

From *the Keynesian Revolution* to the Klein-Goldberger Model: Klein and the Dynamization of Keynesian Theory

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From *The Keynesian Revolution* to the Klein-Goldberger Model:
Klein and the Dynamization of Keynesian Theory

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Abstract

According to Klein, Keynes's *General Theory* was crying out for empirical application. He set himself the task of implementing this extension. Our paper documents the different stages of his endeavor, focusing on his *The Keynesian Revolution* book, *Journal of Political Economy* article on aggregate demand theory, and his essay on the empirical foundations of Keynesian theory published in the *Post-Keynesian Economics* book edited by Kurihara. Klein's claim is that his empirical model (the Klein-Goldberger model) vindicates Keynes's theoretical insights, in particular the existence of involuntary unemployment. While praising Klein for having succeeded in making Keynesian theory empirical and dynamic, we argue that he paid a high price for this achievement. Klein and Goldberger's model is less Keynesian than they claim. In particular, Klein's claim that it validates the existence of involuntary unemployment does not stand up to close scrutiny.

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INTRODUCTION

Lawrence Klein began his career as a researcher by writing a dissertation on Keynesian theory that became a book entitled *The Keynesian Revolution* (1947a). In the process of writing it and in subsequent reflection, he came to realize that the conceptual apparatus set up by Keynes in the *General Theory* “cried out for empirical verification (or refutation)” (Bodkin, Klein and Marwah 1991, p. 19). Undertaking this empirical extension became his life’s work.¹ Success came as his joint work with Goldberger, *An Econometric Model of the United States* (1955) blazed the way for a new field of research, macroeconomic modeling. The aim of this paper is to recount and assess the steps involved in this journey from an abstract, static, qualitative model (the IS-LM model) to an empirically tested dynamic model. In other words, our aim is to elucidate what lies behind statements by Klein such as the following:

I look upon the Keynesian theory as essentially a system of equations. While I may have once been satisfied with the explanatory value of a small version of that system expressed in just one or three equations, I now feel that intelligent discussion cannot be carried on unless the system is expanded to include 15 to 20 or even more equations. In current econometric model construction, I am working with some macro-systems that have more than 100 equations. These larger systems, extended along the lines indicated in this essay, may not easily be recognized as the Keynesian theory, yet I feel that they surely are. They are manifestations of points I have reached, in collaboration with many colleagues, after starting out from the simplest forms of the Keynesian Revolution and working systematically through econometric studies of available data. They are, in a real sense, just extensions of the Keynesian theory in a natural way (Klein [1966] 1997, p. 81).

Of course, it all depends of what is meant by an extension. For our part, we shall argue that the link between Keynesian theory (which we identify with the IS-LM model) and what is commonly called Keynesian macroeconomic modeling, as inaugurated by Klein, is more tenuous than he believed. In particular, we shall show that eventually he proved unable to achieve his project of demonstrating that the validity of Keynes involuntary unemployment hypothesis is ill-founded.²

¹ In Klein’s terms, “Jacob Marshak, after inquiring about professor Samuelson and his latest professional activities said to me: “What this country needs is a new Tinbergen model to forecast the performance of the American economy after the War.” This remark excited me, and I was more than pleased to consider his offer of my coming to the Cowles Commission to take up the task” (Klein, 2006, pp. 173-174).

² Let us add at once that this negative conclusion in no way lessens our admiration for Klein’s work.

In the first part of the paper, we present Klein's interpretation of the central message of Keynes's *General Theory*, as manifested in two pieces published in 1947 (the book *The Keynesian Revolution* (1947a) mentioned above, and a *Journal of Political Economy* article entitled "Theories of effective demand and employment" (1947b)). In a second part, we recount how Klein transformed his Keynesian theoretical model into an empirical model, basing our analysis on his essay on the empirical foundations of Keynesian theory published in the volume of *Post-Keynesian Economics* edited by Kurihara (Klein, 1955). In part three we assess Klein's contribution, in particular his claim that his empirical model is a valid extension of the theoretical model.

PART I. KLEIN'S EARLY WORK

Klein started publishing in leading journals at an early age, and at an impressive pace.³ Here, we are interested in two of his early pieces, his book, *The Keynesian Revolution* (Klein 1947a) and his *Journal of Political Economy* article (Klein 1947b). Both were published in the same year but most of the book was conceived and written in 1944 as a doctoral dissertation at MIT under Samuelson's supervision.⁴ It can thus be presumed that the article was written after the book. While they overlap considerably, the article departs from the book at one critical point, which in our eyes is the first manifestation of Klein's quest for dynamics (see below).

The Keynesian Revolution book

The purpose of Klein's book was to give a general introduction to Keynes's theory. It evolved at two levels. Following Marshall's precepts, Klein explained Keynes's views in prose but also provided his readers with a mathematical appendix.⁵ But Klein's book was more than just of presentation of the ideas in the *General Theory* (as was for example Hansen's *A Guide to Keynes* (1953)). Klein's interpretation of the central message of the

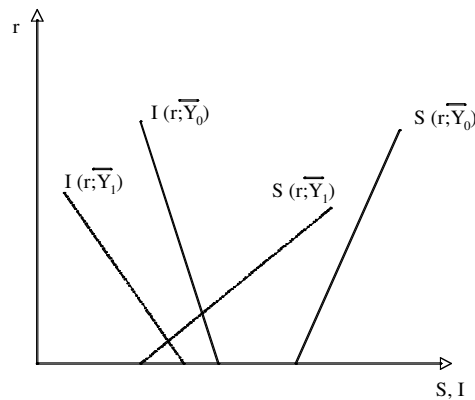
³ Born in 1920, he published five articles in *Econometrica*, two in the *Journal of Political Economy*, one in the *Review of Economics and Statistics* and two books between 1943 and 1950.

⁴ See Klein ([1992] 1997, p. 100. It was Samuelson who suggested to Klein that he should write his thesis on this subject (Klein 2006, p. 171).

⁵ By doing so, Klein was abiding by the usual practice of the time. However, to him, the mathematical appendix was not secondary. The reason he applied to the newly created graduate program at MIT was his interest in formulating economic analysis in mathematical terms (Klein 2006, p. 167). It is also worth mentioning that one of the appendix's distinctive features was Klein's insistence on giving Keynesian theory a choice-theoretical basis, thereby indicating a pre-occupation with micro-foundations that was unusual at the time. He explained agents' decision-making processes in a detailed way, considering the existence of a large number of goods and extending the problem inter-temporally. Likewise his analysis of entrepreneurs' behavior was sophisticated for the time. However, when he turned to the issue of market outcomes, Klein fell back on the standard IS-LM model. Klein explored the issue of aggregation in two of his *Econometrica* articles (Klein 1946a, 1946b). For a discussion of this issue, see Hoover (2009).

