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JAMES TOBIN AND MODERN MONETARY THEORY

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JAMES TOBIN AND MODERN MONETARY THEORY

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Abstract: This paper examines the relationship of the monetary economics of James Tobin to modern monetary theory, which has diverged in many ways from the directions taken by Tobin and his associates (for example, moving away from multi-asset models of financial market equilibrium and from monetary models of long-run economic growth) but which has also built upon aspects of his work (e.g. the use of simulation and calibration in his work on inter-temporal consumption decisions). Particular attention will be paid to Tobin's unpublished series of three Gaston Eyskens Lectures at Leuven on *Neo-Keynesian Monetary Theory: A Restatement and Defense*, and the paper draws on my forthcoming volume on Tobin for Palgrave Macmillan's series on Great Thinkers in Economics.

Keywords: James Tobin, modern monetary theory, microeconomic foundations, Keynesian economics, corridor of stability

JEL Codes: B22, B31, E12

INTRODUCTION: AN "OLD KEYNESIAN" AMONG MONETARY ECONOMISTS

James Tobin (1974, p. 1) began his John Danz Lectures by reminding his audience that "John Maynard Keynes died in 1946, and his *General Theory of Employment, Interest and Money* was published ten years earlier. Yet Keynes and his book continue to dominate economics." A very few years later such a claim could not be made: when Tobin opened his Eyskens Lectures at Leuven, *Neo-Keynesian Monetary Theory: A Restatement and Defense* (1982c, pp. 1-2), about "the living tradition of Keynesian monetary theory, which has greatly revised the letter of Keynes's own writings, while remaining true to its spirit", he acknowledged that "Today of course the tradition is under strong attack from a classical counter-revolution, espousing the quantity theory, the real-nominal dichotomy, and the neutrality of money." As the subtitle of his Eyskens Lectures indicates, he had moved to the defensive – even though the lecture series had been rescheduled because he had to go to Stockholm on the original date of the lectures, to accept the Royal Bank of Sweden Prize in Economic Science in Memory of Alfred Nobel. Although Janet Yellen, nominated in October 2013 to chair the Federal Reserve System, "decided to pursue a doctorate at Yale University after hearing a speech by James Tobin, the economist she still regards as her intellectual hero" (Appelbaum 2013a, p. A18) and wrote the foreword to Tobin (2003)[1], and Robert Shiller, one of the Nobel laureates in economics the following week, was closely linked with Tobin and shares his views on financial market efficiency (Tobin 1984, Colander 1999, Shiller 1999, Appelbaum 2013b), the mainstream of monetary economics (at least until its confidence was shaken by the financial crisis that began in 2007) moved away from Tobin's approach from the late 1970s onward (see, e.g., the elegiac tone of Solow 2004)[2]. Mainstream monetary economics (as represented, for example, by textbooks such as McCallum 1989 and Walsh 2003) moved far enough away from Tobin[3] and Keynes – before the current crisis -- that Robert Lucas (2004, p. 12) could describe himself, only partly in jest, as "a kind of witness from a vanished culture, the heyday of Keynesian economics. It's like historians rushing to interview the last former slaves before they died, or the last of the people who remembered growing up in a Polish shtetl." In this paper, I examine what Tobin meant when he termed his approach "A General Equilibrium Approach to Monetary Theory" (1969), how it contrasted with what others meant by general equilibrium monetary economics, why Tobin's approach failed to appeal to monetary

[1] In the 1970s Tobin, Yellen, William Brainard, and Gary Smith worked on a manuscript of a textbook on the intellectual development of macroeconomics (Yale University Library 2008, MS 1746, Accession 2004-M-088, Box 8), begun in the 1960s before Yellen's arrival as a Yale graduate student, but it never progressed nearly as far as the manuscript on monetary theory, begun in the 1950s, that eventually became Tobin with Golub (1998).

[2] See Colander et al. (2009), Blanchard (2009) and Laidler (2010) on the extent to which the crisis might change macroeconomics, and Colander, ed. (2006) and Colander et al. (2008) for advocacy of moving beyond dynamic stochastic general equilibrium (DSGE) models to agent-based simulation, which harks back to the simulation model of Brainard and Tobin (1968) as well as to the microsimulation studies of Tobin's colleague Guy Orcutt (see Orcutt et al. 1976, Orcutt 1990).

[3] The index to Snowdon and Vane (2005) has 46 entries for Tobin – but that book is as much a history of modern macroeconomics as a survey of current practice.

economists in the 1980s and later, and how Tobin's monetary economics relates to developments since 2007, particularly his modeling of a corridor of stability (Tobin 1975, 1980, 1993) and his emphasis that Keynesian economics is not about unexplained rigidity of nominal wages but about downward flexibility of money wages may fail to eliminate unemployment (as in Keynes 1936, Chapter 19 "Changes in Money-Wages").

Tobin accepted the label "Old Keynesian" (see e.g. Tobin 1993), distinguishing his approach from New Keynesian economics (which he considered as the addition of nominal rigidities such as menu costs to what were otherwise New Classical rational expectations, natural rate models) or Post Keynesian economics which rejected neoclassical microeconomics and optimization. Tobin belonged to the generation that came to Keynesian economics in the late 1930s and the 1940s, notably, in the United States, the Nobel laureates Paul Samuelson, Robert Solow, and Franco Modigliani at MIT and Lawrence Klein at the University of Pennsylvania (see Klein 1946, Modigliani 1986, 2003, Solow 2004). Among the leaders of that generation of American Keynesians, Tobin stood out for his emphasis on financial intermediation in a multi-asset monetary-exchange economy[4].

Introducing his Eyskens Lecture 2 "On the Stickiness of Wage and Price Paths," Tobin (1982c, p. 1[5]) stated, "I want to emphasize that Keynesian theory is not solely or even primarily a story of how nominal shocks are converted, by rigid or sticky nominal prices, into real shocks. Keynes believed that real demand shocks were the principal sources of economic fluctuations, and he did not believe that flexibility of nominal prices and wages could avoid these shocks and those fluctuations. Modern 'new classical' macroeconomists assume the opposite when they use 'flexibility' as a synonym for continuous and instantaneous clearing of markets by prices." This theme, which recurred explicitly in Tobin's writings from 1975 onward, is crucial to his understanding of what he meant by calling himself an "Old Keynesian." From 1975, Tobin (1975, 1980, 1993, 1997) and, independently, Hyman Minsky (1975, 1982, 1986)[6] insisted on Chapter 19 as an integral part of the central message of Keynes's *General Theory*.

[4] Among monetarists (a term coined by Brunner), Karl Brunner and Allan Meltzer (1993) stood out for their emphasis on multiple, imperfectly-substitutable assets. Given the considerable resemblance between the structures of their models, Tobin could never understand how Brunner and Meltzer could get the monetarist result of money having such a special role among the many imperfectly-substitutable assets (apart from the exogenous fixing of its own-rate of return), and Brunner and Meltzer could never understand why Tobin didn't get such a result (see Brunner 1971, Meltzer 1989, and the contributions of Brunner and Meltzer and of Tobin to Gordon 1974).

[5] The typescript of Lecture 2, which is 56 pages long, is not paginated. Lecture 1 "Major Issues in Monetary Theory," in typescript, and the Lecture 3 "The Transmission of Monetary Impulses," partly in typescript and partly in manuscript, are paginated.

[6] Minsky (1975) and Tobin (1980) also drew attention to Irving Fisher's long-neglected "Debt-Deflation Theory of Great Depressions" (1933). Minsky and Tobin met as Harvard graduate students competing for the attention of Leontief and Schumpeter, and their long, uneasy professional relationship included disagreements about the extent to which they disagreed with each other (see Dimand 2004b, and Tobin, "The Minsky Agenda for Reform," presented 1999 and published in Tobin 2003). Tobin had not known of Fisher (1933) in the early 1960s, when Axel

Keynes, who was an outspoken critic of Britain's return to the gold exchange standard in 1925 at an exchange rate that required a reduction of British prices and money wages, was of course acutely aware that British money wage rates fell only slowly in the face of substantial unemployment after "the Norman conquest of $4.86," and in Chapter 2 of *The General Theory*, he explained why, given overlapping contracts, workers who cared about relative wages would, without any irrationality or money illusion, resist money wage cuts without offering any comparable resistance to price level increases that reduced the real wages of all workers at the same time without affecting relative wages (Tobin 1982c, Lecture 2, p. 38). Keynes's Chapter 2 analysis of overlapping contracts and relative wages as a cause of rational downward rigidity of money wage rates, consistent with the failure of money wages to drop in Britain after the return to the prewar parity of sterling, was independently reinvented by John Taylor (1980), whose work was hailed as a great advance over Keynes's supposed reliance on money illusion[7]. But Keynes, both in *The General Theory* and in his lectures in the early 1930s (reconstructed from student notes in Rymes 1989), also emphatically drew attention to the fact that money wage rates in the United States had fallen by 30% from 1929 to 1932 without preventing or eliminating mass unemployment and even without reducing real wages, because the price level fell by slightly more (see Dighe 1997 and Dighe and Schmitt 2010 on what happened to US money wages between the wars). In Chapter 19, Keynes dropped the simplifying assumption of given money wages and argued that while a *lower* price level and *lower* money wage rate would be expansionary, the same did not hold for *falling* prices and money wages: deflation lowers the opportunity cost of holding real money balances, causes consumers to defer purchases until prices are lower, and, as Keynes (1931a,

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Leijonhufvud initially intended to write his PhD dissertation on his independent discovery of the debt-deflation theory of the Great Depression: "Despite a year (1963-64) at the Brookings Institution, where Leijonhufvud discussed his thesis with James Tobin, he did not discover Irving Fisher's work until the end of the year, when David Meiselman told him to look in the early issues of *Econometrica*" (Backhouse and Boianovsky 2013, p. 54).

