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By HANS BREMS

110-WORD ABSTRACT

On the fiftieth anniversary of the climax of the Swedish School the present paper examines and compares its founding fathers, Wicksell and Cassel. Fifty years ago, Wicksell's short-run, macroeconomic, dynamic, disequilibrium method was exactly what was needed, and Cassel's long-run dynamic equilibria looked less relevant.

From today's vantage point, Cassel looks better. After thirteen years his optimal depletion of mines came back with Hotelling; after nineteen years his microeconomic growth inspired von Neumann; after twenty years his revealed preference came back with Samuelson; after thirty years his macroeconomic growth came back with Harrod; and after fifty years his dichotomy between nominal and real variables came back with Friedman.

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THE FOUNDING FATHERS OF THE SWEDISH SCHOOL: WICKSELL AND CASSEL*

By HANS BREMS

I. WICKSELL (1851-1926)

1. The Long Run: Fixed and Circulating Capital

Capital is necessary in production, and its necessity has something to do with time. In the capitalist production process, what precisely is it that takes time? Two different types of capital have been distinguished by economists, i.e., fixed and circulating capital.

In the case of fixed capital, what takes time is the utilization of durable plant and equipment. In the case of circulating capital what takes time is the maturing of output in slow organic growth in agriculture, cattle raising, forestry, and winery or in time-consuming construction.

Again and again throughout his life, Wicksell gave profound contributions to the theory of capital.

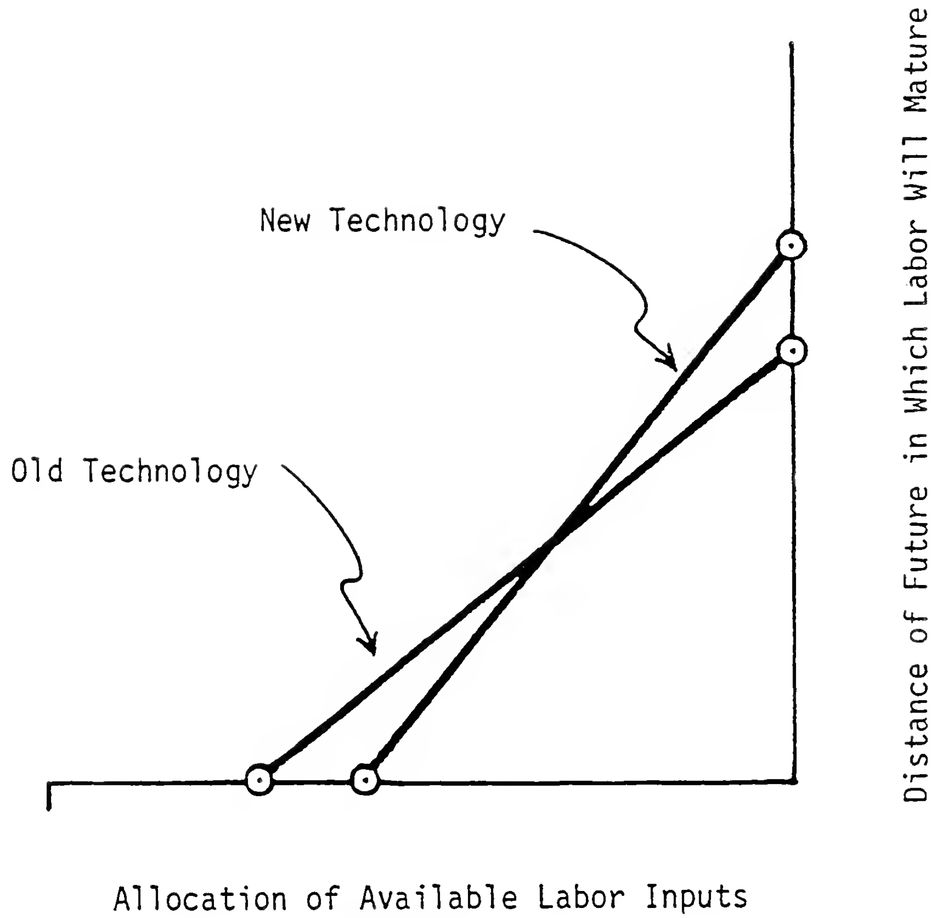
The pioneer of circulating-capital theory was Böhm-Bawerk [1888 (1923)]. Using simple interest, Böhm-Bawerk had built a verbal aggregate model of capital and labor in which all available labor inputs were invested in the same period of production. Given available labor force and available real capital stock, Böhm-Bawerk determined the equilibrium interest and real wage rates. Still using simple interest Wicksell [1893 (1954)] restated Böhm-Bawerk mathematically and summarized his main result in one sentence--the Wicksell Effect: "In the case of a relative increase of the national capital the wage [rate] increases and the level of interest decreases."

