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# Kornai's DRSE Theory Versus General Equilibrium Theory

SUMMARY: János Kornai's DRSE theory (Kornai, 2014) follows the ex post model philosophy which radically rejects the ex ante set of conditions laid down by the dominant neoclassical school and the stringent limits of equilibrium, and defines its own premises for the functioning of capitalist economy. In other words, the DRSE theory represents an extremely novel trend among the various schools of economics. The theory is still only a verbal model with the following supporting pillars as the immanent features of the capitalist system: dynamism, rivalry and the surplus economy. (The English name of the theory uses the initial letters of the terms Dynamism, Rivalry, Surplus Economy). The dominance of the surplus economy, that is, oversupply is replaced by monopolistic competition, uncertainty over the volume of demand, Schumpeterian innovation, dynamism, technological progress, creative destruction and increasing return to scale with rivalry between producers and service providers for markets. This paper aims to examine whether the DRSE theory can be formulated as a formal mathematical model. We have chosen a special route to do this: first we explore the unreal ex ante assumptions of general equilibrium theory (Walras, 1874; Neumann, 1945), and then we establish some of the possible connections between the premises of DRSE, which include the crucial condition that just like in biological evolution, there is no fixed steady state in the evolutionary processes of market economy, not even as a point of reference. General equilibrium theory and DRSE theory are compared in the focus of Schumpeterian evolutionary economics.[1]

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The focus of research in economics is gradually shifting from the investigation of steady states to non-steady states. *Walras* and *Marshall's* equilibrium models, dating back more than a century, were so preeminent in economics that it was practically a heresy to investigate non-steady states in the 20th century. This also meant that static models dominated economics. As the neoclassical school adopted these models ready-made, which in addition were also compatible with their mathematical studies, this school became predominant in economics for many years to come. Even *Keynes* echoed Marshall in his supply-demand analysis when he represented continuous adaptation by means of a series of discrete steps, examining the dynamic process using the shifts between static steady states.

In Chapter 1 we examine the premises of general equilibrium theory, or more precisely, some of the key hypotheses of Walras' general equilibrium theory, followed by a discussion of the Neumann model. The definition of "free goods" and "scarce goods" as well as the interpretation of duality will later be given a significant role in characterising the operative mechanism of the DRSE model. Chapter 2 examines the primal aspect of the DRSE model, while Chapter 3 looks at its dual aspect. Whilst the former interprets surpluses

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and the surplus economy itself on the market for goods and services as well as on the labour force market, the latter describes the development of market prices and effective wages as a process incompatible with Walras' concept of tatonnement. No equilibrium can be achieved between demand and supply without prices and wages that clean the market. More accurately, the driver of endogenous change is innovation, and the source of innovation is entrepreneurial activity which creates imbalances. The market shapes prices, which determine profit. The dynamics of the evolutionary system are driven by a stochastic dynamic process, which, due to insufficient profit, changes the rules of operation. New routine procedures emerge through imitation or innovation. In other words, the system is in complex and constant vortex-like movement which creates surpluses. In Chapter 4 we scrutinise the premises of the DRSE theory and the possible correlations among them and compare them with the criteria that ensure a balance between Walrasian supply and demand as well as with *Neumann's* duality theorem. What is the point in comparing a verbal model with mathematical models of equilibrium, one may ask. There are several kinds of affirmative answers to this question. Let me mention just two of them. First, since the theoretical background of the DRSE verbal model is partly provided by the Schumpeterian evolutionary economics, which contradicts general equilibrium theory on several points, it is obvious that it should be compared only to the general equilibrium models. Second, it makes sense to compare it to the main standard features of Walras' general equilibrium theory, namely Walras' Law, and then to Neumann's duality theorem, because these are the first simplest forms of the equilibrium between supply and demand, and as will be shown later, it is precisely the neoclassical interpretation of supply and demand that presents an issue for *Kornai.* In other words, the comparison to the mathematical models of general equilibrium theory will be useful from a didactic point of view as well. In the fifth and final chapter, we refer to the works of *Kaldor* (1971) and *Balogh* (1982), which criticised the key premises of general equilibrium theory in agreement with Kornai. This is where we address the question posed by Kornai as to whether DRSE can be formalised in a mathematical model.

## ARROW–DEBREU'S GENERAL EQUILIBRIUM THEORY AND ITS ANTECEDENTS

General equilibrium theory goes back to classical thinkers: its early forerunners included *Smith, Ricardo*, *Cournot, J. S. Mill* and *Marx.* For example, the question of general equilibrium appears in Cournot's work as follows: *"... but in reality the economic system is a whole for which the parts are connected and react on each other. (...) Therefore, it appears inevitable to examine the entire system as a whole in order to provide a perfect and rigorous resolution of issues linked to particular parts of the economic system. However, this would exceed what mathematical analysis and its computing power could achieve, even if a numerical value could be assigned to each constant parameter (of the model)."* (Cournot, 1838/63, 198). His study included a partial steady-state analysis for a single market, ignoring the consequential effects of the other markets. In his approach, the supply and demand of a product depended only on its own price, and the steady-state price is the rate at which supply is equal to demand.