General Theory was original. While Hicks (1937) had emphasized the liquidity trap and Modigliani (1944) the rigidity of labor supply, Klein's distinct take was to link the occurrence of involuntary unemployment with a very low value of the interest rate at full employment equilibrium. While using the standard IS-LM, Klein gave it a personal touch by declaring that in reality saving and investment were highly inelastic to the interest rate and this fact needed to be incorporated into the model. As a result, there may be no positive rate of interest at which savings and investment are equal. The best conceivable way out, Klein claimed, is for output to depart from its full-employment level (Klein 1947a, pp. 202–203). Figure 1 illustrates this point. At the full-employment level of output (\bar{Y}_0), the two functions fail to intersect in the positive quadrant. This only becomes possible if output is trimmed (\bar{Y}_1).⁶

Figure 1. The lack of equilibrium between saving and investment at full-employment income, according to Klein ⁷



This decrease in income will in turn exert an impact on the labor market, generating an excess of labor supply over labor demand at an increased real wage. Trading then takes place at a point off the supply curve, an idea that was later taken up by Patinkin in *Money, Interest and Prices* ([1956] 1965). This is involuntary unemployment in Keynes's sense (Keynes 1936).⁸ In modern parlance, we should speak of short-side trading but Klein told another, more ideologically laden, story by declaring that this outcome resulted from an asymmetrical power relationship between employers and employees (Klein 1947a, pp. 86–87, 203).

If income falls from $(Y_w)_0$ to $(Y_w)_1$ [\bar{Y}_0 to \bar{Y}_1 in our graph], then output and employment will be forced to lower levels. ... The final position will be that of Figure 5 [here Figure 2 below], with the supply of labor in excess of the demand at the going real wage rate. The excess of supply over demand ($N_2 - N_1$) is a measure of unemployment.

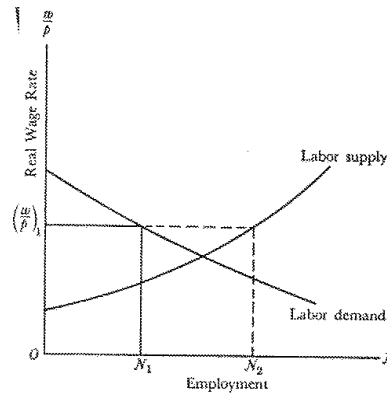
⁶ Although Klein does not mention it, his graph supposes that $\bar{I}_y < \bar{I}_y$.

⁷ Drawn from Klein (1947a, p. 82).

⁸ A state where some people wish to work but are unable to put their optimizing plans into practice. See De Vroey (2004).

The superior bargaining power of the employer over the employee explains easily why the supply-demand relation for labor is the one relationship of the system which can have a solution that is not an intersection point (1947a, pp. 86–87).

Figure 2. The labor market outcome⁹



In his 2006 article, written in a book honoring Samuelson, Klein praises Samuelson for having suggested the explanation he eventually adopted:

On the morning-after [a seminar presentation by Klein to an economic study group at Harvard], Professor Samuelson inquired about the course of the discussion at the seminar. When I told him about the issues of labor supply specification, he immediately suggested that maybe the long-run equilibrium point of the final system, reduced, after substitution, to two equations depending on two variables, would have a logical intersection point only in an invalid quadrant — one where the real wage or some other positive variable would have to be negative. He then said it would be impossible to get the economy to that point, but in the process of trying to do so, there would be unstable deflationary movements with wages being competitively bid downward. In terms of the IS-LM diagram, the curves would be shifted through the search for an equilibrium solution that exists only in a quadrant that permits negative interest rates. In *The Keynesian Revolution*, this situation was depicted graphically as shown in Figure 11.1 [Figure 1 above] (Klein, 2006, p. 172).

With hindsight, Klein's explanation of involuntary unemployment is just a sketch, but at the time nothing more could be expected. In certain respects, it looks more appealing than the Hicksian or Modigliani stories. In particular, it conveys the idea of a spillover, i.e. the idea that the origin of unemployment should be looked for elsewhere in the economy. Moreover, its notion of involuntary unemployment corresponds to Keynes's definition, which

⁹ Drawn from Klein (1947a, p. 87).

Modigliani's theory does not.¹⁰ On the other hand, everything in Klein's theory hinges on the investment and savings function lacking interest-elasticity.¹¹

The Keynesian nature of this hypothesis is open to debate. Many passages in the *General Theory* state exactly the opposite. For example, in the final chapter of the book Keynes's urge to keep the interest rate low is based on the assumption that investment has a high interest-elasticity. While admitting his departure from Keynes's standpoint, Klein defends his own view on empirical grounds by referring to two studies based on questionnaires submitted to business men, and unspecified other studies (Klein 1947a, pp. 65–66). Of course at the time, data were scarce, but nonetheless we are tempted to conclude that Klein's position here was as much *a priori* as empirical.

The *Journal of Political Economy* article

Klein's aim in his *Journal of Political Economy* article (1947b), entitled "Theories of effective demand and employment", was to compare three theories of employment: the classical, the Keynesian and the Marxist. We are only interested in the first two, which form the first two sections of Klein's paper. Klein's reasoning is dense and its thread sometimes difficult to follow. At this stage, we will just summarize the main points, which will be pieced together in Section 3.

The main element of continuity between Klein's article (1947b) and his book (1947a) is that he continues to argue that the distinctive trait of Keynesian theory is the low interest-elasticity of the investment function. This assumption, Klein claims, must be adopted because of its strong empirical validation. As in the book, the assumption leads to the result that the economy stabilizes at a less-than-full-employment level of activity. However, Klein now realizes that an additional condition, namely $i > 0$, is needed.¹² Adding this condition has the effect of possibly voiding the model of any solution. In the extreme case of a strict interest rate inelasticity of savings and investment, output is determined independently by two separate parts of the model, the saving-investment relation, on the one hand, and the supply and demand for labor under a given production technology, on the other. Nothing insures that these two levels of output will coincide (1947b, p. 110). Resolving this dilemma is the main task that Klein sets himself in the article.

¹⁰ See De Vroey (2004, Ch. 8).

¹¹ Klein became interested in this topic before he started working on his dissertation, the result of Samuelson having assigned him to investigate the statistical estimation of savings and investment functions in the United States.

¹² Klein must have meant the nominal interest rate, although this choice is odd in view of the fact that all the other variables are expressed in real terms.