Eight years later Wicksell [1901 (1934)] adopted compound interest with continuous compounding, dropped the assumption that all available labor inputs were invested in the same period of production, and drew his famous triangles. Their base showed how a year's available labor inputs were allocated between current and future uses, and their height showed in how distant a future they would mature. As a result, the area of his triangles would show the size of existing capital stock broken down into vintages.

Under given technology, thrift would increase the area of a triangle by increasing its base as well as its height, thus leaving less current labor unabsorbed, hence raising the marginal productivity of current labor. Wicksell [1901 (1934: 164)] concluded that "the capitalist saver is thus, fundamentally, the friend of labour."

Under given thrift, "so long as no further capital is saved," technological progress might be labor-saving. In that case the area of the triangle would stay the same but with a narrower base and a taller height, thus leaving more current labor unabsorbed, hence reducing the marginal productivity of current labor. Wicksell [1901 (1934: 164)] concluded that "the technical inventor is not infrequently [labor's] enemy."

On fixed capital Böhm-Bawerk had been silent and so was Wicksell in [1893 (1954)] and [1901 (1934)]. But three years before his death, Wicksell [1923 (1934)] was inspired by Åkerman (1923) to take up the theory of fixed capital. In an elegant mathematical restatement of Åkerman he built a model of an economy whose capital stock consisted of axes and whose equilibrating variable was the optimal useful life of such axes. Here, Wicksell found an elasticity of optimal useful life with respect to the rate of interest equaling <u>minus</u> one or, in Wicksell's [1923 (1934: 278)] words: "it follows that the product of the rate of interest (with continuously compound interest) and the optimal lifetime of the axe is a <u>constant</u>..."


New Technology
Old Technology
Distance of Future in Which Labor Will Mature
Allocation of Available Labor Inputs

2. The Short Run: The Cumulative Process

Having restated Böhm-Bawerk, Wicksell [1893 (1954)] began to wonder how a "natural" rate of interest thus determined was related to the rate of interest observed in markets where the supply of money met the demand for it. If commercial banks could create money in the form of drawing rights upon themselves, disposed of by checks, such a supply of money would be quite flexible. Would the "money" rate of interest determined by such supply coincide with the "natural" rate? If it didn't, would some equilibrating variable be set in motion and keep moving until the two rates coincided? Wicksell's answer was the following.

The money rate of interest would not have to coincide with a Böhm-Bawerk "natural" rate of interest at all times. If it did not, Böhm-Bawerk's physical output and real wage rate would still prevail--determined as they were by available labor force and available real capital stock. But nominal values would be changing. If the natural rate of interest were higher than the money rate of interest, entrepreneurs would be induced--and the money supply correspondingly expanded--to pay a higher money wage rate. Physically speaking, nothing would come of this, for when labor spent the higher money wage rate, prices would rise correspondingly and unexpectedly leave the real wage rate unchanged. There would be a cumulative process of inflation expected by nobody. Eventually, such inflation would drain the banks for cash, so the money rate of interest would have to be raised to equality with the natural rate--thus stopping the expansion of credit.

If the natural rate of interest were lower than the money rate of interest, entrepreneurs would be induced--and the money supply correspondingly contracted--to pay a lower money wage rate. Again, physically speaking, nothing would come of this, for when labor spent the lower money wage rate, prices would fall correspondingly and unexpectedly leave the real wage rate unchanged. There would be a cumulative process of deflation expected by nobody. Eventually, such deflation would leave the banks with so much cash that the money rate of interest would have to be lowered to equality with the natural rate--thus stopping the contraction of credit.

Wicksell's [1898 (1936)] answer was made possible by a method fundamentally new in three respects. First, Wicksell's method was explicitly macroeconomic, second, it was explicitly dynamic and, third, it was an explicit disequilibrium method based upon adaptive expectations whose disappointment constituted the motive force of the system.

Such a short-run, macroeconomic, dynamic, disequilibrium method was just what was needed in the thirties. All that remained to be done was to add physical output as an additional variable. Ohlin (1934) was inspired by Wicksell in the sense that his feedback between physical output and aggregate demand unfolded in a cumulative process along a time axis and was a succession of disequilibria: expectations and plans were forever being revised in the light of new experience.

3. The Long Run: Nonconstant Returns to Scale

Wicksteed was the first to formulate the product-exhaustion theorem but [1894 (1932: 33)] considered a linear homogeneity of his production function "of course obvious." It was left to Wicksell [1901 (1934: 128-129)] to examine the stability of a product-exhaustion equilibrium by asking what would happen if, still assuming pure competition, returns to scale were not constant. Wicksell added exit and entry to the picture and thought of the scale of the production function as passing gradually through three domains.