[7] Ironically, despite his prompt positive reaction to most of Keynes (1936), Tobin's undergraduate honours thesis, nominally supervised by his final-year tutor Edward Chamberlin with more active advice from Wassily Leontief and published as Tobin (1941), saw money illusion in Keynes's Chapter 2 labour supply schedule (a view of Keynes's labour supply schedule also held by Leontief), rather than overlapping contracts and rational concern with relative wages: "In fact the first thing I wrote and got published [in 1941] was a piece of anti-Keynesian theory on his problem of the relation of money wage and employment" (Tobin, interviewed in Snowdon and Vane 2005, p. 151). Perhaps that is why Tobin, in his remarks at the 1983 Keynes Centenary Conference, stated, "I *now* think, however, that Keynes provides a theory free of this taint" of money illusion (reprinted in Tobin 1987, p. 45, emphasis added). The concept of money illusion is not due to Keynes, who insisted in his Chapter 2 that downward stickiness of money wages in Britain was due to a rational concern with relative wages, but to Irving Fisher, author of *The Money Illusion* (1928). Fisher hoped to stabilize the economy by educating people about fluctuations in the purchasing power of money, producing a weekly commodity price index from his Index Number Institute. Tobin (1941), his "piece of anti-Keynesian theory," was contemporaneous with a distinctly fiscalist and un-monetarist book called *Taxing to Prevent Inflation*, a study submitted to the Treasury in fall 1941 and coauthored by Milton Friedman (published as Shoup, Friedman and Mack 1943).

1931b, pp. 168-78; 1936, Chapter 19, pp. 264, 268, 271[8]) and Fisher (1933) had stressed, raises the risk of bankruptcy and default because of debts fixed in nominal terms. Consequently Keynes *recommended* not cutting money wages, rather than *assuming* money wages would not fall. Nonetheless, Guillermo Calvo (2013, p. 51) announces his discovery that "Actually, the deleterious effects of DD [debt-deflation] would be *minimized* if the economy displays GT [*General Theory*] characteristics, that is, complete price/wage inflexibility!"

As far as macroeconomics textbooks are concerned, none of these points might ever have been made. In the leading graduate macroeconomics textbook, written by a self-identified "New Keynesian," David Romer (4th ed., 2012) treats "Keynes's model" as just unexplained rigidity of the money wage rate[9] (no overlapping contracts and relative wages from Chapter 2, no Chapter 19) and, when discussing the Great Depression in the US in the early 1930s, does not mention that money wage rates went down, let alone down by 30% over three years[10]. A learned literature debates whether the actions and public statements of the Hoover Administration or those of the Roosevelt Administration were to blame for the supposed failure of money wage rates to fall in the Depression (e.g. Cole and Ohanian 2004), a literature that takes for granted that a (further) reduction in money wage rates would have reduced real wages in the same proportion without affecting the price level. Even Roger Farmer (2010b, p. 180 n6), citing Cole and Ohanian (2004), writes, "In the first three years of the Great Depression manufacturing wages rose slightly and real wages increased", a sentence that would be pointlessly repetitive unless the

[8] Guillermo Calvo (2013, p. 51, n 20) declares that "There seems to be no reference to DD [debt-deflation] in the GT [*General Theory*]." The references in Keynes (1936, Chapter 19, pp. 264, 268, 271) are all cited in the index under "Debts, burden of, and changes in money wages."

[9] Long before Keynes, Thomas Robert Malthus held that "We know from repeated experience that the money price of labour never falls till many workers have been for some time out of work" (Malthus to David Ricardo, 16 July 1821, in Ricardo 1951-73, Vol. 9, p. 20). Even Jean-Baptiste Say, who famously attributed crises and unemployment to changes in the composition of demand rather than any deficiency in the aggregate level of demand, recommended public works as a remedy for unemployment during transition periods (Hutchison 1980, p.3).

[10] Another fact no longer mentioned in macroeconomics textbooks such as Romer (2012) is that US gross private domestic investment fell by 94% from $16.2 billion in 1929 to $1.0 billion in 1932 and $1.4 billion in 1933 (so that net private domestic investment, which had been +$8.7 billion in 1929, became negative: -$5.1 billion in 1932 and -$4.3 billion in 1933), which might seem relevant to the Keynesian view of the fall in equilibrium income in the Depression as the multiplier effect of a fall in investment driven by a collapse of expectations of future profitability as represented by Keynes's marginal efficiency of capital or Tobin's q (the numerator of Tobin's q is the market value of capital assets, the present discounted value of the expected income stream from owning those assets). Other possible explanations of the drop in investment include the accelerator effect of the decline of output or transmission of the contraction of the money supply, but since even bare mention of the 94% drop in gross investment has disappeared from the macroeconomics textbooks, the textbooks cannot discuss how to choose among competing explanations of the unmentioned phenomenon. Farmer (2010a, p. 96) notes "a drop in expenditure on new capital goods from 16% of GDP in 1929 to 6% in 1932"(including public as well as private spending).

"manufacturing wages" mentioned are nominal (and unless the increase in real wages was not slight). I say "even Roger Farmer (2010b)" because elsewhere in the same book (Farmer 2010b, p. 116; see also Farmer 2010a) he emphasizes very clearly, "But money wages fell 30% between 1929 and 1932. Unemployment does not persist because wages are inflexible." Oddly, Farmer offers this sound observation as a refutation of Keynes and his followers who supposedly "assert that unemployment persists because wages and prices are slow to adjust to clear markets" as if Keynes, both in *The General Theory* and in his lectures, did not repeatedly and vigorously invoke that very fall in US money wages from 1929 to 1932 as evidence that downward inflexibility of money wages was not the problem[11]. Perhaps the one thing widely remembered about Keynes's Chapter 19 before Tobin (1975) and Minsky (1975) renewed interest in it was that Keynes devoted an appendix to that chapter to criticism of Pigou's *Theory of Unemployment* (1933), but the point of Keynes's critique was forgotten. By looking only at the labor market, Pigou (1933) had to conclude that a lower money wage would clear the market[12], whereas Keynes argued that, with an endogenous price level, bargaining over money wages would not adjust real wages to market-clearing levels.

Sometimes, when notice was taken of Tobin's claim that in Keynesian theory the labor market might not clear for reasons other than money illusion and that downward flexibility of money wages might not restore full employment, his position was ridiculed rather than analyzed. Thus Stephen LeRoy (1985, pp. 671-72), reviewing in *HOPE* the proceedings of the Keynes centenary conference in Cambridge, quoted Tobin as asking, "Why are labor markets not always cleared by wages? Keynes' … answer is usually interpreted to depend on an *ad hoc* nominal rigidity or stickiness in nominal wages, and thus to attribute to workers irrational 'money illusion.' … I now think, however, that Keynes provides a theory free of this taint." Without mentioning that Tobin had formally modeled his argument in Tobin (1975), or that Taylor (1980) had a formal model of staggered contracts and relative wages in which workers rationally resist nominal wage cuts, LeRoy protested, "It is this propensity to engage in such verbal argumentation divorced from disciplined economic theorizing that critics of Keynesian economics find so frustrating. Little wonder that recent generations of graduate students – tired of trying to remember for exam

[11] In his lecture on October 16, 1933, Keynes declared, "the enormous cut in money wages in the early 1930s in the United States did not have the effect on unemployment one would expect" (Rymes 1989, p. 89). In Chapter 2 of *The General Theory* (1936, p. 9), Keynes wrote that "the contention that the unemployment which characterises a depression is due to a refusal by labour to accept a reduction in money-wages is not clearly supported by the facts. It is not very plausible to assert that unemployment in the United States in 1932 was due to labour obstinately refusing to accept a reduction of money-wages or to its obstinately demanding a real wage beyond what the productivity of the economic machine was capable of furnishing." See also Keynes (1936, Chapter 19), Tobin (1975, 1980, 1993, 1997), and Dimand (2010a, 2010b).