One possible solution lies in a proposition made by Pigou, later to be called the Pigou or real-balance effect (Pigou 1934). It consists of introducing real cash balances as an argument of the saving function. As a result, that any saving and/or investment inelasticity will no longer impede the attainment of full-employment equilibrium, on the condition that a new argument (M/p) is added to the saving function. Pigou feels this modification to be an improvement. Saving then varies inversely with the real stock of cash balances. If competition cuts wages and hence prices while the supply of money remains constant, an increase in M/p will allow saving and investment to be equal at full employment.

Non-surprisingly Klein is not enthusiastic about Pigou's argument. He points out that, "there is no 'proof' of Pigou's hypothesis" (1947b, p. 113). Instead of challenging Pigou at the theoretical level (which would have been more appropriate), Klein tackles him on empirical grounds. The data, he argues, fail to confirm the inverse relationship between savings and cash suggested by Pigou. In his eyes, cumulative deflation, fueled by expectations, and increased unemployment are a more probable outcome.

Having discarded Pigou's solution, Klein goes on to presenting his own. This consists of modifying the model by replacing the condition of equality between the supply of labor and the demand for labor with a new equation aiming at capturing the adjustment of wages over time. To make his point, Klein proceeds in a convoluted way. He starts by re-iterating his view that workers are powerless with respect to firms.¹³ Next, wondering how to integrate this insight into the model, he declares that labor supply should be accounted for in a new way. At this juncture, Klein departs from the argument in his book. In the book, he developed the idea that the supply of labor had become inactive or virtual, although it retained its standard shape. In the article, he dismisses this idea on the grounds that it cannot be tested.¹⁴ What is needed, he claims, is to drop the entire concept of the supply curve of labor (1947b, p. 116). This appears to be a provocative statement, but at the end of the day its theoretical embodiment is a trivial change consisting of equating the labor force and the supply of labor, working time being indivisible. Graphically, the supply of labor is a vertical line.

However, the main novelty of the *Journal of Political Economy* article lays in Klein's sudden introduction of a wage formation equation.

¹³ Klein's powerlessness claim has a definite Marxist ring to it and runs as follows: "The owners of the means of production, the capitalists, make all the final decisions with regard to the use of the means of production. The workers have nothing to say about the amount of unemployment that will be forthcoming at any point in time" (Klein 1947b, p. 116).

¹⁴ "This concept of unemployment is not easily measurable, however, since it involves virtual, unobserved points. In order to measure unemployment in this model, we would have to sample the population, questioning them on the amount of employment that they would like to supply at prevailing wage rates" (Klein 1947b, p. 117).

The supply of labor is an exogenous variable represented by the labor force and determined by exogenous factors; the wage rate is determined by a market adjustment between demand and supply (collective bargaining) (Klein 1947b, p. 116).

Klein's reference to collective bargaining is odd, and the reader gets no clues about its introduction since market forces and collective bargaining are usually viewed as alternative ways of forming a market outcome. Perhaps Klein thinks that the bargaining process is where the power asymmetry between employers and employees manifests itself. All in all, the introduction of this wage adjustment equation into an IS-LM framework is unusual and looks weird. Klein provides no explicit vindication for it, leaving the reader hanging.¹⁵

After these modifications, the labor market equation are as follows (see Klein 1947b, p. 116):

$$(1) w = py'(N) \text{ (demand for labor)}$$

$$(2) \bar{N} = \text{labor supply}$$

$$(3) \frac{d(\frac{w}{p})}{dt} = g(\bar{N} - N) \quad g' < 0$$

with $y(N)$: production function, w : nominal wage rate and p : price level.

Equation (3), Klein argues, can be replaced by

$$(3') \frac{dw}{dt} = h(\bar{N} - N) \quad h' < 0$$

Another point made by Klein (and another break with the standard IS-LM model) is that unemployment may be also present in the classical system, in the dynamic transition process.

The classical system is static and should be looked upon as the equilibrium solution of a more general dynamical system. It is evident that the equilibrium will always be one of full employment. In the general case — when the system is not at its equilibrium position — there may be unemployment, but this unemployment will be only temporary if the dynamic movements are damped, as the classical economists implicitly assumed. When unemployment does occur in the state of disequilibrium, there is always an appropriate remedial policy available — namely an increase in the amount of money or (its equivalent) a cut in prices or wages (1947b, p. 109).

¹⁵ Still, a hint at what motivates him can be garnered from a footnote suggesting that this equation will play an instrumental role in the empirical assessment of the Keynesian claim. "First differences in the general wage rate (USA, interwar period) are highly correlated (inversely) with unemployment and the lagged wage rate. The parameters of this empirical equation suggest that small wage cuts are not associated with large increases in employment and that $h(0) \neq 0$, from which we conclude that the system does not have a stable equilibrium of full employment" (Klein 1947b, pp.116-117).

Our final comment about Klein's 1947 article is that it is a transitional piece. It wavers between two lines of explanation: his book's insight that the main factor explaining unemployment is the lack of a positive interest rate at full employment equilibrium; and an approach to unemployment in terms of the wage-formation equation, an anticipation of the Phillips curve. Both explanations are invoked in the article, but the treatment of the interest rate argument seems to be *pro forma*, while the brunt of the argument begins to be borne by the wage-formation equation. This shift came to full fruition in Klein's subsequent work.

PART II. THE KLEIN-GOLBERGER MODEL (1955)

A general presentation of the model

We will now consider the end of the first (highly productive) decade of Klein's career as a researcher. Klein's main motivation was to go beyond the Keynesian model, which he dubbed pedagogical, in order to engage in empirical investigations taking into account "all the complexities of dynamics, special institutional arrangements, and disaggregation" (Klein 1955, p. 312). His 1950 monograph, *An Econometric Model of the United States, 1929–1952*, published under the auspices of the Cowles Foundation (Klein 1950), was a first shot in this direction. The full achievement of this project was the 1955 monograph which he co-authored with Goldberger (Klein and Goldberger 1955), *An Econometric Model of the United States 1929–1952*, which introduced the celebrated Klein-Goldberger model.

There is probably no better way of evoking the gist of the Klein-Goldberger model than quoting from a retrospective look taken at it by Klein and two co-authors in a book entitled *A History of Macroeconometric Model-Building* (Bodkin, Klein and Marwah (1991):

The Klein-Goldberger model was initiated as a project of the Research Seminar in Quantitative Economics at the University of Michigan. It was a 'medium size' model, and was truly intended (at the time) to be an up-to-date working model, applicable to practical economic problems like those encountered in business cycle forecasting. A distinctive feature of model was that it was not viewed as a 'once-and-for-all' effort. It was presented as part of a more continuous program in which new data, reformulations and extrapolations were constantly being studied. The model consisted of 15 structural equations, 5 identities and 5 tax-transfer auxiliary relationships. It was estimated by the limited-information maximum-likelihood technique, and was based on the annual observations from the split sample period 1924–41 and 1946–52. In the genealogy of macroeconometric models, no other model has left such a vast legacy of style and flavor as the Klein-Goldberger model. It served as the paradigm for many model-builders for a long time to come (Bodkin, et al. 1991, p. 57).