The concept of general equilibrium was fully developed by Walras, but it only started to develop as a modern theory with the work of *Gustav Cassel* (1918/32). In this work, he published a simplified Walrasian system in an easily accessible form and noted that "essentially, the price issue is a single problem covering the entire exchange economy and lends internal consistence to the pricing process, which can be expressed only by a simultaneous set of equations" (Cassel, 1932, p. 148). In today's modern language this means that steady-state prices are the calculated values of the endogenous variables of the model.

*Wald* (1936, 1951) worked out a general equilibrium model for both production and exchange, respectively, and his other studies (Wald, 1933–1934; 1934–1935) demonstrated the existence of equilibrium for both. The former was based on the works of Walras (1874), Cassel (1918/32) and *Schlesinger* (1933–34) and, together with the latter, the exchange economy model, provided the basis for the framework of the Arrow–Debreu model, putting considerably weaker constraints on the technologies of producers and the preferences of consumers. A lesser known fact is that the concept of decreasing marginal utility appeared in Wald's works too, in particular in his exchange model.

The only other model that treated the existence proof of the solution offered by the general equilibrium models rigorously in the 1930s was John von Neumann's growth model. In the economy that von Neumann studied, production factors are not limited and technology has constant returns to scale, producing $n$ goods with the help of $m$ activities, allowing for twin products as well. The solution offered by the model is represented by the definition of the intensity rates of activities, the growth rate, the product price ratios and the interest rate.

The modern version of general equilibrium started with a paper written by *Arrow* and *Debreu* (1954), in which they remodelled Wald's system, replacing the fixed-coefficient technologies and the marginal utility functions by the introduction of production sets and consumption preference structures, respectively, and defining the equilibrium based on market competition for a competitive economy, in short, the competitive equilibrium.[2] They started out with the premise that as every competitive equilibrium is Pareto-efficient, and every Pareto-efficient allocation can be seen as a competitive equilibrium, the social activities that facilitate efficiency require the investigation of the existence of equilibrium for competitive economies. In a general and abstract model, Arrow and Debreu (1954) provided proof of the existence of competitive equilibrium which can be "reduced" (and vice versa, "extended") to Wald's and then to Neumann's model, and which meant the "conclusion" to a nearly 200-year old debate.

## The formalised definitions of general equilibrium theory

### *Walras' general equilibrium model*

For the sake of later discussion, it is worth looking at the main standard feature of the Walrasian general equilibrium model, namely, *Walras' Law*, as this is the simplest first form of the equilibrium between supply and demand.

Let

$$D_i(p_1,p_2,\ldots,p_n)-S_i(p_1,p_2,\ldots,p_n)=0,\ i=1,2,\ldots,\ n,$$

expressed differently,

$$E_i(p_1,p_2,\ldots,p_n)=0,\ i=1,2,\ldots,\ n,$$

where $p_i$ is the unit price of the $i^{\text{th}}$ product, and $D_i$, $S_i$ and $E_i$ are its demand, supply and excess-demand, respectively. Walras' Law is expressed by the following equation for a general equilibrium model with $n$ products:

$$\sum\nolimits_{i=1}^{n} p_i E_i(p)=0$$

for every permitted $p$.

It is worth noting that this equation is valid not only with steady-state but with all the other prices too. In other words, it is a global (general) stipulation for the correlation between prices and excess-demand. Furthermore, it is also obvious that if we can find a price vector for the case with $n$ products that removes ($n$–1) from the market (eliminates excess-demand or excess-supply), then the same price vector cleans the $n^{th}$ market as well, which is called the general steady-state price vector for the entire system in the literature, hereinafter marked by $p^*$.

Let's consider a case where prices are not negative and are not general steady-state prices, which requires $E_i(p^*)\leq 0$ for every $i$. The result of using Walras' Law for such a steady state is that $p_i^*E_i(p^*)=0$ for all instances of $i$. This result is given by all the $p_i\geq 0$ prices as well as the combination of the Walras' Law and the equilibrium condition. Thus, the result of Walras' Law is that in an economy where strict steady states are possible, the following conditions prevail for the steady-state price vector $p^*$:

$$\text{if } p_i^*>0, \text{ then } E_i(p^*)=0, \qquad (1)$$

and

$$\text{if } E_i(p^*)<0, \text{ then } p_i^*=0. \qquad (2)$$

Hypothesis (1) states that with positive steady-state prices, excess-demand is zero in the steady state on the appropriate markets (scarce goods), while (2) says that the price of goods featuring excess-supply should be zero in equilibrium (free goods). Conditions (1) and (2) are often called *complementary-slackness conditions*, since they state that for every $i$ only one of the values of $p_i^*$ and $E_i(p^*)$ can be non-zero. Since the $p^*$ steady-state vector eliminates excess-supply from the market, it is called a market-cleaning steady price vector.

The second interesting property of Walras' systems is the zero-degree homogeneity of the excess-demand functions. This hypothesis is represented by the following stipulation:

$$E_i(p)=E_i(\lambda p), \ \lambda>0, \ p\geq 0. \qquad (3)$$

Zero-degree homogeneity is the economic property of what is called the no money illusion. According to Walras' Law, condition (3) is the most obvious for clean exchange, but it is also valid for production economies with fairly standard assumptions. One of its consequences is that the steady-state price vector is not a point but a radius in the price range. This is because $\lambda p^*$ gives exactly the same value for all the excess-demand as $p^*$, since $E_i(p^*)=E_i(\lambda p^*)=0$ for all instances of $i$, and for every $\lambda>0$. Another consequence of it is that the prices can be normalised in various ways without violating the properties of excess-demand. For example, prices can be defined so that their sum yields one. This means that all the prices are multiplied by $\lambda=1/\sum_i p_i$, which naturally leaves all the excess-demand unchanged by assuming zero-degree homogeneity. Another way of normalisation means the selection of a product as *numeraire*, and the price of every other product is measured expressed in terms of the price of the former. If the $j^{th}$ product is selected, then $\lambda=1/p_j$.

