OUR WASSILY: W.W. LEONTIEF (1905-1999)

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Leontief had a long and picturesque life in three countries, on two continents. Over sixty years his was a bully pulpit at Harvard and NYU. (It was a nineteenth century Harvard graduate who said, "Good Americans, when they die, go to Paris." It is I who says: "Good economists, before they die, go to NYU." Fritz Machlup, Oskar Morgenstern, Will Baumol and Wassily Wassilyovitch Leontief will know I state the truth.)

At the editors' invitation, I speak here for an early generation of Leontief's boys, those in his special workshop within a golden pre-war Cambridge age. Listed in approximate chronological order, I bear witness for Abram Bergson, Paul Samuelson, Sidney Alexander, Shigeto Tsuru, Lloyd Metzler, Dick Goodwin, Jim Duesenberry, Hollis Chenery and Bob Solow: a baker's half dozen that owing only to age-related inadvertence omits to mention a few other celebrated names. (Marion Crawford [Samuelson] was at least one gender exception: her 1937 Summa Senior Honors Thesis was written as Leontief's Radcliffe tutee.)

For a long time I was as much younger than Leontief as Solow is younger than Samuelson. However, late in the era of the Soviet Union, revisionist research into Czarist vital statistics pushed back from 1906 to 1905 the birth year of my beloved master. But what signifies age? When I first glimpsed

Wassily, brown-suited, dark, scarred and handsome, at the 1934 Palmer House Chicago meeting of the AEA, he looked much the same as when at 69 he left Harvard in a huff for NYU. Even in the months before he died in 1999, his appearance had not changed much. I may also add that his foreign accent softened little over the years; but after my first hour of hearing him lecture, his soft-spoken words came through loud and clear.

We graduate students spun legends in the Junior Common Room about our mentor. At the age of puberty, as a Menshivick his life was spared by the Bolshevicks in the hope that he would grow up to know better. The scar on his neck was not the wound from a student's duel; actually the German operation that produced it did provide him the exit visa to leave the USSR. (Unlike Prokofiev he never went back--except to preach to his Fatherland the virtues of input/output analysis.) Like an earlier immigrant, Simon Kuznets, the young Leontief first seemed quite apolitical in America. Later he reversed the usual lifecycle: with age, conservative cynicism peeled of f--particularly after those Republicans cut back on input/output development.

In 1935 Harvard was just moving from torpor into an Elizabethan renaissance. Frank Taussig had aged. Allyn Young had died prior to returning from the London School to Harvard. Failing to achieve tenure, Laughlin Currie had recently been banished to Washington. Charles Jesse Bullock and Thomas Nixon Carver had at long last retired. Economic historian Edwin Gay,

although he may not have known it, was in his last year at Harvard (thereby liberating Abbott Payson Usher to teach graduate students). John Williams led cracker-barrel seminars that were respectable and, after Alvin Hansen arrived (in 1937 by a Harvard miscalculation!), the two made a great macroeconomic duo. Edward Chamberlin at 35 was, judged retrospectively, at the zenith of his scholarly career; Edward Mason was not yet the important elder statesman he was to become. Other local worthies can mostly be overlooked.

Thanks only in part to Adolf Hitler, the foreign rescuers were on their way: Schumpeter from Austria and Weimar Germany; Haberler from Vienna and the League of Nations. It must have been the newly-arrived-in-Cambridge Schumpeter who plucked Leontief from a brief National Bureau stint to Harvard. (I suspect Schumpeter fastened on Leontief as a genius on the basis of the 24-year-old's German article on how to identify demand and supply elasticities from a time-series sample--a brilliant investment decision even if not 100% cogent.)

It was only in the calendar year 1935 that Schumpeter and Leontief were permitted to lecture on their specialties. That was luck for me since it provided both a telescopic and a microscopic add-on to my training. It rescued me from my miscalculation which had diverted me from Morningside Heights to the Harvard Yard. (When the Social Science Research Council, my Medicis, dictated that I leave Chicago, Midway locals without exception advised choosing the Columbia of

Wesley Mitchell, Harold Hotelling and J.M. Clark. Joseph Schumpeter, I was told, was the eccentric who believed in a zero interest rate for the stationary state. Leontief neither I nor they knew anything about. Before Seymour Harris was an "inflationist," Lloyd Mints warned me against him as one. Independently of any Chicago reading list, I had discovered on my own the (1933) Theory of Monopolistic Competition on the SSRC Reserve Room shelf. That predisposed me toward Harvard. But truth to tell, it was because I expected Harvard to be like Dartmouth--located around a New England green common, with a white chapel tower and much ivy on the walls--that I arrived by street car, unannounced, at the Harvard Yard.)

That first registration day I gladly burned my bridges. Defying undescribable high authority, William Tell refused to take economic history from Gay. (I already knew it from John U. Nef.) That made room to take two advanced courses: one was from Chamberlin; 21 years later when I substituted for him to teach the basic elementary Harvard graduate course in theory, I encountered precisely the same unchanged reading list: J.S. Mill, A. Marshall, E.H. Chamberlin and J.V. Robinson! Eschewing Gay in the spring semester, I was able to learn genuine modern statistics from E.B. Wilson, bypassing Edwin Frickey (who with Leonard Crum taught at Harvard courses *against* modern statistics!). But all was not lost.

For the first time Wassily gave a one-semester mathematical economics seminar; it was camouflaged as "Price

Analysis" but that didn't fool me. We were a small class. Abe Bergson, then a third-year graduate student, was one attendee. Another was Harvard honors senior Sidney Alexander. Maybe Shigeto Tsuru and Philip Bradley were auditors, as was Schumpeter occasionally.