The structure of the Klein-Goldberger model may be viewed as the first empirical representation of the broad basic Keynesian system. The mathematical formulation of this system developed by J. R. Hicks and O. Lange was extended in the neoclassical direction through a use of the production and the marginal productivity condition for the employment of labor. Its very rudimentary trade sector was also specified in terms of neoclassical reasoning. The model dealt with both the real and the monetary phenomena; most, but not all, behavioral equations were specified in real terms, and a very specific blending of real and money values was achieved as both the constant-dollar magnitudes and their associated price deflators were estimated as part of the model. The dynamic components were added in terms of cumulated investment, time trends and Koyck distributed lags. It also contained several non-linearities in terms of the variables, which were subsequently linearized in an approximate manner, in order to obtain the solution of the entire system (Bodkin et al. 1991, p. 58).

Klein and Goldberger's challenging aim was to make the Keynesian theoretical model, the IS-LM model, empirical. They were of course aware that the distance between theory and reality was huge, and that in order to bridge it a series of new specifications needed to be made. A crucial difficulty to be overcome was that the Keynesian theoretical model was static while reality was intrinsically dynamic.

This [the Keynesian system] is an extremely useful pedagogic model for teaching students the main facts about the functioning of the economic mechanism, but it is surely not adequate to explain observed behavior. ... A workable model must be dynamic and institutional; it must reflect processes through time, and it must take into account the main institutional factors affecting the working of any particular system (Klein 1955, p. 278-279).

Klein and Goldberger worked in a pragmatic spirit. To them, modeling was definitely more data- than theory-constrained. Their overarching principle was to increase the fit between the model and reality. As a result, they had no qualms about engaging in a back-and-forth process between the specification and the estimation of parameters, a practice that was later to be vilified as 'data mining', with the consequence that the theory supporting the model was obscured. Moreover, as hinted at in the quotation above, their model was in no way a once-and-for-all construction. Rather they viewed it as the first step in a broader program around which other economists' might rally — an invitation that was to be taken up beyond all their wildest dreams.

The implementation of their project involved various steps. The first was to decide on the features of the model. In terms of its mathematical structure, the Klein-Goldberger model is a system of time-recursive difference equations, most of which are linear approximations of the structural theoretical relations. Within each period circular interdependencies are present,

reflecting the simultaneous determination of some of the variables of the system. Other variables are predetermined by the previous state of the economy. Flows are annual, due to the statistical material available at the time. In other words, the year is taken as the unit period of analysis. The adjustment towards equilibrium is assumed to occur instantaneously. Stocks are measured at the end of the period. At the end of this first step, a fully specified system of equations exists. It has to be numerically solved for each period.

The next stage, consisting of the estimation of the parameters, is more technical. Klein and Goldberger devoted a lot of attention to it, using the latest econometric techniques that had been developed at the Cowles Commission at the time. They were the first to apply the limited-information maximum-likelihood technique to real data. The estimation task completed, the model could be run either for predictive purposes or to compare the effects of alternative economic policies.

For the purposes of this article, our attention will focus exclusively on the transition from the theoretical to the empirical model.¹⁶ In their book, Bodkin, Klein and Marwah (1991) emphasize that the Klein-Goldberger model had two basic features: it was Keynesian *and* neoclassical. In his famous Critique, Lucas was to contest this second claim (Lucas [1976] 1981). We, however, are mainly interested in the first characterization. Is the Keynesian lineage of the Klein-Goldberger model so obvious? Looking at the 1955 book in isolation, and wondering whether it manifests such a lineage, the main clue we find is that its division of the economy into separate sectors comes close to the divisions to be found in macroeconomic theory. Moreover, the names given to the equations echo Keynesian categories. But is there more to it than this? Have the core features of the Keynesian theoretical model, as defined by Klein in his earlier theoretical pieces, been preserved in the process? Klein, for his part, was certain they had. He argued this in an article published in a volume edited by Kurihara in the same year as the Klein-Goldberger book:

Yet complex as the present model is, it stems directly from the Keynesian inspiration. It is an outgrowth of the theoretical macrodynamic models of the Keynesian system and the empirical testing since 1936. It attempts to distill a workable model out of the vast research stimulated by the *General Theory* (Klein 1955, p. 316).

¹⁶ For a more detailed account, see Malgrange (1989).

Klein's 'Empirical foundations of Keynesian economics' paper (1955) ¹⁷

The aim of this article was to recount the steps taken to transform the simple Keynesian model into an empirically testable model. Several dimensions are involved, the main one being the dynamization of the static Keynesian system. How, we may wonder, can a dynamic system verify the validity of a static system? Klein's answer is as follows:

If we start at the empirical level and estimate a dynamic statistical equation system of actual behavior, we must be able to show whether or not this system is actually a dynamization of a static Keynesian system. To put the matter in another way, the static system derived from our empirical dynamic system must not contradict the hypothesis of a static Keynesian system if the latter is to be judged acceptable. This is the type of correspondence required between abstract static models and realistic dynamic models (Klein 1955, p. 280).

Klein starts by presenting the customary mathematical exposition of the Keynesian system, a four-equation system. For all its pedagogical usefulness, this model, Klein claims, is inadequate to explain observed behavior. After having made a series of remarks (to some of which we shall return below), Klein presents a system of equations for an enriched Keynesian model. It runs as follows :

- | | | |
|-----|-------------------------|--|
| (1) | $C = C(i, Y)$ | consumption |
| (2) | $I = I(i, Y)$ | investment |
| (3) | $\frac{M}{p} = M(i, Y)$ | money market equilibrium ¹⁸ |
| (4) | $Y = Y(N, D)$ | production function |
| (5) | $D = D(Y, K)$ | capital depreciation |
| (6) | $N = N^D(w/p, D)$ | demand for labor |
| (7) | $N^S = N^S(w/p)$ | supply of labor |
| (8) | $Y = C + I$ | goods market equilibrium |

¹⁷ In this article, Klein expressed his gratitude to Goldberger for having done the calculation for his model ("Mr. Arthur Goldberger of the staff of the Research Seminar in Quantitative Economics, University of Michigan, has prepared the basic data and carried out the computation" (Klein 1955, note 48, p. 314)). This implies that Goldberger played a secondary role in the development of the model, and that most of the methodological choices underpinning it were devised by Klein. Therefore, in this section, we shall refer only to Klein, rather than to Klein and Goldberger.