***Neumann's model***

All the information required for the formulation of the original Neumann model is represented by the matrix pair $(A, B)$. Each of them is an $n\times m$ non-negative matrix, respectively. Here $n$ refers to the number of goods and $m$ to that of activities. The column vectors of $A$ and $B$ with the same index denote a combination of inputs and outputs. In other words, $A$ and $B$ represent a Neumann technology, that is, $m$ number of activities with unity intensity, each of which can use and release $n$ number of goods.

Vector $x=(x^1,x^2, \ldots, x^m)\in\Re_+^m/\{0\}$ is used to represent the intensity of the activities, where $Ax$ denotes the input used, $Bx$ the output produced broken down in accordance with $i\in I=\{1, \ldots, n\}$ goods.

Similarly, vector $p=\{p^1,p^2, ..., p^n\}\in\Re^n_+/\{0\}$ is used to represent the price constellation of the goods, where $pa_j$ and $pb_j$ denotes the sum of the input costs and output values of the $j^{th}$ activity, respectively, operating at the unit level.

Let us take the following two subsets:

$$\underline{\Gamma}=\{\alpha\in\Re|\exists x\geq 0:(B-\alpha A)x\geq 0\}, \qquad (4)$$

$$\overline{\Gamma}=\{\beta\in\Re|\exists p\geq 0:p(B-\beta A)\geq 0\}, \qquad (5)$$

Here $\alpha$ represents the growth factor (1 + the growth rate) and $\beta$ the interest factor (1 + interest rate); $\Re$ denotes the set of real numbers.

Hypothesis (4) refers to the material balance, while hypothesis (5) to the account balance. An economy that operates in accordance with hypotheses (4) and (5) is called a Neumann economy.[3]

Let $\alpha\in\underline{\Gamma}$ and $\beta\in\overline{\Gamma}$ be the values related to vectors $x$ and $p$, respectively. In accordance with (4) and (5) only, the following relation can be given: $\alpha<\beta$, that is, the intersection of the two subsets, $\underline{\Gamma}$ and $\overline{\Gamma}$ is an empty set. However, if we assume that

$$pBx>0, \qquad (6)$$

then, through the chain of relations

$$\alpha pAx\leq pBx\leq \beta pAx$$

the following inequality is given:

$$\alpha\leq\beta.$$

As a result, if the Neumann economy is operating with a positive output value, that is, $pBx>0$, then a sustainable interest factor is always minorised by a sustainable growth factor.

A maximum sustainable growth rate can be achieved when $\alpha$ and $\beta$ coincide. This is what motivates the following definitions: the triplet $(\lambda,x,p)$ denotes a Neumann equilibrium if

$$Bx\geq\lambda Ax,\ x\geq 0, \qquad (7)$$

$$pB\leq\lambda pA,\ p\geq 0. \qquad (8)$$

Relations (7) and (8) are duality theorems offered by linear programming, which can be used to solve the Neumann model. In this context, $\lambda$ is called an expansion factor that belongs to the Neumann equilibrium.

Furthermore, a Neumann equilibrium which satisfies (6) is called a positive Neumann equilibrium. Here positivity is simply assumed practically without any arguments. Later, it will be ensured by special conditions set for the technology. These assertions will be key for our later assertions. What we call Neumann equilibrium was called economic equilibrium by *Kemeny*, *Morgenstern* and *Thompson* (1956). However, the attribute "economic" is used here in a slightly different sense, and instead, in order to prevent any misunderstanding, we use the term positive Neumann equilibrium.

The uniqueness of the Neumann model means that the expansion factor that belongs to the Neumann equilibrium is clearly determined. This leads to the simplest result and in some sense follows the neoclassical theory, even though the Neumann model does not belong to the models of the neoclassical school. In this case, the intersection of subsets (4) and (5) contains a single expansion factor $\lambda$, which is equal to the maximum $\alpha_0=sup\underline{\Gamma}$ and the minimum $\beta_0=inf\overline{\Gamma}$, that is, $\alpha_0=\lambda=\beta_0$. Needless to say that $x$ and $p$ may be unambiguous or ambiguous (in accordance with multiplication by a positive number).

Neumann himself was interested in the uniqueness of the expansion factor and he ensured it using the assumption made for the Neumann technology, namely

$$A+B>0, \qquad (9)$$

that is, every unit of goods appears in an activity either as input or as output (cf. Neumann, 1945, p. 3).

