chaos. Their book gave a radically new way of looking at how capitalism worked as a chaotic and disorganised system. Farjoun and Machover had the the insight to see that physics had already developed theories to describe similar disorganised and chaotic systems.

In a market economy, hundreds of thousands of firms and individuals interact, buying and selling goods and services. This is similar to a gas in which very large numbers of molecules interact, bouncing off one another. Physics speaks of such systems as having a 'high degree of freedom', by which it means that the movements of all individual molecules are 'free' or random. But despite the individual molecules being free to move, we can still say things about them in the aggregate. We can say what their average speed will be (their temperature) and what their likely distributions in space will be.

The branch of physics which studies this is statistical mechanics or thermodynamics. Instead of making deterministic statements, it deals with probabilities and averages, but it still comes up with fundamental laws, the laws of thermodynamics, which have been found to govern the behaviour of our universe.

Now here is the surprise! When they applied the method of statistical mechanics to the capitalist economy, they found that the predictions it made coincided almost exactly with the labour theory of value as set out in volume 1 of Marx's Kapital. Statistical mechanics showed that the selling prices of goods would vary in proportion to their labour content just as Marx had assumed. Because the market

is chaotic, individual prices would not be exactly equal to labour values, but they would cluster very closely around labour values. Whilst in Kapital I the labour theory of value is just taken as an empirically valid rule of thumb. Marx knew it was right, but did not say why. Here at last was a sound physical theory explaining it.

It is the job of science to uncover causal mechanisms. Once it has done this it can make predictions which can be tested. If two competing theories make different predictions about reality, we can by observation determine which theory is right. This is the normal scientific method.

Farjoun and Machover's theory made certain predictions which went directly against the predictions made by critics of Marx such as Samuelson. In particular their theory predicts that industries with a high labour to capital ratio will be more profitable. Conventional economics predicts that there will be no such systematic difference between the profit rates in different industries. When put to the test it turned out that Farjoun and Machover were right. Industries with a high labour to capital ratio are more profitable. But this is exactly what we should expect if the source of profit was the exploitation of labour rather than capital. Their theory made predictions which not only turned out to be empirically spot on, but at the same time verified Marx's theory of the exploitation of the worker.

The next big advance was made by the phsyicist Viktor Yakovenko, who showed in his paper 'the Statistical Mechanics of Money' that money in a market economy played the same role as energy in physics.

Just as energy is conserved in collisions between molecules, so money is conserved in the acts of buying and selling. So far so obvious!

What was not obvious was what this implies. Yakovenko showed that the laws of thermodynamics then imply that the distribution of money between people will follow the same form as the distribution of energy between molecules in a gas : the so called Gibbs-Boltzmann distribution. This sounds very scientific, but what does it actually mean?

What the Gibbs-Boltzmann distribution of money says is that a few people with end up with a lot of money and a lot of people with end up with very little money. It says that the distribution of money will be very uneven, just as we see in capitalist society. In fact Yakovenko showed that the distribution of wealth in the USA fits the Gibbs-Boltzman distribution pretty closely.

There is a tendancy to think that rich people owe their wealth to intelligence or effort, but physics tells us no. Given a market economy, then the laws of chance mean that a lot of money will end up in the hands of a few people.

In fact when we look at the USA we find that the distribution of wealth is even more uneven that we would expect from the Gibbs-Boltzmann law. If the Gibbs Boltzman law held, there would be millionaires but no billionaires. Why the disparity?

Yakovenkos original equations represented an economy that is rather like what Marx called simple commodity production. It assumed only buying and selling. More recent work by Yakovenko and Wright, has shown that if you modify these equations to allow either the earning of interest on money, or the hiring of wage labour, then the equations predict a polarisation of the population into two groups. The great bulk of the population, the working class and petty bourgeois, follow a Gibbs-Boltzmann income distribution. But there is a second class, those whose

income derives from capital, whose wealth with follow a different law, what is called a power-law. Again, look in detail at the distribution of wealth in and you provide exactly the distribution predicted by Yakovenko's theory. This, says Yakovenko, proves that Marx was right when he said that modern society was comprised of two distinct and opposed classes : capitalists and workers.

So modern physics has shown that not only was Marx right in his basic analysis, but he was right because his conclusions follow from the most basic laws of physics, the laws of thermodynamics.

There is also a less obvious conclusion that we can draw from physics relating to the undesirablity of Market Socialism. We can see from Yakovenko's work that a market socialist economy would also have a very uneven distribution of money. There too the Gibbs-Boltzmann law would rule. A small number of people or co-operatives would end up with a lot of money, and many such people or co-operatives would end up poverty stricken. From this capitalism would be regenerated. As Lenin wrote : "small production engenders capitalism and the bourgeoisie continuously, daily, hourly, spontaneously, and on a mass scale".