¹⁸ Henceforth bold type indicates that the variable is exogenous.

$$(9) \quad K - K_{-1} = I \quad \text{capital accumulation}$$

To complete the model, an equation relating the demand for, and the supply of, labor is needed. The classical solution is of course:

$$(10) \quad N^D\left(\frac{w}{p}, D\right) = N^S\left(\frac{w}{p}\right).$$

However, due to his desire to emphasize dynamics, Klein formulated Equation (10) as:

$$(10') \quad \frac{dw}{dt} = f(N^S - N^D); 0 = f(0).$$

The Keynesian solution must be different on some score. As Klein wanted Keynesian theory to be neoclassical, he kept this differential equation. The only change he made concerns its outcome. Classical theory claims that in equilibrium (i.e. when the rate of changes in prices is zero) the supply of, and the demand for, labor match. In contrast, in Keynesian theory an excess supply of labor is still present at equilibrium.¹⁹ That is, Equation (10') is replaced by Equation (10''), where

$$(10'') \quad \frac{dw}{dt} = f(N^S - N^D); 0 \neq f(0).$$

The problem is now simple. It consists in assessing which of Equation (10') and Equation (10'') holds empirically. This “testing of the association of zero unemployment with zero wage changes in the bargaining equation of the labor market”, Klein declares in the Kurihara article (Klein, 1955, p. 289), is the ultimate purpose of the Klein-Goldberger model. Other queries bear on the interest elasticity of investment, the effect of real wealth on consumption and the interest elasticity of the liquidity preference function (Klein 1955, p. 289). The first of these additional items refers to Klein’s own pet theory about where it all begins. The second assesses whether Pigou is right, while the last is a test of the Hicksian liquidity-trap assumption. On each of these points, the empirical model should lean either towards the Keynesian or the classical outcome. Keynesian theory would win the battle if the Keynesian insight looked empirically stronger than the non-Keynesian one, and vice versa for classical theory. Small wonder that Klein would eventually claim that Keynesian theory wins the day in every one of these contests.

Before entering into the nuts and bolts of the model, two additional remarks need to be made. First, the wage-adjustment equation is expressed in nominal rather than real terms. Does this mean that Klein is going to resort to a money illusion type of argument? Yes and no. While he remains keen to cast the Keynesian model in real terms as far as the supply of labor is concerned, to him, this trait is compatible with an account of the working of the labor market

¹⁹ “The central point of all Keynesian economics is the following: *The system of classical competitive equilibrium does not automatically lead to a stable solution of full employment.*” (Klein 1955, p. 281; emphasis in the original).

where variations in wages are the result of a bargaining process between wage earners and firms bearing on the nominal wage. Although workers optimize with respect to the real wage, the bargaining is over the money wage. Hence money illusion enters the picture. Klein's contrived solution consists of declaring that money illusion happens only during the adjustment process and vanishes at equilibrium, where the classical properties of homogeneity are back in charge (Klein 1955, p. 286).²⁰ Second, Klein's model faces the objection that, with $0 \neq f(0)$, equilibrium can be non-existent. Klein's way out of this dilemma was to declare that models, which have no solution in their static form, can have solutions when they are in motion. Klein claimed Haavelmo's support for this idea, invoking an article (Haavelmo 1949-50) the gist of which, he claims, is that the problem is common and hence not serious:

Professor Haavelmo argues that certain dynamic systems, representing the real world, always have solutions provided they are in motion, but that the corresponding static system, representing abstractions, do not possess solution. The system fluctuates but not about an equilibrium position (Klein 1955, p. 285).²¹

Our last remark bears on the notion of full employment. Klein makes it clear that he sticks by his earlier views about the meaning of full employment and involuntary unemployment. After having dismissed what he calls a pragmatic definition of full employment, he proposes to redefine it as "a situation in which all of who are willing to work at going real wage rates can find employment" (Klein 1955, p. 283). That makes full employment the reverse of the Keynesian notion of involuntary unemployment. The existence of full employment, so defined, or the lack thereof is the thing he wants to assess.²²

The connection between the theoretical and the empirical models

We are now able to compare the theoretical and the empirical models, basing our analysis on Klein's 1955 article. We propose to do this equation by equation, but considering only the most significant ones: the consumption function, the investment function, the liquidity-preference function, and the labor market relations.

²⁰ "Later, in continuing discussions at the Cowles Commission, among Don Patinkin, Trygve Haavelmo, and myself, Trygve suggested that the Keynesian model be specified as one that always had a valid solution, in which negative wages or interest rates would not be present, as long as the system was in motion, in a dynamic sense, but when one imposed equilibrium conditions which included full employment a solution would not exist. Personally, I find that explanation attractive" (Klein, 2006, p. 172).

²¹ To a present-day reader, this assertion is perplexing. Moreover, it is hard to detect the view attributed by Klein to Haavelmo in Haavelmo's paper.

²² The only *caveat* made by Klein is that to him the existence of involuntary unemployment ought to be tested not at every instant of time but as an equilibrium phenomenon — that is, with reference to his views on the link between statics and dynamics, as "the static system which is viewed as the equilibrium position of an associated dynamic system" (Klein 1955, p. 283).

The consumption function

Klein argued that Keynes's version of the Keynesian propensity to consume is too simple and that a richer relationship is needed (1955, p. 289). His strategy was to envisage different possible factors that might influence consumption or saving, exploring whether they exert an effect and hence should be included in the model. He observed that the different income classes did not have the same propensity to save. This led Klein to separate three basic occupational groups: farmers, businessmen, and non-farmer non-business people, the last category comprising mainly wage earners. Klein ended up making aggregate consumption (and hence saving) a function of three types of income: wages, business income and farm income.