Kemeny, Morgenstern and Thompson (1956) made and alternative proposal, namely:

Let

$$Ax\geq 0\ ,\ x\geq 0 \qquad (10)$$

and

$$pB\geq 0,\ p\geq 0. \qquad (11)$$

These KMT assumptions require that each activity should use at least one unit of goods as input and each unit of goods should be produced as output at least in one activity. In addition to these assumptions, uniqueness also requires the (technologically) irreducible hypothesis provided by *Gale* (1960) or the weaker hypothesis introduced by Móczár (1980, 1995), the hypothesis of the so-called weakly reducible structure.[4]

## Stability criteria

The stability of Walras' general equilibrium was first described by *Hicks* (1939/78). Hicks took the Jacobian matrix that can be generated from the excess-demand function:

$$\left[\frac{dE_i}{dp_j}\right],\ i,j=1,2,\ldots,\ n,$$

and showed that the equilibrium is stable if the main minors of the Jacobian matrix used for the steady-state price has alternating signs, that is:

$$\det\left[\frac{dE_1}{dp_1}\right]<0,\ \det\begin{bmatrix}\frac{dE_1}{dp_1} & \frac{dE_1}{dp_2}\\ \frac{dE_2}{dp_1} & \frac{dE_2}{dp_2}\end{bmatrix}>0,\ \text{etc.}$$

Hicks' definition does not use any dynamic control process, his stability criterion depends only on the partial monotonicity of the excess-demand functions, that is, in the case of a single market, the steepness of the supply curve should be greater than that of the demand curve.

*Samuelson's* stability studies (1943, 1947) eliminated the deviations from equilibrium by introducing Newton's laws of motion, a first order autonomous set of differential equations simulating the method of tatonnement:

$$\frac{dp_i}{dt}=k_iE_i(p_1,p_2,\ \ldots,\ p_n)=0,\ i=1,2,\ \ldots,\ n,$$

which states that the absolute change rate of the $i^{th}$ price is proportionate to excess-demand on the $i^{th}$ market. There are two important premises in this proposition. One of them is that the players of neither demand nor supply can influence the price which exists on the market but rather, they take it as given. This behaviour of accepting prices is one of the premises of a competitive market. The other premise is that price is just one parameter on the market. At every moment in time, the players of demand and supply adjust the quantities appropriately that they wish to seek or offer but only on the basis of the price information provided for them; in other words, they may not shape the prices. We assume that this adjustment is momentary.[5]

## THE PRIMAL ASPECT OF KORNAI'S DRSE THEORY

Kornai (2014) sees excess-supply in capitalist systems as a continuous state, at times of peace, instead of an equilibrium between demand and supply, which he calls surplus. Whilst the socialist system is characterised by a shortage of surpluses and workforce, the capitalist system shows an abundance of goods and unemployment with physical capacities and human resources being underused. At the micro level, he explains the asymmetry between these two systems by the motivation of stakeholders, drivers and rules of behaviour. He calls these explanatory factors the natural attributes of the system, which can be strengthened or weakened for a short while by fiscal or monetary policy, but the decisive role will not change significantly. This is one of the reasons why he does not address issues of financial policy in the surplus economy.

The reason why capitalism as a surplus economy deserves priority against socialism lies in the Schumpeterian evolutionary drivers which determine the functioning of capitalism.[6] Evolutionary theory offers a mechanism for creating variance (innovation), a selection mechanism (market), and a mechanism ensuring the continuity of the elements chosen through selection (different profitability) on the basis of limited rationality.[7] The framework of analysis is the rapidly changing, uncertain environment, and the structural uncertainty does not make it possible to maximise profit. Although in the process of "seeking satisfactory profit" companies may raise their aspiration levels in the long-term, which can be interpreted as chasing profit, this does not mean profit maximisation. For lack of optimisation, however, the state of equilibrium cannot develop, and the majority of the companies operate under dynamic, non-equilibrium conditions. In the following, our investigations will be limited to these decisive factors. We will not consider here the conclusions of the author in regards to the social and economic policy of the socialist and capitalist systems, although we do not underestimate their significance.

## Surplus on the goods and services market

What mainstream economics calls excess-supply is called surplus by Kornai (2014), and the surplus economy is created by oligopolistic competition, innovation and dynamism by means of excessive capacity, excess-inventory and excess-supply. However, this distinction also means that we are confronted, among other things, with classical market mechanisms, such as Say's Law[8] as well as with the representative consumer and the ceteris paribus principle[9] of neoclassical approaches, the law of a single price, the classification of so-called free and scarce goods, or the duality theorems of linear programming. When Keynesian microeconomics emerged, the old debate was revived. The question was whether there can be overproduction for a given short period of time in the entire economy? Kornai clearly had to ignore the hypotheses, laws and theorems in order to arrive at the concept of surplus economy. Kornai avoids using the term overproduction. Instead, he characterises capitalism as a continuous, chronic surplus economy, a system that operates with measurable stocks which are sufficient to guarantee the decisions of customers, encourage rivalry and lubricate the machinery in order to overcome problems of regulation. This marks the beginning of a new research programme in the sense of Lakatos (1976), which can take us much closer to reality. It is certain that we need to sacrifice some of the artificial elegance of contemporary mainstream precisely in the interest of relevance.

Kornai (2014) admits that he examines both the exchange of goods and services and employment without addressing the issues of the financial sector, that is, money, credit, interest, fiscal and monetary policy. Thus, just like in his Anti-Equilibrium (1971), he stays within the framework of classical economics. The fiscal and monetary policy, or the policy of income distribution and the prices may increase or mitigate certain surplus phenomena, Kornai argues (ibid, p 118), but this does not create a surplus economy.