[12] Contrary to criticism of Pigou by some early Keynesians such as Lawrence Klein (1946), Pigou always advocated, as a matter of practical policy, aggregate demand expansion rather than wage cuts as the remedy for unemployment, and considered both his 1933 volume and his later articles on the real balance effect (e.g. Pigou 1947) as exercises in pure theory without direct application to policy – hence Keynes's ironic praise of Lionel Robbins for advocating deflationary measures consistent with his theoretical position.

purposes that Keynesian unemployment is due to inertia in nominal wage and price paths but not to *ad hoc* nominal rigidity (or is it vice versa?) – have responded with enthusiasm when invited by Lucas and others to take economic theory completely seriously in thinking about macroeconomic issues!"[13]

ENCOUNTERING KEYNES

James Tobin encountered economics and Keynes's *General Theory* simultaneously during the Great Depression, as an 18 year-old sophomore at Harvard in 1936[14]. In addition to their courses, Harvard undergraduates had a weekly tutorial in their major. Tobin's tutor Spencer Pollard, a graduate student who was also the instructor for the Principles of Economics section Tobin was then taking[15], "decided that for tutorial he and I, mostly I, should read 'this new book from England. They say it may be important.' So I plunged in, being too young and ignorant to know that I was too young and ignorant" to begin studying economics with *The General Theory* (Klamer 1984, Colander 1999, Shiller 1999, Snowdon and Vane 2005, Dimand 2010a). Reading Keynes's *General Theory* during a depression, deep recession or economic crisis can be transformative even for such an established Chicago economist as "law and economics" pioneer Judge Richard Posner (2009a, "How I Became a Keynesian" 2009b, 2010), who was shocked to find that the supposedly unreadable, refuted and discredited book made sense and provided insight into what was happening in the world. The effect of the newly-published book on a beginning economics student in 1936 was deep and long-lasting: all his subsequent exploration of economics was affected by his initial encounter with Keynes during the Depression. Others at Harvard were introduced to Keynes by Robert Bryce, a Canadian (later eminent in the public service) who became a Harvard graduate student, bringing with him a paper on Keynes that he had presented at four successive meetings of Hayek's LSE seminar, based on notes that Bryce had taken at three years of Keynes's Cambridge lectures from 1932 to 1934. But before Bryce arrived at Harvard, and before Harvard professor Alvin Hansen famously was converted to Keynesianism between his two reviews of the *General Theory*, one eighteen year-old Principles student had already read and largely (not entirely) accepted Keynes's *General Theory*. Unlike many of the Keynesians of his generation, Tobin's Keynesianism embraced the entire title of *The General Theory of Employment, Interest and Money* instead of stopping with the word *Employment* or, in the case of liquidity preference theorists at the

[13] Ironically, the imperfect-information version of New Classical economics presented in Lucas's papers (reprinted in Lucas 1981a), in which employment fluctuates because workers on imperfectly-communicating islands mistaken changes in money wages for changes in real wages, is a formalization of money illusion. To explain the lasting unemployment of the 1930s in this model would require assuming that US workers took several years to hear about the Great Depression and the decline in the price level.

[14] Interviewed in Snowdon and Vane (2005, p. 149), Tobin said 19 years old, but he was born in 1918, entered Harvard in 1935 (graduating in 1939), and took Principles of Economics in 1936-37.

[15] "The same crazy graduate student who was my Ec A instructor was also my tutor" (Tobin, in Shiller 1999, p. 870); "I didn't know any better so I read it, and I didn't feel it was that difficult" (Tobin, in Snowdon and Vane 2005, p. 149).

British Cambridge, *Interest*. For Tobin, the key to understanding and dealing with Keynesian unemployment was that it was a phenomenon of a monetary economy, and required understanding of the monetary system and financial assets. It is noteworthy that Alvin Hansen's *Monetary Theory and Fiscal Policy* (1949), the only one of his books to focus on monetary theory rather than on fiscal policy or business cycles, was the one among Hansen's books to be strongly influenced (with full acknowledgement) by James Tobin, then a Junior Fellow in Harvard's Society of Fellows (see Dimand 2004).

Coming to economics and Keynes in 1936, Tobin regarded high levels of unemployment (25% unemployment in the US in the worst of the Depression in 1932-33 and back up to 17% during the recession of 1937, 22% unemployment in Britain before Britain left the gold standard in 1931), lasting for years, as self-evidently not the result of voluntary consumption of leisure or investment in search, nor as the result of failure to know what had happened to the price level. Involuntary unemployment, like any form of involuntary behavior, has proven elusive to define or measure (see DeVroey 2004). Tobin did not attempt to do so, taking an attitude to whether there was involuntary unemployment in the 1930s that brings to mind Justice Potter Stewart, who, when challenged to define pornography, replied, "I know it when I see it."[16] Nor did Tobin care whether protracted high unemployment in the 1930s, whether involuntary (however defined) or not, was an equilibrium phenomenon or merely a very long-lasting disequilibrium: "The Great Depression is the Great Depression, the Treasury View is still ridiculous, whether mass unemployment is a feature of equilibrium or of prolonged disequilibrium" (1974, Lecture 1, p. 15). Entering economics when he did (17% US unemployment in 1937, lasting high unemployment in Britain where money wages fell only slowly after Britain's return to the gold standard but also continuing high unemployment in the United States where money wages fell 30% in the first three years of the Depression[17]), and starting with Keynes, Tobin saw economics as source not just of knowledge (light) but also of dealing with practical problems (fruit). As Janet Yellen said, "He encouraged his students to do work that was about something, work that would not only meet a high intellectual standard, but would improve the well-being of mankind"[18] (quoted by Appelbaum 2013a, p. A18).

In his unpublished John Danz Lectures, Tobin (1974, Lecture 1, p. 3) recalled his first teenaged reading of Keynes as "an exhilarating experience. Here was a theory of enough intellectual rigor and elegance to

[16] It was reported by journalists Bob Woodward and Scot Armstrong that, at screenings of films submitted as evidence in First Amendment freedom of speech cases before the Supreme Court, law clerks would happily exclaim, "That's it! That's it! I know it when I see it."

[17] "The second prong of Keynes's argument is the futility of wage reduction. Prices may simply follow wages down, leaving employers with no incentive to hire any more labor. Doesn't orthodox theory teach that price is governed by marginal variable cost?" (Tobin 1974, Lecture 1, pp. 12-13).

[18] In the 1970s Tobin, together with William Nordhaus, constructed a pioneering Measure of Economic Welfare, one of the first instances of "green accounting."

challenge youthful minds with some taste for the abstract and the mathematical. Here was an attack on conventional wisdom appealing to young students, then as now quite ready to believe that most of their elders had personal stakes in inherited error. Here were novel and far-reaching policy implications promising solutions of the major economic ills of the world, unemployment and depression. Here even, one could hope, was the salvation of peace, freedom, and democracy, since economic collapse and stagnation seemed to be the main sources of the totalitarian threats of the 1930s."

When Tobin told Robert Shiller that he found Keynes (1936) "pretty exciting because this whole idea of setting up a macro model as a system of simultaneous equations appealed to my intellect", Shiller (1999, p. 870) responded, "I wouldn't think of looking at Keynes's *General Theory* for the inspiration for explicit simultaneous equation macroeconomic models; he didn't do that there."[19] But Tobin insisted, "Well, that set it apart if you looked at it from the right point of view. Other people were algebraizing models. Articles by Hicks and others used algebra and geometry quite explicitly to expound Keynes. Keynes's book was setting off a whole new scheme of economics – called then the *theory of output as a whole*, Joan Robinson's term for it. She made it appear quite distinct from the ordinary Marshallian partial equilibrium, which we got in our micro theory in our theory classes. That was what theory was in those days at Harvard." What Tobin took from Keynes was not just a view of public policy, but, when formalized, a way to do economics: "In my opinion, Keynes did revolutionize economic theory. But the revolution he made was not the revolution he intended. The actual revolution was more an innovation of method than of substance, and for this reason probably more important" (Tobin 1974, Lecture 1, p. 9).