A second factor is lags. From his early writings, Klein had been alert to these. He introduced them into most of his equations. Having tried different fits, he came to the view that "the best possible lag relation found in aggregative data, however, is that in which past consumption levels, rather than past income, influence present consumption" (Klein 1955, p. 291). Next, Klein introduced two additional arguments into the equations (population and lagged year-end personal liquid assets), on the grounds of their good fit (at the time, the concept of data mining had not yet been coined!). On the other hand, he discarded other plausible factors. This was the case for expectations, which he decided to sidestep because they were too difficult to incorporate: "It is an unsolved problem to develop a complete system in which expectations are endogenous" (Klein 1955, p. 291).²³ Likewise, he discarded the interest rate on the ground that its direct influence was not significant (Klein 1955, p. 292). This exclusion was hardly benign. If the facts leaned heavily towards the opposite conclusion, this would be damaging for the vision that he had held from *The Keynesian Revolution* onwards. A third excluded factor was wealth, again not an innocuous neglect. After a lengthy discussion, Klein ended up arguing that the Pigou effect works for low income groups but that it is attenuated or reversed at high income levels. This mitigated result sufficed for him to claim that Keynesian theory was salvaged!²⁴

At the end of the day, Klein transformed the theoretical consumption equation ($C = C(i, Y)$) into the empirical equation

$$C = \alpha_0 + \alpha_1 W + \alpha_2 \Pi + \alpha_3 A + \alpha_4 C_{-1} + (L_H)_{-1} + N_p,$$

²³ Klein and Goldberger could have argued that the introduction of lags was an indirect way of taking adaptive expectations into account. This is the standpoint that their followers adopted.

²⁴ "This finding is of the greatest importance, because it means that the arguments against the central point of Keynesian theory based on the wealth-saving relationship are of doubtful importance. Some people react to market forces in a way to refute the Keynesian theory, while others react in a way to support it. On balance, there is probably more strength to the negative than to the positive effect of wealth on savings, but the net result is that market forces are so weakened that they are not reliable instruments of adjustment" (Klein 1955, p. 293).

where C is aggregate consumption, W is the real disposable wage income, Π is the real disposable non-wage non-farm income, A the real disposable farm income, C_{-1} lagged consumption, L_H personal liquid assets, and N_p population.

The investment function

In the theoretical model, the investment function was defined as $I = I(i, Y)$. Central to Klein's argumentation was a low interest-elasticity of investment. In his theoretical work, Klein had off-handedly justified this assumption on factual grounds, without entering further into the matter. Addressing it again here, he adopted a more nuanced position. After having surveyed the literature, he admitted that industries such as railroads and electric utilities did exhibit significant interest elasticity of investment. Nonetheless he ended up concluding that "empirical studies of time series data show little or no significant relation between interest and aggregate investment" (Klein 1955, p. 295). This allowed him to drop the interest rate from the investment function.

As to the role of expectations on capital formation, Klein dismissed them on the ground that empirical studies had failed to provide illuminating results about expectations, and that this cast doubt on the theory of the marginal efficiency of capital. On the other hand, he introduced new factors into the picture, namely gross corporate income, capital, and corporate liquid assets, the first and third of these exerting a positive influence on investment, and the second a negative one. These magnitudes appear with a one-period lag, which may be interpreted as an indirect way of incorporating expectations.

The empirical equation runs as follows:

$$I = \beta_0 + \beta_1(Y_G)_{-1} - \beta_2K_{-1} + \beta_3(L_2)_{-1},$$

where Y_G is gross corporate income, K is the year-end stock of capital, and L_2 the year-end business liquid assets. Note this equation predetermines investment: it depends only on past values.

The liquidity-preference function

Klein remarked that the liquidity preference function should be split into two functions, one for households and one for the business sector. Thus, the single theoretical function $M = M(i, Y)$ ought to give way to two empirical equations. The households' function is the most challenging. Although Klein did not insist on the liquidity-trap notion in his theoretical writings, he nonetheless viewed it as part of the Keynesian heritage. Therefore he wanted the empirical investigation to confirm that the liquidity preference function has high interest elasticity at low interest rates. To ascertain this, a delicate preliminary task had to be addressed, namely sorting out active balances, which are linked to transactions, from idle ones. Fortunately, at the time, the study of liquidity preference was fashionable, and several contributions were available.

By examining them, Klein again drew conclusions that were favorable to the Keynesian viewpoint (Klein 1955, p. 307). He was thereby led to define a household's liquidity preference as an additive function of two variables: the net disposable income of the three income groups, and the difference between the long-term rate of interest and a minimum rate set at 2 %, expressed as a power function.

$$L_I = \chi_1(W + \Pi + A) + \chi_2(i_L - 2.0)^{-\chi_3} \quad \chi_1 \text{ and } \chi_2 > 0$$

where W stands for total wage income, Π for profits, A for farm income, and i_L is the yield on long-term corporate bonds in per cent. The last term of the equation indicates that whenever the long-term interest rate tends towards 2 %, the demand for idle balances exhibits infinite interest elasticity. So the liquidity trap is fully part of the picture. As to the liquidity preference of the business sector, Klein specified it as follows:

$$L_2 = \delta_0 + \delta_1(W_I) - \delta_2 i_S - \delta_3(p - p_{-1}) + \delta_4(L_2)_{-1} \quad \delta_1, \delta_2 \text{ and } \delta_3 > 0.$$

The business sector's preference for liquidity is a function of the wage fund (W_I designating total private wages), of firms' portfolio choices (i_S the yield on short-term commercial paper in per cent), due account being taken of inflation, and of its lagged value.

The labor market

Acknowledging that more satisfactory results are available for the demand for labor than for its supply, Klein equated labor supply with the labor force. The reason given is pragmatic — “it is difficult to assess individuals' economic motives beyond demographic forces and other factors in deciding whether or not to offer their services on the labor market” (Klein 1955, p. 307). Hence he sets

$$N^S = N,$$

with the labor force N given exogenously as in the *Journal of Political Economy* article!²⁵

As to the demand for labor, Klein proposed the following equation:

$$W_I = -\phi_1 + \phi_2(Y + T + D - W_2) + \phi_3(Y + T + D - W_2)_{-1} + \phi_4 t,$$

where W_I is the real private wage income, $Y + T + D - W_2$, the real private gross domestic product, D the capital consumption allowance, W_2 the real public wage income, T the real net indirect taxes, and t a time trend starting in 1929. The specification of this equation is derived from the hypothesis that the production function is Cobb-Douglas, implying that wages constitute a constant average proportion of output, with some adjustment lags.

²⁵ This assumption, Klein writes, ought to be dropped in the future (Klein 1955, p. 317). For all their central character, Klein commented less on the labor market equations than on other aspects of his system. We suspect that this might be a sign of some uneasiness about his formulation of the labor market.

The wage adjustment equation is:

$$w - w_{-1} = \varepsilon_0 - \varepsilon_1(N - N_w - N_E - N_F) + \varepsilon_2(p_{-1} - p_{-2}) + \varepsilon_3t,$$

where w measures the nominal index of hourly wages, N the labor force, N_w the number of wage earners, and N_e and N_f the number of non-farmer and farmer entrepreneurs.²⁶ This equation incorporates partial indexation ($\varepsilon_2 = 0.56$). The last term, ε_3t , can be interpreted as a proxy for the effect of increases in productivity.