He explains the appearance of the surplus economy by the monopolistic competition, the uncertainty of demand, Schumpeterian innovation, creative destruction and growing returns to scale. In my view, this list is not complete, and several other things can be added to it, such as changes in preferences and fashion, expiring models, loss of income, redundant inventories, etc. That is, if demand is smaller than supply, then in the sense of "the rule of the shorter side", the economy is a surplus economy, which presupposes the rejection of Say's law. Demand is not stationary in the market mechanism but it is constantly changing, Kornai argues (2014). We can add to it that it is changing stochastically rather than deterministically, which is also a departure from the set of conditions of the neoclassical school.

He measures the changes in and the dynamics of oversupply using various partial indicators: the capacity of producers and service providers; their utilisation; the turnover of warehouses; queuing and waiting times, etc. In addition to these direct indicators, Kornai considers it important to mention the role of so-called synthetic indicators, such as the "freedom index", the "corruption index" and the "business climate index." The measurement of the above obviously raise serious questions, even though they have considerable influence on the dynamics of demand and supply but, similarly to other composite indexes, their impact can only be quantified on a rather subjective basis. Another question is how to introduce accidence to the measurement of these indicators and whether it is possible to approximate the temporal development of demand or supply by using a probability distribution function, and if so, what function should be used?

## Labour force market: the mechanism of reproducing surplus

In Kornai's interpretation (2014), the number of vacant jobs *(V)* reflects labour shortage, while the number of registered jobless people *(T)* shows surplus labour force. He proposes introducing a statistical method that differs from the usual labour force statistics, in which the surplus labour force is determined by the sum of inactive and unemployed people $(T=M+U)$.[10] For Marx, this is the reserve from which labour force can be recruited in accordance with the needs of the labour market.

During times of economic boom, the market absorbs some of this surplus, which not only reduces unemployment but makes some of the people formerly inactive active (*M*), including those not seeking a job. Kornai acknowledges that whilst it is easy to interpret surplus economy on the market for goods, it is much more difficult on the workforce market. In his approach, the workforce surplus cannot be interpreted on the basis of the natural unemployment rate introduced by *Phelps* (1968) and *Friedman* (1968). All this is further complicated by the fact that the dynamism of capitalist economy and its propensity for innovation constantly create new jobs and eliminates old ones, but these two processes are not in harmony.

At the same time, structural unemployment is not limited to a particular country; it is the consequence of globalisation, the author warns, which can spread internationally as well: if for example the workforce in agriculture flows into industry in China and India, it may result in the loss of jobs in both Germany and Belgium. The more dynamic a capitalist economy, the more structured the unemployment it has to cope with.

When examining the special features of the labour market, we need to put more emphasis than Kornai does on the fact that the conditions of perfect competition (regarding homogeneity and perfect information) are not satisfied, and therefore the labour market cannot operate in accordance with the Walrasian market because its operation is hampered by frictions. Some of the main sources of these frictions include: the discrepancy between the qualification and the needs of the workforce and the different kinds of jobs offered by the companies and their needs; the lack of information due to differentiation; frequent asymmetric information; coordination problems; and the costs of mobility. The search-match models make it possible to analyse these frictions by introducing the so-called matching function. In these models, unemployment is caused by the aforementioned frictions, and it is not reduced to the phenomenon of oversupply. Job-seekers without a job and companies offering vacancies are simultaneously present on the labour market in this model (Diamond, 1982; Mortensen, 1986; Mortensen and Pissarides, 1994; Pissarides, 2000; in Hungarian: Morvay, 2012a). The search-match models have been used in a large number of empirical studies. In these studies, the cyclical nature of so-called steady-state unemployment rate is given an important role (the rate which reflects long-term unemployment at which the number of unemployed people does not change, and with constant labour force the number of people becoming unemployed is equal to that of job-seekers) (see Shimer, 2005; Fujita – Ramey, 2007; Morvay, 2012b studying the Visegrád countries). Kornai's (2014) other constructive proposal in regards to workforce statistics, which would be indispensable for the empirical application of the labour market search models, concerns breaking down the economically inactive population *(B)* into people incapable of work *(N)*, and people capable of work who are nevertheless inactive *(M)*. The EU LFS database offers numerous opportunities for interesting calculations, but because the codes are anonymous, it is impossible to build a group from the database, that is, the data of the different quarters cannot be linked at the individual level. It would be especially important because of these flows to see the course of life the individual households in the sample take: when do people lose their job, when do they find a job, when do they become inactive or, just the opposite, active?

The labour force surplus, that is, unemployment can also stem from the frictions between labour force supply and demand. In general, there is no perfect match between what job-seekers have to offer and what vacancies require in terms of professional qualifications. All this led Kornai to conclude that both continuous structural realignment and matching frictions result in simultaneous shortage and surplus on the labour market.

## THE DUAL ASPECT OF THE DRSE THEORY

The dual aspect of the DRSE model is determined by how prices and effective wages develop on the market. In the neoclassical theory, the price mechanism adjusts the deviations between demand and supply to a steady-state point through the prices: if there is oversupply, the decrease in prices should reduce supply and increased demand.

Here the development of prices does not correspond to the Walrasian tatonnement process. As both demand and supply change in the meantime, there is no convergence towards a specific target because the target is constantly moving. On a market of monopolistic competition, prices are determined by the seller and accepted by the buyer. The stickiness of the price is asymmetrical and rigid especially in the downward direction. The seller is concerned about profit and finds it hard to commit to reducing the price. They are also concerned about deflation and its destructive macro damages.