Next to Keynes, the leading influence on Tobin as an economics student at Harvard in the 1930s was J. R. Hicks, through his "Suggestion for Simplifying the Theory of Money" (1935), through his IS-LM paper "Mr. Keynes and the Classics" (1937), and through *Value and Capital* (1939), where Tobin first read about general equilibrium, and also through the presence as a visitor at Harvard of R. G. D. Allen, who had been Hicks's coauthor in demand theory. Tobin's dissertation (1947), which neglected to mention that Schumpeter was (nominally) his thesis advisor, paid tribute to Hicks's seminar participation on a visit to Harvard in 1946. Hicks's later clarifications, qualifications and reservations concerning his early

[19] Keynes expressed his theory as a four-equation model in a lecture on December 4, 1933, differing from later IS-LM models by explicitly including "the state of the news" as an argument in each of the investment, consumption and liquidity preference (money demand) functions (see Dimand 1988, 2007, Rymes 1989). David Champernowne and Brian Reddaway, authors in 1936 of the first two journal articles with systems of equations equivalent to IS-LM (Hicks's priority in 1937 was for the diagram, not the equations), both attended that lecture, as did Robert Bryce. Regrettably, Keynes used the symbol W for "the state of the news" in that lecture, despite having used W for the money wage rate in earlier in the eight-lecture series. Lorie Tarshis, who missed the December 4 lecture and borrowed and copied Bryce's notes for it, wrote in the margin "What the Hell? Ask Bob." Keynes did not include such a simultaneous equations model in book that emerged from his lectures, either because he became dissatisfied with that tentative statement, or following Marshall's celebrated advice to use mathematics as an aid to thought but then to burn the mathematics (advice that Marshall did not follow himself, relegating mathematics to the Mathematical Appendix of his *Principles* but publishing the un-burnt appendix).

work in Hicks (1974, 1980), coming long after Tobin's formative period, never any comparable impact on Tobin. The role of Hicks (1935) in setting the agenda for Tobin's life-work in monetary economics can be seen in Tobin (1961, p. 26): "As Hicks complained, anything seems to go in a subject where propositions do not have to be grounded in someone's optimizing behavior and where shrewd but casual empiricisms and analogies to mechanics or thermodynamics take the place of inferences from utility and profit maximization. From the other side of the chasm, the student of monetary phenomena can complain that pure economic theory has never delivered the tools to build a structure of Hicks's brilliant design" (a passage quoted and stressed by Starr 2012, pp. 4-5).

MICROECONOMIC FOUNDATIONS: OPTIMIZATION SECTOR BY SECTOR

Having assisted and influenced Alvin Hansen (1949) in presenting the IS-LM framework to American economists with what became known as the Hicks-Hansen IS-LM diagram (building on Hicks 1937, Modigliani 1944 and on some early postwar articles by Tobin), Tobin worked on providing optimizing rational-choice foundations for each of the building-blocks of the framework (see Dimand 2004, cf. Starr 2012, pp. 4-5, 19-20, 90-91). He began with a doctoral dissertation, *A Theoretical and Statistical Analysis of Consumer Saving* (1947; Yale University Library 2008, MS 1746 Accession 2007-M-009 Additional Material, Box 1)[20], nominally supervised by Joseph Schumpeter but, like Samuelson (1947) at Harvard just before the war (published six years later because of the war) and Haavelmo (1944) at Harvard in wartime exile from the University of Oslo, effectively self-supervised (see Dimand 2011). It was as an expert on the consumption and saving functions, not on monetary economics, that Tobin was invited to contribute to the 1968 *International Encyclopedia of the Social Sciences*. Tobin's dissertation pioneered the pooling of time series data with cross-section budget studies. To resolve the puzzle that, empirically, time series studies over long periods showed the marginal propensity to save equal to the average propensity to save (so the average propensity to save stays roughly constant as income grows over long periods of time) while cross-section studies and time series studies over the course of a business cycle show marginal propensity to save greater than average propensity (so the average propensity rises when income rises), Tobin introduced household wealth as well as income as an explanatory variable in the saving function (and hence in the consumption function). Wealth would rise with income over long periods of time, but not over the course of a single business cycle. Bringing in wealth linked saving and consumption to past saving (and thus past income), not just current income. This pointed the way to, for example, the life-cycle saving hypothesis of Franco Modigliani, Richard Brumberg and Alberta Ando, the empirical implementation of which is a consumption function with wealth and income as arguments. Tobin's modification of the saving function also involved the life-long Tobin theme that the evolution of the stock of wealth had to be consistent with the flow of saving. Keynes (1936) had modeled consumption as a function only of current disposable income, but added verbal discussion of how other

[20] The Manuscripts and Archives section of the Yale University Library is very reluctant to let anyone see, let alone copy, an unpublished dissertation – until they notice that it is a Harvard dissertation.

variables could affect the size of the marginal propensity to consume (and in wartime Treasury memoranda Keynes denied that a temporary change in taxation, if known to be temporary, would have much effect on spending).

From consumption and saving, Tobin (1956, 1958) moved on to model demand for money as optimizing behavior by rational, self-interested individuals. Without then knowing either Allais (1947) or Baumol (1952) (see Baumol and Tobin 1989) but presumably being conscious of the literature on inventory investment[21] (as Baumol was), Tobin (1956) took an inventory-theoretic approach to the transactions demand for money. Bonds pay interest, money does not, and goods can only be purchased with money, not directly with bonds. Individuals receive a pay-cheque at the beginning of each period, and spend it all at a steady rate over the course of the period. If there were no costs to selling bonds for money (or if the cost was a percentage of the value of bonds sold), people would hold all their wealth in interest-bearing bonds, continuously selling bonds at the same rate they spend the proceeds of the bond sales. But if there is a lump-sum cost per transaction between bonds and money (perhaps the value of the time spent going to an ATM), optimizing individuals maximize income net of transactions costs by trading off foregone interest against transactions costs, deriving an optimal number of transactions per time period which gives average cash balances (money demand) as a function of income, interest and transaction cost: optimization in one sector.

Tobin was bothered by Keynes's analysis of demand for money as an asset, according to which there was a distribution across individuals of expectations of the future level of the interest rate, with each individual believing with certainty some point-estimate of what the interest would become. Bulls, who expected the interest rate to drop from its current level and therefore the market price of securities to rise, would hold all their wealth as securities and none as money. Bears (those who expected the interest rate to rise and the price of securities to fall by enough to more than compensate for the earnings from holding securities), would hold only money and so securities. As the current interest rate moved past an individual's critical level, that individual would switch from holding only money to holding only securities, or vice versa. The idea of someone believing a point-estimate of the future interest rate with certainty clashed with Keynes's view of fundamental uncertainty, the idea that individuals with the same information would hold different expectations was troubling, and the result that people held either all bonds or all money contradicting the analysis of optimal diversification presented by Harry Markowitz (1952), then spending a year at Yale writing his Cowles Monograph on *Portfolio Diversification* (Markowitz 1959). Instead of each individual making a different forecast of the rate of return on securities, despite having the same information, Tobin (1958) assumed that, given the same information, all individuals would have the same probability distribution over the rate of return which would be, given the available information, the correct distribution (but did not emphasize endogeneity and model-consistency of expectations): "My theory of liquidity preference as behavior

[21] In an endnote added to the reprint of his 1956 article, Tobin (1971-1996, Volume I, p. 240 n2) described Baumol (1952) as "a paper which I should have read before writing this one but did not." The only citation in Tobin (1956) was to Hansen (1949), which to some extent was Tobin citing himself.

towards risk was built on a rational expectations model long before the terminology"[22] (Tobin, in Shiller 1999, p. 878). As the title of Tobin (1958) indicated, his analysis there dealt with risk (randomness that can be represented by a probability distribution), not with Keynes's argument that people hold money as a response to fundamental uncertainty.

Treating money as a riskless asset with an exogenously-fixed return (not necessarily zero) that was strictly lower than the expected return on risky securities, Tobin (1958) used a mean-variance analysis to find the fraction of the portfolio that would be held in the riskless asset, with the remainder held in a portfolio of risky assets optimally diversified following Markowitz's theory[23] (which was much simplified by William Sharpe and John Lintner in the mid-1960s as the Capital Asset Pricing Model, which needed to consider only how each asset's return co-varied with the market basket, no how each asset's return co-varied with the return of every other asset). The Tobin separation theorem showed that the proportion of the total portfolio held in the riskless asset was independent of how the portfolio of risky assets was diversified within itself (see Tobin with Golub 1998, pp. 89-91). This depended on treating money as a riskless asset, which abstracted from the risk of changes in the purchasing power of money (see Fisher 1928, which was Fisher's fervent attempt to persuade people to think of money as a risky asset).

In a 1969 reply (reprinted with Tobin 1958 in Tobin 1971-1996, Volume I, p. 269) to comments by Karl Borch and Martin Feldstein, Tobin acknowledge that the mean-variance approach was exact only if asset returns were normally distributed (since the normal distribution is full described by its mean and variance) or if people have quadratic utility functions (so that they only care about the first two moments of the distribution of asset returns): "I do not believe it is an exaggeration to say that, until relatively recently, the basic model of portfolio choice in economic theory was a one-parameter model. Investors were assumed to rank portfolios by reference to one parameter only – the expected return, possibly corrected by an arbitrary 'risk premium,' constant and unexplained … This extension from one moment to two was never advertised as the complete job or the final word, and I think that its critics in 1969 owe us more than demonstrations that it rests on restrictive assumptions. They need to show us how a more general and less vulnerable approach will yield the kind of comparative-static results that economists are interested in. This need is satisfied neither by the elegant but nearly empty existence theorems of state preference theory nor by normative prescriptions to the individual that he should consult his utility and his subjective probabilities and then maximize."