The wage adjustment equation plays a crucial role because it allows Klein to reach a conclusion about the battle between the classical and the Keynesian claims. The Keynesian model is declared the winner if there is a mismatch between the supply of and the demand for labor at equilibrium, i.e. whenever $dw/dt = 0$. This, Klein claims, is what emerges from the empirical model:

In the author's previous studies [Klein 1950], a relation was estimated between the annual change in wage rates on the one hand and unemployment and the lagged wage level on the other. This estimated equation has the property that if the change in wage is set equal to zero, unemployment is greater than 3 million for average values of the lagged wage level. Christ in his later study estimated a similar wage adjustment equation for the labor market but added the rate of change in prices as an explanatory variable. ... For equilibrium, we set the rate of change in prices equal to zero. We then find a zero rate of change of wages in his [Christ's] equation associated with substantial unemployment (6–7 million persons) for the average level of the lagged wage (Klein 1955, p. 308).

So, in Klein's eyes, the matter is sealed: the empirical work has proven the superiority of the Keynesian theoretical model:

Regardless of our ultimate treatment of labor supply, the market adjustment equation relating wage changes to unemployment and the lagged changes in prices is of the utmost importance in giving an empirical foundation to Keynesian economics. In equilibrium, this system does not associate zero unemployment with zero wage changes (Klein 1955, p. 317).

The sets of equations in the theoretical and the empirical model are transcribed in Table 1 below.

²⁶ We have the identity $W_1 + W_2 = N_w w/p h$, with h being the (exogenous) index of hours worked per year.

Table 1. A comparison between the theoretical and the empirical model

Equations	Theoretical model	Empirical model
(1) Consumption	$C = C(i, Y)$	$C = \alpha_0 + \alpha_1 W + \alpha_2 \Pi + \alpha_3 A + \alpha_4 C_{-1} + (L_H)_{-1} + N_p$
(2) Investment	$I = I(i, Y)$	$I = \beta_0 + \beta_1 (Y_G)_{-1} - \beta_2 K_{-1} + \beta_3 (L_2)_{-1}$
(3) Liquidity preference	$M/p = (M(i, Y))$	(a) households: $L_1 = \chi_1 (W + \Pi + A) + \chi_2 (i_L - 2.0)^{-\chi_3}$ (b) business sector: $L_2 = \delta_0 + \delta_1 (W_1) - \delta_2 i_S - \delta_3 (p - p_{-1}) + \delta_4 (L_2)_{-1}$
(4) Labor demand	$N^D = N^D(w/p, Y)$	$W_1 = -\phi_1 + \phi_2 (Y + T + D - W_2) + \phi_3 (Y + T + D - W_2)_{-1} + \phi_4 t$
(5) Labor supply	$N^S = N^S(w/p,)$	$N^S = N$
(6) Wage adjustment	$\frac{dw}{dt} = f(N^S - N^D)$	$w - w_{-1} = \varepsilon_0 - \varepsilon_1 (N - N_w - N_E - N_F) + \varepsilon_2 (p_{-1} - p_{-2}) + \varepsilon_3 t$

PART III. AN ASSESSMENT

An impressive leap forward

The first remark that needs to be made is that the construction of the Klein-Goldberger is an impressive step forward. The inaugural paragraph of the entry on Klein in the *New Palgrave Dictionary, Second Edition* captures the historical role that Klein played well:

Lawrence Robert Klein, 1980 Nobel laureate in economics, has been a pioneer in economic model building and in developing a worldwide industry in econometric forecasting and policy analysis. As Klein's Nobel citation states, 'Few, if any, researchers in the empirical field of economic science have had so many successors and such a large impact as Lawrence Klein.' When one thinks of macroeconomic models, his name is the first that springs to mind. Spanning six decades, his research achievements have been broad, covering economic and econometric theory, methodology and applications. In emphasizing the integration of economic theory with statistical method and practical economic decision-making, he played a key role in establishing the directions and in accelerating the development of the theory, methodology and practice of econometric modeling (Mariano, 2008, p. 1).

Several factors concurred to make this new development possible: the emergence of the IS-LM model, new and more rigorous statistical estimation methods, the systematic construction of national data bases, and the invention of new calculation methods eventually leading to the emergence of computers. Klein took advantage of these innovations. He almost self-handedly created a new sub-discipline, macroeconomic modeling. For the first

time, governments had at their disposition a quantitative macrodynamic general equilibrium model that they could use to help in the elaboration of their policy. Klein did not just conceive the first model (with Goldberger). He also contributed significantly to successive generations of models, which all, for better or worse, rested on the methodological standards he had introduced.

Klein's reconstruction of Keynesian theory

A methodological preliminary

Before starting our assessment, we need to pause briefly for a methodological reflection:

- (a) The standard IS-LM model as described in macroeconomic textbooks from the 1950s until the 1970s is not the same as Hicks's 1937 model. The definitive shape of the model is due to Modigliani (1944).²⁷ The Hicksian and the Modigliani versions of the IS-LM (as well as all the ensuing IS-LM models) have in common an opposition between the classical and the Keynesian sub-systems. To Hicks, the specificity of the Keynesian system (with respect to the classical) lay in the shape of the LM curve, in particular its having a horizontal section (dubbed the liquidity trap). To Modigliani, it lay in the specific shape taken by the labor supply (an inverse L form).²⁸
- (b) The usual view is that the IS-LM model deals with the short-period. However, this characterization is misleading. Let us consider Hicks's device of the week, wherein exchanges are confined to Mondays. In this device, the short period refers to a limited succession of weeks. If this definition is accepted, the IS-LM cannot be viewed as dealing with the short period if its object of analysis is the occurrence of involuntary unemployment. This is a phenomenon that arises during a specific unit of exchange, that is, on a given Monday.
- (c) It ought furthermore to be realized that the adjustment towards 'Monday equilibrium' occurs instantaneously. The rationale for this assumption is the need to exclude the possibility that exchanges take place at disequilibrium prices during the adjustment process. As Walras and Marshall realized, such exchanges lead to wealth effects, which prevent the economy or the market from converging towards the equilibrium that they would have reached without disequilibrium exchanges. As a result, using Occam's razor, duration ought to be assumed away as well.
- (d) In the prevailing macroeconomics practice of the 1950s and 1960s, IS-LM models were mainly concerned with what happened in a given period of exchange (misleadingly

²⁷ See De Vroey (2000) for a discussion of this point.