The author devotes special attention to the conceptual apparatus and the measurement methods of the surplus economy. What is the most important here, and what will become crucial later, is that he does not walk into the trap of the neoclassical school. He does not use any artificial, steady-state price which cleans the market, contrary to the neoclassical theory where oversupply reduces the prices and excess-demand increases them, which eventually leads to the steady-state price. As a result, there appears to be an oversupply in a surplus economy even between aggregated quantities calculated at non steady-state prices when there is an imbalance due to structural oversupply. This is further strengthened by the fact that he treats both supply and demand as a (stochastic) dynamic asymmetric *matching* process.

As the neoclassical school does not introduce market-cleaning wages either, the surplus labour force, that is, "steady-state unemployment" is ensured by the introduction of effective wages, which are slightly higher than the market-cleaning "steady-state wages."[11] There are several macro-economic arguments for underemployment, such as the inflationary spiral of wages and prices,[12] which is also the basis of the natural unemployment rate mentioned before. Another argument of technocrats for the labour force surplus is that it makes the reorganisation of production easier as the required labour force can be mobilised rapidly, and it has a positive influence on work discipline as well. At this point, Kornai departs from the strict economic framework. He rejects both the system specific properties of capitalism resulting in chronic unemployment and the populist political catchwords about full employment.

## NEOCLASSICAL EQUILIBRIUM VERSUS THE SURPLUS ECONOMY

Do not be misled by the section title: we continue to accept the findings postulated by Kornai (ibid, p. 52) that the surplus economy is not compatible with the market equilibrium proposed by the neoclassical school.

There is never a state of rest in the theory of surplus economy, nor on the real market: the various competing or opposing players are constantly changing. Supply and demand diverge from each other over time both in terms of quantity and quality. The continuous innovation process and rivalry prevent the interpretation of the concept of strict market equilibrium on the real market. Therefore, the Austrian school goes as far as to deny the existence of a single price and equilibrium, whilst *Kaldor* (1972) simply called equilibrium economics "irrelevant" and even considered it to be one of the main obstacles that prevents economics from becoming a real science.[13]

We all know that both of Kornai's examples, the growth path of Walrasian equilibrium and Neumann equilibrium, raise several questions for relevance. Kornai himself gave the following criticism of these: "an abstract mathematical model, an analytical tool borrowed from the virtual world (...) (ibid, p. 108)

One can agree with Kornai's statement (ibid, pp. 108–109) that strict equilibrium never exists on a real market. This is why the reader is surprised at his claim that the concept of equilibrium has its place in the description of real markets: it can be used as an etalon or reference point. The question is whether it is possible to call something that is defined by the set of conditions of the neoclassical school a real market. It is well known that (neo)classical economic equilibrium is just an illusion (which Walras himself considered to be just an ideal state), just like Einstein's thermodynamic irreversibility is in physics.

*Debreu* (1959) does not explicitly address Walras' general equilibrium model in his monograph. In *Bourbaki's* approach, the general equilibrium model lost its earlier status and was no longer considered to be an independent formal structure. The fact that Walras' theory was not much respected either in France or the US provided a favourable circumstance for this view. The alternative versions of the neoclassical program, such as Marshall's demand-supply apparatus, had much more supporters in the United States. This is much like the sympathy shown towards Hicks's book (1939) unlike towards Keynes' book (1936). In both cases the explanatory factor might have been the difference in the liberal approach.[14]

Kornai (2014) does not address the problems emerging in connection with Debreu's book (1959), in particular, the Debreu–Sonnenschein–Mantel thesis (in short, DSM). All the three authors started with the premise that the demand and excess-demand functions for the market can be defined by summarising the activities of consumers aimed at maximising utility. They claim that the demand and excess-demand functions for the market, on which all the "intuitive" claims of market-level microeconomics and macro-level macroeconomics are based, do not have the properties that the consumer demand and excess-demand functions possess. To put it more simply: for example, even if everybody's own demand function has a regular shape, we cannot say that the market demand function will also have a regular shape. Only in very special cases can we expect that the economy behaves like an idealised consumer. This view practically destroyed all the endeavours of the economic theory to lay down "micro-foundations", describing aggregated demand and supply as the behaviour of market participants aiming at maximising utility. This is only in seeming contradiction with Kornai's observation (ibid, p. xii) that the explanation for both types of the asymmetrical state, the surplus economy and the shortage economy, lies at the micro level. For him the micro level does not mean the consumer's behaviour aimed at maximising utility but it means the motivations and aspirations of economic agents, the drivers, the irregularities in behaviour, the rivalry between them, etc. According to him, these factors shape the properties of the system, making up its immanent, internal genetic programs (the changing patterns of innovative behaviour) and, eventually, the nature of capitalism to which the subtitle of the book refers.

Kornai's (2014) surplus economy predicts oversupply for the primal aspect of the economy. If he does not make use of the so-called weak complementarity conditions (1) and (2) or the adaptation of duality provided by linear programming proposed by Neumann, that is, correlations (7) and (8), what happens to oversupply, for example to old collections or technologically less advanced products? Kornai does not address this issue explicitly in his book! Or better to say, if he continues to view the capitalist economy as an ex post scholar, he will have to reject the law of so-called single price and accept that these products and services are sold under season clearance sale or last-minute sale at a reduced price. However, this means that the evaluation of the surplus economy requires a completely new price theory that deviates from the neoclassical equilibrium, which is one of the key research directions in this area. On the labour market, effective wages can be accepted as the explanation for unemployment as surplus labour force.