The first domain consisted of relatively low scales on which the returns to scale would be increasing. Here, if every input were paid its marginal value productivity, the entrepreneur would find himself going broke. The slices would be adding up to more than the pie! With such negative profits, there would be exit from the industry, and the number of firms in it would be declining. With fewer firms, each firm would be growing in scale, hence passing out of the first domain and into the second.

The second domain consisted of relatively medium scales on which the returns to scale would be constant. Here, if every input were paid its marginal value productivity, the entrepreneur would find himself just breaking even. The slices would be adding up to just the pie! With such zero profits, there would be neither exit from nor entry into the industry, and the number of firms in it would remain stationary. With a stationary number of firms, each firm would remain stationary in scale and remain in the second domain.

Wicksell's third domain consisted of relatively high scales on which the returns to scale would be decreasing. Here, if every input were paid its marginal value productivity, the entrepreneur would find himself with something left--a distributive share not explained by the marginal-productivity principle. The slices would be adding up to less than the pie! With such positive profits, there would be entry into the industry, and the number of firms in it would be growing. With more firms, each firm would be declining in scale, hence passing out of the third domain and back into the second.

Unlike Marshall, Wicksell was willing to surrender the assumption of pure competition. In [1901 (1934: 129)] he defined his "optimum scale" as lying "at the point of transition from 'increasing' to 'diminishing returns' (relative to the scale of production). The firm will here conform to the law of constant returns." At such an optimum scale firms might still be [1901 (1934: 130)] "numerous enough for perfect competition to be maintained," or they might not: "If the optimum scale of the enterprise is so high, and the number of enterprises consequently so small, that the owners can easily combine in a ring, trust, or cartel; then there no longer exists any equilibrium of the kind we are here considering."

II. CASSEL (1866-1945)

1. The Long Run: Microeconomic Growth

Cassel [1923 (1932: 32-41 and 137-155)] was the first to dynamize general equilibrium into his "uniformly progressing state," thus inspiring John von Neumann [1937 (1968)] who, as Weintraub (1983: 4-5) has pointed out, knew the Walras system only in its Cassel version. In neither Cassel nor von Neumann did prices display any growth, only physical quantities did.

Let there be m physical outputs supplied by industry and demanded by households, on the one hand, and n primary physical inputs supplied by households and demanded by industry, on the other. Cassel set out his dynamic system as follows. Input prices will equalize the given supply of any input with the demand for it. Once such prices are known all incomes are known. Multiply each such price by the technical coefficient for an industry, add such products for that industry, add interest, and find the price of the output of that industry. Once all incomes and such output prices are known consumer demand follows. Output prices will equalize the supply of any output with the demand for it. Once such industry supplies are known, multiply each of them by the technical coefficient for an input, add growth, add such products for that input, and find the aggregate demand for it. Input prices will equalize the given supply of any input with such demand for it. Thus we are back at our point of departure. Unlike Walras, Cassel was a mathematician before he turned to economics. But like Walras, he counted equations and unknowns and merely said [1923 (1932: 140, 145)] that equal numbers of them would "generally" suffice to determine the unknowns--with one reservation.

Like the Walras system, the Cassel system was homogeneous of degree zero in its prices, money expenditures, and money incomes. In this sense the system was indeterminate. The job of determining absolute prices, money expenditure, or money incomes would be left, Cassel [1923 (1932: 154-155)] said, to monetary policy. Here we see Cassel anticipating Friedman's (1968) dichotomy between nominal and real variables: monetary policy can affect nominal variables but never real ones.

Was Cassel no more and no less than Walras, then? He was at the same time more and less.

Walras asked how a stationary economy would allocate inputs among outputs and outputs among households. Cassel asked how a growing economy would do those things and showed [1923 (1932: 153)] that in a growing economy the current physical input required per physical unit of current output was a new coefficient that would "contain, in addition to the elements of the old 'technical coefficients,' only the rate of progress." In this sense, Cassel was indeed more than Walras.

Walras thought of utility as a measure of human sensation. Pareto [1906 (1971: 105-133)] abandoned the meaning of utility as such a measure and replaced it by a utility index. Infinitely many indices would serve equally well as long as any of them was a monotonic transformation of any other. Here we may ask two questions. First, given a utility function using such a Paretian index, can a demand function always be found by maximizing the utility function subject to a budget constraint? The answer is yes provided the utility function is differentiable and strictly quasi-concave. Second, given an observed demand function, can a utility function always be found whose maximization subject to a budget constraint will deliver the given demand function? Here the answer is: not necessarily. Antonelli (1886) and Fisher (1892: 86-89) were the first to see this so-called integrability problem.