[22] Louis Bachelier's 1900 dissertation on the theory of speculation built on expectations that are correct on average even longer before the terminology of rational expectations existed, but was known only to a few before its first English translation in 1964 (see Davis and Etheridge 2006, which includes a new translation of Bachelier's thesis, and Dimand and Ben-El-Mechaiekh 2006).

[23] "Markowitz's main interest is prescription of rules of rational behaviour for investors; the main concern of this paper is the implications for economic theory, mainly comparative statics, that can be derived from assuming that investors do in fact follow such rules" (Tobin 1971-1996, Volume I, p. 271 n15).

From money demand, Tobin turned to money supply in "The Commercial Banking Firm: Firm" (1982b), drafted in the late 1950s as a chapter of the manuscript[24] that eventually became Tobin with Golub, *Money, Credit and Capital* (1998, Chapter 7 "The Banking Firm: A Simple Model"), and in "Commercial Banks as Creators of 'Money'" (1963). Unlike the quantity theory of money, Tobin (1963, 1982b) did not take the quantity of money as exogenously set by the central bank (or, under the gold standard, by the stock of gold). Rather, the central bank set the monetary base (outside money, that is currency plus reserves with zero or other exogenously-fixed rate of return), and then optimizing financial institutions created financial assets including inside money that were imperfect substitutes for each other[25]. Monetary policy, open market creation or destruction of outside money, would affect the economy by changing the market-clearing rates of return on all these imperfectly-substitutable assets, but the central bank did not directly control either interest rates or the quantity of money (Tobin 1982c, Lecture 1, pp. 13-16). By changing these market-clearing rates of return on financial assets, monetary policy could affect investment by changing Tobin's *q*, a concept introduced by Brainard and Tobin (1968) and Tobin (1969). Post Keynesian exogenous money theorists such as Basil Moore (1988) interpret endogeneity of the money supply as implying a supply curve for money (and an LM curve) horizontal at an interest rate set by the central bank (or set by commercials at a constant mark-up over the central bank's discount rate), without explicit optimizing foundations, in place of the quantity theory's supply curve for money that is vertical at a quantity of money set by the central bank (and a vertical LM curve). Like the long-forgotten exercise by Edgeworth (1888), Tobin (1963, 1982b) explicitly modeled money creation by optimizing banks to derive an upward sloping supply curve for money: higher interest rates induce banks to create more money by choosing lower reserve/deposit ratios.

Tobin and Brainard (1968) and Tobin (1969) argued that investment depends on *q*, the ratio of the market value of capital assets to their replacement cost. If *q* exceeds 1, a firm increases its market value by investing in creating a new capital asset. If *q* is less than 1, firms will allow the capital stock to decrease through depreciation, and if it is 1, the capital stock is in equilibrium, with gross investment equal to depreciation. The numerator of *q*, the market value of capital assets equal to the present discounted value of the expected stream of net earnings from owning the capital assets, provides the channel for monetary policy, asset market fluctuations, and changing expectations of future profitability to affect investment, a channel that makes the stock market crash of 1929 relevant to the collapse of

[24] Messori (1997) recounts the even longer history of the book: Tobin agreed to write the book for McGraw-Hill's Economic Handbook Series, edited by Seymour Harris, after the death in 1950 of Joseph Schumpeter, who had intended to revise and extend a manuscript of his about money (a fragment has been translated as Schumpeter 1991), begun in the 1930s, into two handbooks on money and banking. Tobin's work on what became *Money, Credit and Capital* was interrupted when he was appointed to President Kennedy's Council of Economic Advisors, but draft chapters were used in Yale monetary and macroeconomics courses for decades.

[25] "Milton Friedman has often said that only the monetary liabilities of banks have macroeconomic significance, and he has excoriated central bankers for their concerns about 'credit.' The common-sense neo-Keynesian view is that both sides of intermediary balance sheets matter" (Tobin 1982c, Lecture 1, p. 14).

investment in the Great Depression. Tobin's *q* was offered as a common-sense generalization about behavior, not as the result of a formal analysis of optimization by firms.

Tobin thus added informal optimizing foundations to each component of the IS-LM model of aggregate demand: investment, saving, liquidity preference (money demand), and money supply. Tobin and Brainard (1968) and Tobin (1969, 1982a) linked sectors and markets, including the markets for many imperfectly-substitutable financial assets, through balance-sheet identities and adding-up constraints, and through the stock-flow consistency that was taken further by Tobin and Buiter (1976, 1980a) and Backus, Brainard, Smith and Tobin (1980). But he refused to link sectors and markets through the budget-constraint of an optimizing representative agent or to assume a continuously-clearing labor market.

"A GENERAL EQUILIBRIUM APPROACH TO MONETARY THEORY"

Having separately examined each of the components of Keynesian aggregate demand (saving function, q theory of investment, transactions demand for money, demand for money as an asset, the banking system as creator of money), Tobin used the occasion of the inaugural issue of the *Journal of Money, Credit and Banking* to expound the "General Equilibrium Approach to Monetary Theory" that brought together his work in monetary economics. What Tobin (1969) presented as his "general equilibrium approach" had its intellectual roots in J. R. Hicks's "Suggestion for Simplifying the Theory of Money" (1935) and *Value and Capital* (1939), as much as in Keynes (1936). Although Tobin was well aware of subsequent technical advances in general equilibrium theory, particularly Gerard Debreu's *Theory of Value* (1959) which was written at Yale and published as a Cowles Foundation Monograph while Tobin directed the Cowles Foundation, his approach was shaped by his initial encounter with general equilibrium was as a Harvard graduate student reading Hicks's newly-published *Value and Capital* and Paul Samuelson's 1941 PhD dissertation, published after the war as *Foundations of Economic Analysis* (1947), and attending a course on general equilibrium nominally taught by Schumpeter but dominated by Samuelson, Lloyd Metzler and R. G. D. Allen[26]. Tobin's understanding of what general equilibrium meant differed significantly from the use of that term in later New Classical economics.

[26] Tobin always treated Hicks and Samuelson with the utmost respect and deference, for example when he travelled to Toronto in the summer of 1987 to be present for Hicks's visit to Glendon College. Debreu left Yale for the University of California at Berkeley in 1960 after not receiving tenure (and later declined to return to take Tjalling Koopmans's chair on Koopmans's retirement), apparently because the Economics Department doubted that his future contributions would be in economics as distinct from mathematics. It is unlikely that in 1960 Yale's Economics Department would have denied tenure to anyone whom Tobin strongly wished to receive tenure. Yale made some other curious tenure decisions in economics in the early and mid-1960s, losing Mark Blaug and Edmund Phelps while granting tenure and a named chair to at least one person who never published again.

Tobin's model of many assets that were imperfect substitutes for each other was a general equilibrium model in which asset markets were linked by the adding-up constraint that asset demands must sum to total wealth, and in which changes in stocks were carefully tied to flows. It was not a model in which all markets, including the labor market, were linked through the budget constraint of a single representative agent, a formulation unsuited to considering macroeconomic coordination issues. The requirements for existence of a representative agent have been shown to be as heroic as those for existence of Keynesian aggregate functions (see Geweke 1985, Kirman 1992, Hartley 1997). Tobin and Brainard (1968, p. 99) were sharply, albeit obliquely, critical of existing Keynesian macro-econometric models for insufficient attention to "the importance of explicit recognition of the essential interdependence of markets in theoretical and empirical specification of financial models. Failure to respect some elementary relationships – for example, those enforced by balance-sheet identities – can result in inadvertent but serious errors of econometric inference and policy. This is true equally of equilibrium relationships and of dynamic models of the behavior of the system in disequilibrium. We will try to illustrate the basic point with the help of computer simulations of a fictitious economy of our own construction. This procedure guarantees us an Olympian knowledge of the true structure that is generating the observations. Therefore, it can exhibit some implications of specifications and misspecifications that are inaccessible both to analytical inspection and to econometric treatment of actual date." Brainard and Tobin (1968) and Tobin (1969) thus show what Tobin meant by general equilibrium: not linkage through the budget constraint of an optimizing representative agent, but careful attention to adding-up constraints for wealth, balance-sheet identities and stock-flow consistency.