The other important problem is the stability of the surplus economy. On the basis of this, both high and low prices are simultaneously present when the economy is in a state of oversupply, and in addition, they can change randomly in different directions, which suggests that the question of stability and instability are not decided by prices. The continuous survival of the surplus economy is decided rather by Shumpeterian innovation that determines the functioning of capitalism, dynamism, technological progress, and the constant rivalry between producers and service providers for the market. The question is whether this can or needs to be put into a formalised form. This is the question we will attempt to answer in the concluding section.

## CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Kornai is undoubtedly the most authentic and pioneering scholar pursuing research on the differences between social systems and their asymmetrical steady states, even by international standards.[15] As mentioned above, the set of conditions for the general equilibrium theory cannot provide the basis for the theory of surplus economy. In order to prove this thesis, we call upon two excellent economists for help who not only accepted the criticism provided in Anti-Equilibrium but who themselves came up with a similar criticism using a different approach.

One of them is Nicholas Kaldor (1972), who viewed the assumption of decreasing returns to scale proposed by the general equilibrium theory and demonstrated the legitimacy of increasing returns to scale in economic analyses using the results of *Adam Smith* (1776), *Allyn Young* (1928) and *John Maynard* Keynes (1936). This is precisely the condition that Kornai's surplus economy requires. Kaldor even questioned the claim that the "equilibrium prices" has any explanatory power or relevance for the prices used in practice. These proofs corroborate Kornai's theory of surplus economy.

*Thomas Balogh's* book (1982) similarly corroborates the set of conditions in the surplus economy. *"The idea of classical thinkers that they should spend their time editing models, the only criteria of which are consistency and elegance but which could not have relevance for the world in which they lived, would simply have knocked them down as an absurdity! The raison d'etre of their political economy was far from becoming separated from historical and everyday social reality, being used by it, then and there, in order to patch up everyday life."* (ibid, p. 30)[16] In this spirit, free of politics, he scrutinised the assumptions of the neoclassical school purely on scientific grounds and refuted their sustainability from the point of view of empirical economic studies.

Finally, let us see how Kornai explains oversupply and whether the so-called drivers he outlines can contribute to the mathematical formulation of the DRSE theory.

In order to answer the question, let us look at the so-called drivers first, which in some way influence the surplus economy:

- monopolistic competition which leads to excess capacity. According to Kornai, excess capacity is created because the aim is not to maximise profit[17] and therefore the capacities are used to a lesser extent[18] in markets where a limited, imperfect market structure prevails;
- the uncertainty of demand, which justifies the maintenance of product inventories and excess capacities. And this point Kornai introduces a security level, which is the ratio of customers making a purchase in accordance with their intention compared to the total number of customers visiting a store. The higher the security level the larger the inventory should be. This means that the security level minorises the inventory;
- innovation, creative destruction: these ensure technological progress. It is worth noting that Schumpeter stipulated that the pace of creation is greater than that of destruction. The old and the new product and service jointly create surplus compared to the demand. In other words, the supply is greater than the demand;
- return to scale: in the case of increasing marginal cost the return decreases, and with decreasing marginal cost it increases. The obstacle to the increasing volume is that there is no demand for more than a particular quantity of products.

Demand is also a dynamic process: its extent is influenced by the price, the preferences, income and wealth of customers and many other factors, including supply too. In other words, the demand and the supply processes mutually influence each other and are in interaction. Both are described by a multi-variable function. Yet what creates oversupply? What restrains demand? The answer lies in the conflict of interest between employers and employees. The former resist the wage demands of the latter as they could be satisfied only at the expense of profit. The hard budget constraint restrains the spending of both companies and households, which in turn reduces the amount. The concurrent movement of demand-supply-price cannot eliminate the general state of oversupply! This is further supported by the fact that the functioning of the economy is characterised by a demand boundary.

Kornai (2014) made several different proposals, which can lead to the general mathematical model of the DRSE theory. On the basis of my investigations, it is an ergodic dynamic system which has a constantly changing equilibrium point that the system can never reach, and which includes a system of constraints expressing the previously described "drivers" that ensure the functioning of the surplus economy. Undoubtedly, we could get closer to the formulation of the model if Schumpeter had expressed his evolutionary theory in mathematical formulas as well. On the other hand, there are many disequilibrium models in the literature which have attempted to provide a modern overview of Schumpeterian dynamics. Let me call attention to two books here: *Bénassy* (2005) and *Punzo* (2001), as well as *Sinai* (1994), which can certainly get us closer to a specific mathematical formulation of the DRSE model.

## Notes

[1] The author would like to thank an anonymous reviewer for the valuable remarks made on an earlier version of this paper. Any possible errors and mistakes are those of the author.

[2] I agree with János Kornai (ibid, p. 112), who raised a semantic objection to this shortened term which has gained ground in the Hungarian literature, just like the term *competitive equilibrium* has spread in the English-speaking international literature. Although more sophisticated readers know that the shortened term means the equilibrium resulting from the competition between sellers and buyers, there is every reason to expect a technical term to be unambiguous.