Cassel may never have heard of the integrability problem; at least he never mentioned it. What he did say was that demand is observable and that utility is not. As a quantitative science economics must deal with observables only, so Cassel [1899, 1923 (1932)] purged his system of all references to utility. In this sense he was less than Walras and the first to use revealed preference--anticipating Samuelson (1938) by 20 years.

So Cassel was at the same time more and less than Walras. Either way his debt to Walras is apparent. Cassel (1899) did mention Walras but merely to scold him for his utility concept. Nowhere in Cassel [1923 (1932)] can the name Walras be found. In his autobiography Cassel (1940: 435) says: "When [after 1899] I continued developing economic theory on the foundation I had chosen, I found it unnecessary to occupy myself with Walras and actually never had time to open his works."

2. The Long Run: Macroeconomic Growth

Thus Cassel had given us a microeconomic growth model. But later in the same volume he [1923 (1932: 61-62)] also gave us a macroeconomic one, fully set out in hard algebra identical except for notation to that of Harrod (1948) 30 years later. Exactly as in Harrod the equilibrium rate of growth of output equaled the propensity to save divided by the capital coefficient. Since both were stationary parameters, the rate of growth was stationary: growth was steady-state and balanced or, in Cassel's [1923 (1932: 62)] own words: "We ... come to the conclusion that, in the uniformly progressive exchange economy, the total income as well as both its parts--consumption and capital accumulation--increases in the same percentage as the capital."

In a Cassel model a higher propensity to save would permit more investment and hence more rapid growth; indeed the steady-state equilibrium rate of growth was in direct proportion to the propensity to save. Saving was a Good Thing! Writing in 1914, Cassel had no Keynesian savings paradox to unlearn and observed [1923 (1932: 61-62)] that "saving is the chief element in progress."

Cassel saw his uniformly progressive economy merely as a first, but important, approximation--many other possible patterns were to be found at Stockholm by Lundberg (1937).

3. The Long Run: A Theory of Mining

Sweden was traditionally a major exporter of iron ore and had traditionally applied a conservationist public policy imposing a maximum export quota. Cassel's advice was to do away with the export quota and let the market decide what the optimal depletion of mines should be. What should it be, then? Cassel [1923 (1932: 289-297)] showed that in a free market optimal depletion would depend on the rate of interest and the future price of the mineral: Given the rate at which price and cost per ton were inflating, optimal depletion would be the faster the higher the rate of interest. And given the rate of interest, optimal depletion would be the slower the higher the rate at which price and cost per ton were inflating.

III. A COMPARISON

Wicksell and Cassel both came to economics from mathematics. Thus both had a head start, but Wicksell made more operational, and therefore more effective, use of his mathematics. Both men had a remarkable ability to reduce a problem to its essence; both wrote a terse and lucid German. Both were original thinkers, but Wicksell thought deeper. Cassel's comparative advantage was his ease with data. Long before the days of national income accounting, Cassel managed to find and effectively use the data he needed. One example is his estimate of the capital coefficient and the propensity to save. Another example is the massive use of data in his business-cycle theory to which Wicksell [1919 (1934: 255)] paid tribute: "it is in my opinion incomparably the best part of his work. Professor Cassel's great gifts for concrete description based on facts and figures here show to advantage."

In character Cassel and Wicksell were as different as night and day. A writer more generous to others than Wicksell would be hard to find. By contrast, Cassel followed Walras and Pareto, mentioned neither, and never paid tribute to anybody. Indeed if Cassel's autobiography (1940-1941) and the successive editions and translations of

Theoretische Sozialökonomie were marred by a unifying theme it was his lack of generosity to others and his conviction of his own infallibility, so irritating to his reader--and so redundant: his work could well have spoken for itself!

From the vantage point of the thirties, Wicksell's short-run macroeconomic, dynamic, disequilibrium method was exactly what was needed, and Cassel's long-run dynamic equilibria, whether macroeconomic or microeconomic, looked less relevant.

From the vantage point of the eighties, Wicksell may still look like the more profound thinker. But Cassel is not as far behind as he seemed to be in the early thirties. His microeconomic growth inspired von Neumann (1937), his optimal depletion of mines came back with Hotelling (1931) 13 years later, his revealed preference came back with Samuelson (1938) 20 years later, his macroeconomic growth came back with Harrod (1948) 30 years later, and his dichotomy between nominal and real variables came back with Friedman (1968) 50 years later.

FOOTNOTE

*Parts of the present nontechnical paper utilize passages from the author's more technical (1986a), (1986b) and (1986c).

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