Robert Solow (2004, p. 659), perhaps the economist closest to Tobin, observed, "The first thing you will notice about 'A General Equilibrium Approach' is that its basic building blocks are net-asset-demand functions, which determine the fraction of total wealth parked in each specified asset as a function of the rates of return on the various assets, plus the ratio of income to wealth (to allow for 'necessities' and 'luxuries' among assets, and to connect up with current flows) and also many unspecified predetermined variables that make sense in context. The signs of the various partial derivatives are discussed in common-sense terms. There are no optimizing consumers, who maximize the expected present discounted values of infinite utility streams, no Euler equations. So where are the 'microfoundations'? The answer is that they are embedded in those common-sense restrictions on partial derivatives. The usual homogeneity postulates and the adding-up conditions imposed by budget constraints are also built into Tobin's specifications. … The other big difference you will notice between Tobin's approach and today's fashion is the absence of a representative agent. … One can take it for granted that agents are heterogeneous, because they are. … The economist's responsibility is to choose those asset-demand functions (or whatever) in such a way that they leave adequate space for the market consequences of the heterogeneities that happen to exist. That cannot be done exactly … All one can do is to try to make proper allowance, accept criticism, and respect the data."[27]

[27] Solow (2004, p. 660) added, "it is not the general appeal to 'microfoundations' that Tobin would have rejected in 1968 or 2002; it is rather the extraordinarily limiting and implausible microfoundations that the literature seems

For Tobin (1969), "The essential characteristic – the only distinction of money from securities that matters for the results given above – is that the interest rate on money is exogenously fixed by law or convention, while the rate of return on securities is endogenous, market determined … If the interest rate on money, as well as the rates on all other financial assets, were flexible and endogenous, then they would all simply adjust to the marginal efficiency of capital. There would be no room for discrepancies between market and natural rates of return on capital, between market valuation and reproduction cost. There would be no room for monetary policy to affect aggregate demand. The real economy would call the tune for the financial sector, with no feedback in the other direction" (as reprinted in Tobin 1971-1996, Volume I, pp. 334-335). He concluded, "According to this approach, the principal way in which financial policies and event affect aggregate demand is by changing the valuation of physical assets relative to their replacement cost [Tobin's *q*]. Monetary policies can accomplish such changes, but other exogenous events can too" (1971-1996, Vol. I, p. 338). So, given a fixed nominal return on money, open market operations matter because they affect *q*, on which investment depends.

As Willem Buiter (2003, pp. F590-F593) noted, Tobin found the Maurice Allais-Paul Samuelson-Peter Diamond overlapping generations framework useful for analyzing Social Security systems, both in his lectures at Yale and in papers such as Tobin (1967), Tobin and Dolde (1971), and Dolde and Tobin (1983), and he selected Samuelson's OLG article Samuelson 1958) to be reprinted in Tobin (2002)[28]. Buiter (2003, p. F591) writes that "One key question it [Tobin 1967] addresses is to what extent the life cycle model can, without a bequest motive, account for the kind of saving rates we see in the US. Tobin's answer was that it can account for most or all of it. … The empirical methodology employed is an early example of simulation using calibration. With only a modicum of hyperbole, one could describe Tobin as the methodological Godfather of the RBC school and methodology of Kydland and Prescott (1982)!" However, he firmly rejected claims that OLG models in which money was the only way to hold wealth

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willing to accept. One could even question whether a representative-agent model qualifies as microfoundations at all. I realize that some fashionistas are in fact working to extend the standard model to allow for heterogeneous agents and various frictions and non-standard behaviour patterns. More power to them."

[28] Similarly, with regard to Ricardian equivalence (debt neutrality), Shiller (1999, p. 872) remarked to Tobin, "In 1952 I you were saying that there must be some tendencies in the direction Ricardo specified" (referring to Tobin 1952, one of the articles following up on his PhD dissertation on saving), Tobin replied, "Yes, I said that. In the same article I noted some of the anti-Ricardian arguments of my later paper [Tobin and Buiter 1980b]. I get credit for a lot of things like that, and then the ideas are pushed beyond where I intended." David Ricardo, after mentioning debt neutrality in his 1820 *Encyclopaedia Britannica* article on "The Funding System," had also discussed in the next paragraph reasons why debt neutrality might not hold. Thirty years before Barro (1974), John Maynard Keynes also argued that government debt is not net wealth, in editorial correspondence concerning Michal Kalecki's 1944 *Economic Journal* comment on Pigou's first article on the real balance effect. Kalecki pointed out that the real balance effect did not apply to the whole quantity of money, just outside money (the monetary base) because inside money is someone's liability as well as someone else's asset. Keynes added that the real balance effect did not apply to interest-bearing government debt either, because the value of the bonds was the present value of the implied liability of taxpayers (Dimand 1991).

from one period to another provides a rigorous explanation of the existence and value of fiat money (see Tobin's acerbic comments in Kareken and Wallace 1980, pp. 83-90, and Tobin in Colander 1999, p. 124). If it was arbitrary for Allais (1947)[29], Baumol (1952), and Tobin (1956) to assume a lump-sum cost per transaction of selling bonds for money (such as the value of the time taken up in transacting), so optimizing agents would hold positive balances of money even though bonds paid a higher return, it was even more arbitrary to assume that the cost of buying and selling other assets was infinite so that only money would exist in strictly positive quantities. Instead, Tobin emphasized scale economies in transacting between assets (as in the Allais-Baumol-Tobin inventory approach to transactions demand for money) and network externalities (see Tobin in Kareken and Wallace 1980, and Starr 2012).

LOSING INFLUENCE

Starting in the late 1960s, Keynesian economics lost ground to monetarism (Friedman 1968, 1977) and to New Classical economics, first in its rational expectations monetary-misperceptions versions (Lucas 1981a, 1996, see also Klamer 1984, Hoover 1988) and then as Real Business Cycle theory, with a partly off-setting development of New Keynesian economics (Mankiw and Romer, eds., 1991) that introduced nominal rigidities into otherwise New Classical models. Partly this was due to external factors: the resurgence of inflation as a policy problem, unresponsiveness of unemployment to aggregate demand management. This situation created a receptive audience for the Friedman-Phelps expectations-adjusted Phillips curve and natural rate hypothesis, casting doubt on the ability of governments to reduced unemployment below some Non-Accelerating Inflation Rate of Unemployment (NAIRU)[30] without spiraling inflation, and for the New Classical argument, adding rational expectations to the natural rate hypothesis (or Lucas supply function), that no systematic monetary policy could affect unemployment. In contrast to the view of Keynes and Tobin that unemployment (in excess of structural, seasonal and frictional levels) represented both lost output and a physic cost to the unemployment, the natural rate hypothesis implies that reducing unemployment below the NAIRU involves tricking people into surrendering voluntary consumption of leisure or productive investment in search in exchange for a smaller real wage that they believe they will get (such a reduction in unemployment could still be socially desirable, as offsetting the distorting effect on labor supply of

[29] See Baumol and Tobin (1989) on the priority of Allais's 1947 derivation of the square root rule for transactions demand for money – in the same appendix as Allais's anticipation of Samuelson's OLG paper and the same book as Allais's anticipation of Phelps's 1962 "Golden Rule of Economic Growth" to maximize per capita consumption along a steady-state growth path. Possibly Anglophone economists might have benefited from reading French. Edgeworth (1888) had derived the square root rule for the demand by banks for reserves.

[30] The term NAIRU was coined by Tobin in 1980 (see Snowdon and Vane 2005, pp. 402-403) to describe the actual meaning of that rate while taking away the rhetorical advantage of the adjective "natural." "Natural" and "rational" are powerful words in economics: rational distributed lags enjoyed a brief vogue until people noticed that the adjective only meant that the lag coefficients were calculated as ratios.

marginal income tax rates). The amount and duration of additional unemployment needed to lower inflation and expected inflation by a certain amount, while far from trivial (in contrast to the New Classical claim that a reduction in the rate of monetary growth, if announced beforehand, would lower inflation without any additional unemployment), proved to be less than predicted by, for example, Tobin (1972). There were also factors internal to the economics discipline, such as the Lucas critique of economic policy evaluation (Lucas 1976, Hoover 2003, pp. 422-23). Jacob Marshak, Herbert Simons and Tjalling Koopmans[31] at the Cowles Commission in Chicago in the late 1940s and early 1950s, had recognized that the parameters of econometric models were not invariant to changes in policy regime, but it was Lucas who drew wide-spread attention to the implication that traditional structural models could not be used to evaluate the effects of policy regime changes (hence the inclusion of Lucas 1976, like Friedman 1968 and Barro 1974, in *Landmark Papers in Macroeconomics Selected by James Tobin*, 2002). But beyond these factors affecting Keynesian economics in general (at least until the renewed public interest in Keynes since the global financial crisis began in 2007), there were issues specific to Tobin's approach to monetary economics that caused the influence of that approach in monetary theory to erode just when award of the Nobel Prize would seem, to the public beyond the economics profession, to signal ultimate professional recognition and acceptance. So, in terms of explaining the dramatic waning of Tobin's influence in monetary theory, this section may be read as, in a sense, the case for the prosecution.