Here is what we learned from late September to almost November Thanksgiving: (a) specified two-good indifference contours, non-intersecting and "convex to the origin;" (b) a negatively-sloped budget line; (c) no indicator of **cardinal** utility at all. The commodity on the vertical axis was specified to be numeraire good, so that P_1/P_2 determined the absolute slope of the budget line. (d) As this price ratio changed, the budget line pivoted around the intercept where it hit the vertical axis. (e) What could we **prove** about the signs of $aq_1/a(P_1/p_2)$ and $aq_2/a(p_1/P_2)$? But first, (f) what might be true of the signs of income elasticities or of $[aq\sim/a(I/P_1)]$ when I/P_1 is defined as $(P_2/P_1)q_1 + q_2 = I/P_1$, the budget constraint?

We learned that, in so-called Normal Case(s), **both income** elasticities would be positive. But also there could be cases where one, but **not both,** of the income elasticities could be negative. Finally, somewhere between Columbus Day and Thanksgiving, we found the Holy Grail at the North Pole.

Theorem: In all "normal" cases, own-price elasticities were indeed negative. However, in a case where a good's income elasticity was negative

and much was spent on it, Giffenosity could obtain

to make $3q\sim/3(P_1/P\sim) > 0$!

We didn't learn this by writing down in our notebooks the professor's dictated statements of the theorem. We PROVED it by 2-by-2 determinants! Ah bliss.

No other course I ever took so profoundly set me on the way of my life career. It was so to speak slow motion, and all the better for that. It prepared me to master Edwin Bidsell Wilson's exposition of Willard Gibbs' thermodynamic analysis. Leontief assigned no readings in Pareto or Allen-Hicks or, for that matter (1913) W.E. Johnson or (1915) Eugen Slutsky--only our own laboratory work. Then, after Thanksgiving, we replaced the linear budget equation by a 1930 Haberlerian concave "opportunity-cost" curve--thereby mastering Leontief's own (1933) *QJE* vindication of (1879) Marshallian offer curves in international trade. Obviously we were prepared for James Meade's later (1952) graphics of international trade.

I have told more than once how Haberler's resistance to indifference curves provoked from one brash Leontief student the rebuke: "Well, without indifference curves, your 1925 Vienna Ph.D. thesis on index numbers evaporates into thin air." The theory of revealed preference was born one second later as I listened to what *I* was saying.

Although Wassily rarely lectured on *his* current

researches, this was a golden decade in his own life. (Also, it was that for Abba Lerner far away in London. And for the Oskar Lange whose muse left him after his patriotic return to post-war Soviet-satellite Poland.) Notable and already mentioned was Leontief's **QJE** paper on indifference curves in international trade. Less noticed was his (1934) paper--in German, but translated in collected (1966) *Essays--on* cobweb dynamics of nonlinear supply and demand curves: here his topological explorations into multiple periodic motions came close to chancing on modern **chaos** theory. Already his Harvard lectures introduced testable partial differential equations for disaggregation separability: in my 1941 thesis, **Foundations** *of Economic Analysis* (1947, p. 178), I referred to the **Leontief** condition for independence of goods x and y, namely a^2 log (Marg. rate of Subt.)/ax8y 0.

Leontief's middle and final decades were increasingly preoccupied by input/output researches. These were of tremendous value to society and to him. His Nobel Prize properly cited them. Well and good. A scholar should follow his own instincts and volitions. Still, I have to confess to a certain regret. Max Born, the Physics Nobel Laureate who helped to found the better post-Bohr Quantum Mechanics theory, expressed my sentiments when he wrote to the Albert Einstein who, from the age of 45 on, concentrated all his energies on creating a new unified field theory combining gravity, relativity, quantum theory and cosmology. To do this, Einstein

chose to cut himself off from most of the frontier developments in 1925-1970 physics. Born wrote to his admired master: "We are left to struggle on without our leader." I am much like Oliver Twist who always asks for "More." So original and lively an economist as Leontief, in my contra-factual history, could well have given us another volume of diverse and sparkling collected papers like those in his classic 1966 book. The whole world appreciated the genius of Wassily W. Leontief. But we his disciples knew the full measure of his inspiration.

At Berlin Leontief was lucky in his teacher Ladislaus von Bortkiewicz, a keen contributor to statistics and to mathematical economics. Matching this depth came the width from Werner Sombat, the grandiose creator of theories for economic history. From Bortkiewicz's improvements on Marx must have come an early interest in the Quesnay-like circular interdependence of input/output; but from my later explicit quizzing of him, I can rebut the innuendo that he ever did know the (1898) work of Vladimir Dmitriev. Just as Sraffa's (1960) book on input/output never cited Leontief, Leontief's 1925-1999 writings seem never to have cited the work of Sraffa.

I try not to make those venial mistakes. I am conscious of how much I have benefitted from teachers like Leontief: at Chicago Jacob Viner, Henry Simons, Frank Knight and Paul Douglas; at Harvard Edwin Bidwell Wilson, Joseph Schumpeter,

Leontief, Gottfried Haberler and Alvin Hansen. It is humbling when one weighs accomplishments against advantages. Old school ties are dummy variables that boost one's R^2. And when your teachers pass off the stage, your students step in to add on their push. All the while the wind is broken for us by contemporaries like Abram Bergson, Robert Solow, Kenneth Arrow, Gerard Debreu, Abraham Wald, Lionel McKenzie and the rest of the Invisible College.

Sixty-five years have not dimmed memories of that golden age in the Harvard Yard: so to speak Wassily Leontief at one end of the log and me at the other.

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