²⁸ Henceforth our discussion of the IS-LM model will refer to Modigliani's version.

called the short period). The issue of the connection between the short and the long period, was swept under the rug.²⁹

A twofold transformation of the standard IS-LM model

Without stating it explicitly, Klein was led to modify the IS-LM model in two significant ways. The first is that the subdivision of the IS-LM into two distinct sub-systems, the classical and the Keynesian, within the IS-LM model, was abolished. In Klein's hands, the Keynesian and the classical system were one and the same system of equations. In other words, to him, there was no specific Keynesian model that would compete with the classical model as rival representations of reality. Instead, Klein contented himself with a single system, the classical one, just adding that it could lead to two different end-states. It is the task of empirical research to assess which of these reflects reality.

Klein's second and related departure from the standard IS-LM approach is that, from his *Journal of Political Economy* article onwards, the object of study of the IS-LM model is no longer a given Monday's outcome (to use the terminology introduced above). Or to put it in more standard terminology, its concern is now the long- rather than the short-period. Again, Klein does not state this explicitly, but nonetheless this is what he is actually doing. Otherwise, his statement that the classical system comprises states of unemployment makes no sense.³⁰

An anticipation of the natural rate of unemployment idea

Klein's theoretical model constitutes an anticipation of the idea of a natural rate of unemployment. When made inter-temporal, Equation (2.10) becomes:

$$\frac{w - w_{-1}}{w_{-1}} = \alpha - \beta \left(\frac{\bar{N} - N}{\bar{N}} \right) = \alpha - \beta U$$

where α and β are positive parameters, \bar{N} is the fixed labor supply, N is the short-period level of employment ($N \leq \bar{N}$), and U is the rate of unemployment. The long-period equilibrium is obtained when the wage rate ceases to change:

$$0 = \alpha - \beta \left(\frac{\bar{N} - N^*}{\bar{N}} \right)$$

²⁹ A fine illustration of this standpoint is to be found in Allen's book, *Macroeconomic Theory: A Mathematical Treatment* (1967): "The main variables are flows, of income and employment or of investment and saving, which refer only to one point of time or to one period. We relate them at a given time (or period); there are no links between one time (or period) and another" (Allen 1967, p. 101).

³⁰ That the classical system can witness disequilibrium is an idea that was present in Hicks's 1937 paper but it vanished when Modigliani transformed Hicks's initial model into the standard IS-LM model.

$$U^* = \left(\frac{\bar{N} - N^*}{\bar{N}} \right) = \frac{\alpha}{\beta}$$

where N^* is the equilibrium level of employment and U^* the corresponding equilibrium rate of unemployment. Hence in short period equilibrium, by the introduction of U^* , the equation describing the wage adjustment equation can be written as:

$$\frac{w - w_{-1}}{w_{-1}} = \beta U^* - \beta \left(\frac{\bar{N} - N}{\bar{N}} \right)$$

$$\frac{w - w_{-1}}{w_{-1}} = -\beta(U - U^*)$$

How can the unemployment arising in this system be characterized? On reading the 1947 article, there is no doubt that, to Klein, U^* is involuntary unemployment. As to U , we may presume that it is due to money illusion.³¹

Assessing the empirical model

We have already stated that the mere construction of the Klein-Goldberger model was impressive; however our concern here is different. It touches the central question of our inquiry: can we accept Klein's claim that the Klein-Goldberger model succeeds in demonstrating that reality operates along Keynesian rather than classical lines? The answer to this question hinges on whether the concept of unemployment present in the empirical model is the same as that in the theoretical model. For our part, we do not think that this is the case.

To make our point, it is worth starting with a brief return to Keynes's *General Theory*. As well known, Keynes drew a distinction between several types of unemployment, the two main ones being involuntary unemployment and frictional unemployment. This distinction pertains to reality. However, Keynes did not endeavor to build a theory where the two main types of unemployment were present at the same time. His theory only encompasses one form of unemployment, involuntary unemployment. Either it is present or there is full employment. The same is true for the standard IS-LM model as well as for Klein's modified IS-LM model: the only possible type of unemployment is involuntary unemployment. In the model economy there can be no doubt that any unemployment 'observed' is involuntary unemployment since this the only possible form of unemployment. However, in reality, this is not true. No doubt, there will always be a positive level of unemployment, but this is not necessarily involuntary unemployment. It can as well be frictional unemployment. Therefore, any empirical work

³¹ Frictional unemployment is a tempting hypothesis, but Batyra and De Vroey (2009) show that there is no room for frictional unemployment in supply and demand models *à la* Marshall.

undertaken along the lines opened up by Klein will actually be unable to verify Keynesian theory in its specificity, i.e. the claim that involuntary unemployment exists.³²

In order to validate Keynesian theory, Klein should have addressed the question of what fraction of the existing unemployment is voluntary and what is frictional unemployment. Instead, he took it for granted that all the observed unemployment was involuntary, a mistake still often made today and consisting of interpreting any real-world unemployment as a case of excess supply and hence of disequilibrium. “Keynes wrote as though the ‘involuntary’ nature of unemployment was verifiable by direct observation, as though one could somehow look at a market and verify directly whether it is in equilibrium or not” (Lucas [1977] 1981, p. 220). The same remark could be made about Klein. Klein’s mistake was to believe that real-world unemployment was necessarily the empirical counterpart of the theoretical category of market non-clearing. To a present-day economist, this mistake may look gross, but at the time it passed totally unnoticed. While we should not blame him for it, the fact remains that Klein’s declaration that he had demonstrated the empirical existence of involuntary unemployment is unwarranted.³³

CONCLUDING REMARKS

In the introduction to his *Studies in Business Cycle Theory* book, Lucas remarks that:

In following Lawrence Klein work, I had been struck with the impression that as the short-term forecasting abilities of his models steadily improved, he evidently was becoming less and less interested in both economic and econometric theory (Lucas, 1981, p. 10).

Our paper has shown that Klein’s shift from theory to empiricism began at an early stage in his career. It is often true that people who do empirical work were never interested or knowledgeable about theory. This was not the case for Klein. His first writings witness his firm grasp of Keynesian theory. It is just that he drifted away from it in the process of trying to make it empirical and dynamic. Keynesian theory may well have been crying out for empirical verification but then the notion of involuntary unemployment seems to have been the exception to the rule!

³² This problem was later addressed by Lucas and Rapping (1969) from the opposite side, in an argument aimed at showing that what may look like involuntary unemployment is actually voluntary unemployment.

³³ This conclusion pertains to Klein’s main claim. As we have seen, the data on two of his other claims (the interest-elasticity of investment and the wealth effect) are inconclusive, but Klein tends to give more weight to the factors which support the Keynesian interpretation.

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