Interviewing Tobin, Robert Shiller (1999, p. 888) asked, "So what happened to your general equilibrium approach to monetary theory? It seemed to be a movement for a while, right? Here at Yale a lot of people were doing this, and I haven't heard about such work lately." Tobin responded, "Well, people would rather do the other thing because it's easier." Certainly that is part of the reason for monetary economists turning away from Tobin to New Classical models, especially the Real Business Cycle (equilibrium business cycle) non-monetary variant of New Classical economics: assuming that the economy is at potential output (Y = Y*) does ease the modeler's life, as does assuming the existence of a single representative agent (or, in Overlapping Generations models, two representative agents, one old and one young). The nonlinear differential equations describing the motion of a disaggregated multi-asset model such as that of Backus, Brainard, Smith and Tobin (1980)[32] did not have closed-form solutions, and using simulation to solve the model numerically was a challenge to the computing

[31] Similarly, when Shiller (1999, p. 878) mentioned as "another criticism of much modern macroeconometrics" the spurious significance tests resulting from specification searches, Tobin replied, "That's a good criticism. I recall hearing Tjalling Koopmans point it out, years ago … The traditional tests wouldn't apply if you mine data that way. When I wrote my dissertation and when I wrote my article on demand estimation it took three days to do a regression with three independent variables. Since you were not going to do many of those, you tried to sure to be sure that your specification is what you really want to test … I'm not saying it's a bad thing to have all this computing power, but the theory of significance tests was based on the view that you were only going to do one computation" (see also Dimand 2011).

[32] It should be noted when this paper, "A Model of US Financial and Nonfinancial Economic Behavior," was reprinted in 1996, it was retitled "Towards General Equilibrium Analysis with Careful Social Accounting."

capacity of 1980[33]. As Tobin said (in Shiller 1999, p. 889), "The whole thing is not in fashion. The whole idea of modern finance does not include imperfect substitution. I suppose in defense of ignoring it is the fact that we weren't actually able to solve the nonlinear equations with these adjustment mechanisms." By the time the SND (Simulating Nonlinear Dynamics) package of Chiarella, Flaschel, Khomin, and Zhu (2002) was available, and was applied to modeling stock-flow consistent Tobin-style Keynesian monetary growth dynamics in books by Chiarella and Flaschel (2000), Charpe, Chiarella, Flaschel, and Semmler (2011), Asada, Chiarella, Flaschel, and Franke (2012), and Chiarella, Flaschel and Semmler (2012, 2013), and in such articles as Asada, Chiarella, Flaschel, Mouakil, Proano, and Semmler (2011) and Chiarella and Di Guilmi (2011), the mainstream of monetary economics had moved elsewhere (and the works cited in this sentence, although published by respected outlets such as Cambridge University Press or the *Journal of Economic Dynamics and Control*, were written by economists at Australian, Japanese and Italian universities or at non-mainstream US institutions such as the New School University, not at the top-ranked US departments). Computational difficulty interacted with other factors in turning the trend of macro-econometric modeling in the 1980s. For example, the Canadian Inter-Departmental Econometric Model (CANDIDE) – a Keynesian model but not associated with Tobin or his stock-flow consistent monetary growth modeling – was abandoned in the early 1980s partly because of concern with the Lucas critique of using structural models for policy evaluation but also partly because its sheer size and complexity (2,084 equations by the time the Economic Council of Canada gave up re-estimating it and using it for forecasting and policy evaluation) meant that it had to be estimated by single-equation methods that were clearly inappropriate and that the structure was too complex to grasp.

As Tobin's sometime co-author Gary Smith (1989, pp. 1692-93) remarked, in a review of Owen (1986), there simply was not enough available data for a Tobin-style disaggregate portfolio choice model, given that portfolio optimization implied many explanatory variables in the asset demand functions: "Because of the strong intercorrelations among the available data, the implementation of the Yale approach is inevitably plagued by severe multicollinearity problems. While monetarism is too simple, the Yale approach is too complex. Some [e.g. Owen 1986] accept the high standard deviations and low *t*-values, observing that the data are not adequate for answering the questions asked. Some researchers try to get more precise estimates by using exclusion restrictions; others [e.g. Smith and Brainard 1976] have tried more flexible Bayesian procedures for incorporating prior information."

These problems affected empirical implementation of Tobin-style models such as Backus, Brainard, Smith, and Tobin (1980). The Mundell-Tobin effect, the non-superneutrality of money even with labor-market clearing shown by Mundell (1963) for short-run IS-LM models and by Tobin (1965) for long-run neoclassical growth models (see also Tobin and Buiter 1976, 1980a, Halliasos and Tobin 1990), ran into difficulty at the level of theory (see Orphanides and Solow 1990, Dimand and Durlauf 2009). Mundell (1963) showed that, since investment depends on the real interest rate but the nominal interest rate is

[33] For my assignments in econometrics courses in 1978-79, I ran regressions using punch cards, at night in the Yale Computer Center because computing time was 80% cheaper at night.

the opportunity cost of holding real money balances, an increase in expected inflation shifts the LM curve to the right (when real interest is on the vertical axis) and moves the short-run IS/LM intersection to a lower real interest rate and higher level of real output Y. Tobin (1965) treated money and capital as portfolio substitutes in a long-run neoclassical growth model, so that a faster rate of monetary growth and thus of inflation would shift portfolio composition from money to capital, increasing the capital intensity of the steady-state growth path. Later Tobin papers (surveyed in Halliasos and Tobin 1990) included a government budget constraint, allowing analysis of the optimal trade-off between the social cost of inflation (smaller real money balances for transactions purposes mean higher transactions costs, smaller precautionary balances make risk-averse agents worse off) and the output gain from greater capital intensity. These results contradicted the argument of Irving Fisher (1896) that the rate of change of the money supply and of the price level would have no real effects (in later language, would be superneutral) unless people made mistakes in their inflation expectations (which Fisher thought they did, see Fisher 1928). The Mundell-Tobin effect also appeared to resolve the puzzle of Milton Friedman's analysis of the optimum quantity of money (Friedman 1969, pp. 1-50), in which inflation, by reducing demand for real money balances, reduces welfare without having any other real effects.

But these results turned out to be sensitive to model specifications. Real money balances were posited as an argument in the utility function by Miguel Sidrauski, as an argument in the production function by David Levhari and Don Patinkin and by Stanley Fischer, turning money and capital into complements rather than substitutes (and in the case of money in the production function, making money an intermediate good subject to a public finance argument against taxing intermediate goods). Allan Drazen (1981), in a two-period overlapping generations (OLG) model with explicit optimizing microfoundations, showed inflation increasing capital intensity (as in Tobin 1965) provided the seigniorage from money creation is given to the young, but the reverse if the seignorage is given to the old – while another OLG model had the Tobin effect dominating regardless of which generation received the seignorage (for references and discussion, see Orphanides and Solow 1990, pp. 245-46, Halliasos and Tobin 1990, pp. 300-301, Dimand and Durlauf 2009). So, there is no presumption from economic theory that money is superneutral in the long run, but what mattered to monetary economists was that the existence and direction of the non-neutral effect of money growth on output and welfare in the long-run depends critically on seemingly small and innocuous changes in exactly how a model is specified. Sensible scholars do not wish to stake their careers on what they might be able to produce in such a field. As Orphanides and Solow (1990, p. 257) concluded in their *Handbook of Monetary Economics* survey of "Money, Inflation and Growth": "We end where Stein [1971] ended 20 years ago." The case for the Tobin effect in long-run monetary growth models was not disproven, but the results were far from robust and the discussion wasn't going forward, so monetary economists moved to other topics where robust results seemed attainable.

Tobin's is by no means the only approach to monetary economics to have some of its characteristic components fail to hold the profession's attention, yet this does not mean that the central message of the approach lacks continuing interest. Milton Friedman's emphasis on the costliness of inflation, on the endogeneity of expected inflation, on inflation as a monetary phenomenon, and on monetary rules