[3] Neumann's original paper was so hard to read, not to mention its economic content, that it was no surprise that Nicholas Kaldor, the current editor-in-chief of RES published Champernowne's paper (1945) in the same issue, which was explicitly meant for economists, and for which Samuelson (1989) provided additions much later.

[4] More precisely, uniqueness holds even with technologically or (in the sense of Robinson (1973)) economically weakly reducible structures, which can be explained by the strikingly symmetrical structure of the Neumann model.

[5] These investigations do not require us to use a modern approach to the stability of economic competitive equilibrium. What we have in mind here is the proof using the Lyapunov (1907) function. The most recent results, Scarf (1960) and Gale (1963), however, demonstrated that unstable equilibrium states can exist even in relatively simple Walras models. These counterexamples convinced most of the economists that global stability is just a special case rather than a general property of Walrasian general equilibrium models. For more on this, see Móczár, 2008, pp. 344–346

[6] The term 'evolutionary economics' was first used in a paper published by Veblen (1898). The intellectual forerunner of evolutionary economics was Schumpeter (1954), who made a distinction

between general equilibrium theory and evolutionary economics, implicitly adapted Darwin's evolutionary theory into economics and analysed the nature of evolutionary forces (á la Kornai: "drivers"). The standard work of modern evolutionary economics is Nelson – Winter (1982).

[7] For details, see Simon (1955)

[8] Say stated his renowned thesis "The Law of the Markets" in his 1803 Treatise: "It is worthwhile to remark that a product is no sooner created than it, from that instant, affords a market for other products to the full extent of its own value. When the producer has put the finishing hand to his product, he is most anxious to sell it immediately, lest its value should diminish in his hands. Nor is he less anxious to dispose of the money he may get for it; for the value of money is also perishable. But the only way of getting rid of money is in the purchase of some product or other. Thus the mere circumstance of creation of one product immediately opens a vent for other products." (ibid, p. 167) Say's law was generally accepted for over a century. The faith in it ended when the Great Depression in crisis 1931 lead to a social and political catastrophe.

[9] The last representative of this completely static, unchanging neoclassical system requires perfect or at least the best possible foresight or, as its substitute, the best possible expectation. The latter one resulted in the hypothesis of so-called rational expectations which assumes that people act under the best possible conditions. Numerous studies have already demonstrated that there are dangerous logical contradictions involved in this hypothesis (cf. e.g. Balogh, 1982).

[10] See Table 4.1 (ibid, p. 91) (where *N* should correctly represent people incapable of work rather than the working age population, as in the book)! The header of Table 4.2 (ibid, p. 96) also shows the symbols incorrectly: For Estonia and Lithuania the correct symbol is *v* instead of *u*, while for Slovakia *u* instead of *v*.

[11] Incidentally, even general equilibrium theory defines the steady-state prices that create a balance between the goods and the financial markets on the basis of effective wages. (For this, see Burda – Wyplos, 1995)

[12] Keynes (1936) pointed out that the labour market cannot be compared to any other market. The changes taking place on it, provided that they are general in nature, influence the entire economic system, especially if the economy is dominated by oligopoly (which is quite likely), i.e. a small number of large producers in every sector, where any movement in the wages, and as a result, in the other incomes is followed by changes in prices with some delay or even with no delay. However, Keynes (1936), unlike his closest associate Joan Robinson, evaded examining the inflationary aspect of the problem: he wrote his book in a period of deep recession and focused on demonstrating that unintended unemployment may continue, but can be reduced with the right economic policy.

[13] It is worth noting that Kornai (2006, Ch. 10) criticised Kaldor for this view, although Kaldor uses the term "science" in the sense of "a set of theses which is derived from assumptions based on empirical observations and constitutes hypotheses that can be verified both in respect of the assumptions and the hypotheses." Kaldor (1972, p. 1237) He emphasised precisely the arguments, though not one by one, that Kornai expounded in his book Anti-Equilibrium published in 1971, but he now argues that calling the neoclassical equilibrium into question is both Kaldor's and his fault (ibid, p. 108).

[14] It is also worth mentioning that the cold reception of the Neumann model was not only due to its simplicity but it was also influenced by the remarkable debate between the father of current mainstream (Móczár, 2010b), Samuelson and Neumann. So much so that Samuelson (1992) refutes Neumann's conjecture that in his model growth

could be interpreted in a way which is isomorphic with the potential defined in thermodynamics and the rates of the irreversible processes related to them. For this, see Móczár (2010a)

[15] See Csaba (2015)

[16] Adam Smith's (1776) work provides a remarkably authentic and crystal-clear empirical analysis of the key issues of economics both for the real and the financial sector. It would be misleading to characterise his work with the omnipotence of "an invisible hand" metaphor, all the more so because this term occurs only once in Book IV. Chapter II. It is no wonder that the reader raises the question as to how much our discipline has really developed since then.

[17] This is a key stipulation of the so-called evolutionary economic school. In practice, one of the main features of the Japanese economy is that it does not seek profit maximisation since the Japanese are interested in having a large market in the long term.

[18] "A system which always fully utilises its resources for the best opportunities that are available at a given time may be at a disadvantage in the long term compared to a system which never does so." Schumpeter (1950, p. 83).

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