rather than discretion retains lasting influence – yet the k% growth rule for some monetary aggregate, attempted in Britain, Canada and the US in the late 1970s and early 1980s was abandoned because of "Goodhart's law" (targeting a monetary aggregate changes its relationship to nominal income and other monetary aggregates). Central banks now target interest rates, not the growth of the money supply, and the title of Michael Woodford's *Interest and Prices* (2003) underlines a return to the pure-credit economy of Knut Wicksell's *Interest and Prices* (1898), without a role for the quantity of money, in contrast to the title of Don Patinkin's *Money, Interest and Prices* (1965). Friedman's argument in 1959 and 1966 that the money demand function is completely insensitive to interest rates (so that fiscal policy would be completely crowded out with a vertical LM curve) was abandoned in 1969 to derive the optimum quantity of money from the effect of nominal interest on money demand (Friedman 1969, pp. 1-50). Even Friedman and Schwartz's *Monetary History* (1963), attributing the Great Depression to mistaken Federal Reserve policy that allowed the Great Contraction of the money supply, fitted awkwardly with rational expectations, which suggested that any systematic monetary policy should have been fully anticipated. But no one would doubt that Friedman has had a lasting impact on monetary economics (and on policy discussions: see *The Economist* 2012, "The Chicago question: What would Milton Friedman do now?"). Similarly, the Lucas-Phelps islands model of monetary-misperceptions New Classical economics could only explain the lasting high unemployment of the 1930s if workers somehow took years to learn of the Depression and the fall in the price level, and the countercyclical real wages of monetary-misperceptions New Classical economics (and also of Chapter 2 of Keynes's *General Theory*) do not appear clearly or consistently in the data, any more than the pro-cyclical real wages of Real Business Cycle theory (Real Business Cycle theory's unobservable technology shocks, being unobservable, have not been contradicted by the data) . Fairly early in the history of New Classical economics, Frederic Mishkin's *A Rational Expectations Approach to Macroeconometrics: Testing Policy Ineffectiveness and Efficient-Market Models* (1983), working within New Classical methodology, found empirical rejection of the joint hypothesis that expectations are rational and only unanticipated money has real effects. Yet methodological aspects of monetary-misperceptions New Classical economics, such as rational expectations and the Lucas critique, shaped how monetary economists think and work. So too with Tobin's approach: empirical implementation of models with multiple, imperfectly-substitutable assets had problems with multicollinearity and with lack of explicit solutions of the nonlinear equations describing adjustment, the Tobin effect in long-run growth models depended on fine points of model specification, but there still remains the message of paying attention to stock-flow consistency, to imperfect substitution among assets, and to modeling economies that are self-adjusting for shocks up to some limit but that do not automatically return to potential output after infrequent large demand shocks.

CORRIDOR OF STABILITY

Tobin of course recognized downward stickiness of money wages, as in Britain following the return to the gold exchange standard at the prewar parity in 1925, as a cause of unemployment, drawing attention to the relative wage, overlapping contracts explanation of such stickiness in Keynes (1936,

Chapter 2) and in John Taylor (1980). George Akerlof's and Janet Yellen's efficiency-wage theory (1986) and Tobin's Yale colleague Truman Bewley (1999) showed that the negative effects of wage cuts on morale and productivity could deter employers from lowering wages in recession. New Keynesian economics explored sources of nominal rigidities such as menu costs and efficiency wages (Mankiw and Romer, eds., 1991, Gali 2008) and real wage rigidities (Greenwald and Stiglitz 2003). Russell Cooper's *Coordination Games: Complementarities and Macroeconomics* (1998)[34] used game theory and strategic complementarity to model the possibility that if all firms hired more workers, the workers would spend their wages in a way that justified the hiring, but that no firm acting alone could do this. But where Tobin's work has most relevance to current research and current issues does not concern wage stickiness, but, in the spirit of Keynes (1936, Chapter 19), why adjustment may fail even with nominal flexibility and why faster changes of prices and nominal wages may make things worse rather than better (Tobin 1975, 1980, 1993, 1997), and Tobin's argument that greater microeconomic efficiency of the financial system, faster trading and capital flows (Tobin 1984 and his writings on restraining speculative international capital flows, Tobin 2003)[35], a concern that links up with the studies of overly volatile financial markets by his Yale colleague Robert Shiller (1989, 2005, see also Colander 1999, Shiller 1999).

Tobin told Robert Shiller (1999, p. 871), "Keynes argued that even if money wages were flexible that wouldn't solve the problem. We would still have a problem of the adequacy of aggregate demand." Shiller then asked, "And you bought that; you buy that?" Tobin responded, "Yes, I 'bought that.' I 'buy that.' I have presented the models in which it would be quite reasonable. For one thing, the orthodox proposition depends on the 'real balance effect' of a lower price level. That is quite dubious, because negative effects on debtors' spending could well offset positive effects on creditors. Secondly, expected disinflation and deflation have negative effects on demand. Thus the full employment equilibrium can easily be unstable." Several spokes of the Keynesian wheel have been independently re-invented: John Taylor (1980) rediscovered Keynes's Chapter 2 model of concern with relative wages as a rational explanation of downward stickiness of money wages, Roger Farmer (2010b) finds that US money wages fell sharply in the early 1930s without eliminating mass unemployment, and Guillermo Calvo (2013) recommends price and money wage inflexibility to prevent destabilizing debt deflation, although each presents his concurrence with Keynes as a critique of Keynes. Perhaps Tobin's distinction between a lower price level and a falling price level (following Keynes 1936, Chapter 19), and his modeling of economies that are self-adjusting for shocks up to a threshold level, might be next.

Axel Leijonhufvud had called as early as 1973 (in papers reprinted in Leijonhufvud 1981) for macroeconomic models that were neither always stable (always self-adjusting back to full employment

[34] On the back cover of Cooper (1998), Robert Hall wrote, "Finally, serious economic theory to tell us what Keynes really meant", but Keynes was not mentioned in the text or bibliography.

[35] Calvo (2013, p. 51 n 19) acknowledges, "It is worth noting, however, that the financial sector played a prominent role in Tobin's writings; see, for example, Brainard and Tobin (1968)" but promptly adds, "But not as a source of financial disarray." For a contrasting view see e.g. Tobin (1984).

after a shock) nor always unstable (not self-adjusting once knocked off a knife-edge equilibrium), but that would instead be stable within a "corridor of stability" but unstable for large shocks that pushed the economy outside this corridor. Tobin (1975) provided an example of such a model, possibly the first, without citation of Leijonhufvud (or indeed of anyone except Keynes, Friedman, Blinder and Solow, and Tobin and Buiter, although other names such as Pigou appeared in the text without formal citation).

Tobin (1975, 1980, 1993, 1997) pointed out aggregate expenditure will be a function not only of the price level, but also of the expected rate of change of the price level. As Keynes (1936, Chapter 19) had stressed, a lower price level is expansionary (larger real money balances lower the interest rate) but a falling price level is contractionary (reducing the opportunity cost of holding real money balances). At the lower bound for the nominal interest rate (whether at zero or slightly above), a lower price level can no longer reduce interest rates while each additional percentage point of expected deflation raises real interest by one per cent, reducing investment. Even in such a situation the Pigou real balance effect of a lower price level will still tend to increase consumption (larger real balances of outside money mean larger household wealth, Pigou 1947), but Tobin (1980) and Minsky (1975, 1982) drew to Irving Fisher's debt-deflation theory of depressions (Fisher 1933), that increasing the real value of inside debt does not simply transfer wealth between borrowers and lenders, raising risk of bankruptcy and default which raises risk premiums and causes a scramble for liquidity (see also Keynes 1931a, 1931b). Tobin's formal model, basing of including expected inflation as well as the price level as an argument in the aggregate expenditure function, derived a corridor of stability, with the economy self-adjusting for shocks within the corridor but not for larger shocks taking it beyond the corridor (see Tobin 1975, Palley 2008, Bruno and Dimand 2009, Dimand 2010). In such a model, faster adjustment of prices and wages may narrow the corridor of stability. Tobin's 1975 model was just illustrative of the possibilities, but it demonstrated that the intuitively attractive notion of a corridor of stability, of an economy usually self-adjusting but susceptible to macroeconomic coordination failure in the face of large shocks[36], could be formally modeled. Such models, together with Fisher's debt-deflation process, the Minsky moment, Keynes, and Shiller's critique of efficient financial markets, have received increased attention since the global crisis began in 2007 (see for example the surveys by Blanchard 2009 or Gertler and Kiyotaki 2010), with textbooks of course lagging behind research and public discussion.

Tobin contributed to optimizing foundations for money demand (1956, 1958) and money creation (1963, 1982b), to general equilibrium linkage of markets (1969, 1982a), to rational expectations (1958), debt neutrality (1952), and simulation and calibration of OLG models (Tobin 1967, Tobin and Dolde 1971, Dolde and Tobin 1983), often objecting to the direction in which others later took these ideas. Many of his distinctive contributions, like those of other eminent monetary economists of the past, have

[36] As Calvo (2013, 52) notes, Tobin, in a review of Minsky (1986), held that the Federal Reserve could respond to a crisis by providing as much liquidity as needed (unlike the Federal Reserve's actions in 1930-32). But believing that activist stabilization policy could successfully respond to a financial crisis does not warrant Calvo attributing to Tobin a belief that one need not be concerned about the possibility of such a crisis or the need for such a policy ("the financial sector was not a bone of contention").

lost influence, partly for reasons specific to aspects of his work (multicollinearity in models with many financial assets, no closed-form solution for the nonlinear adjustment equations, results in monetary growth models that are very sensitive to small changes in specification) and partly due to more general trends from Keynesianism to other approaches. But Tobin's emphasis on stock-flow consistency (and his suspicion of using models with a single optimizing representative agent to investigate macroeconomic coordination), his approach to modeling economies that are self-adjusting within a corridor of stability but not self-adjusting for large shocks, and his concern that faster financial flows and faster price and wage adjustment may be undesirable and destabilizing remain on the agenda of modern monetary theory.

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