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

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A paper to be presented at the "Alternative approaches to the building of economic dynamics in the years of high theory" workshop, Siena University, December 18-19, 2009.

Abstract

According to Klein, Keynesian theory was crying for empirical application, and he set himself the task of implementing this extension. Our paper documents the different stages of his endeavor, focusing our attention on his *Keynesian revolution* book, his *Journal of Political Economy* 1947 article on aggregate demand theory and his article on the empirical foundations of Keynesian theory in the Kurihara *Post-Keynesian Economics* volume. Klein's claim is that his empirical model (the Klein-Goldberger model) vindicates Keynes's insights empirically, in particular the existence of involuntary unemployment. While praising Klein for having succeeded in making Keynesian theory empirical and dynamic, we claim that a high price had to be paid. Klein and Goldberger's alleged Keynesian model is much less Keynesian than they claim. 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 researcher career by writing a dissertation on Keynesian theory that became a book entitled *The Keynesian Revolution* (1947). In the process of writing it and in subsequent thoughts, Klein 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 project.<sup>1</sup> Success came along 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 our 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 lays behind statements by Klein such as the following one:

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 one understands by an extension. For our part, we shall argue that the link between Keynesian theory (the standard IS-LM model) and Keynesian macroeconomic modelling, as inaugurated by Klein, is more tenuous than he believed. In particular, we shall show that his claim that he empirically demonstrated the validity of Keynes involuntary unemployment hypothesis is ill-grounded.

In the first part of the paper, we discuss two pieces that Klein published in 1947, his above mentioned book and his *Journal of Political Economy* 1947 article, “Theories of Effective Demand and Employment” which both expose Klein’s version of the Keynesian theoretical model. In its second part, we expose Klein’s extension of this model into a Keynesian

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<sup>1</sup> 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).

empirical model. In part three we assess the connection between these two models and point out the limitations of Klein's undertaking.

## **PART I. KLEIN'S EARLY 1947 WORKS**

Klein started publishing in leading journals while still very young, and at a great pace.<sup>2</sup> Here, we are interested in two 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.<sup>3</sup> It can thus be presumed that the article was written after the book. While they overlap widely, we shall see that the article departs from the book on a critical point that had a definite impact on Klein subsequent work. It constitutes the first testimony of his lasting attitude of placing pragmatism above theoretical consistency.

### **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 exposed his views in prose but provided his readers with a rather advanced mathematical appendix.<sup>4</sup> But Klein's book was more than just of presentation of the ideas presented in the *General Theory* (as Hansen's *A Guide to Keynes* (1953)). His interpretation of the central message of the *General Theory* was original. While Hicks (1937) had emphasized the liquidity trap and Modigliani (1944) the rigidity of labor supply, Klein's distinct perspective was to link the occurrence of involuntary unemployment with a lack of positive value of the interest rate. To make his point, Klein used the standard IS-LM claiming that the saving and investment functions (especially the latter) are highly inelastic to the interest rate. As a result, no positive rate of interest may exist allowing savings and investment to be equalized. The way out is to have income departing from its full-employment level (Klein 1947a, p. 202-203). Figure 1 illustrates.

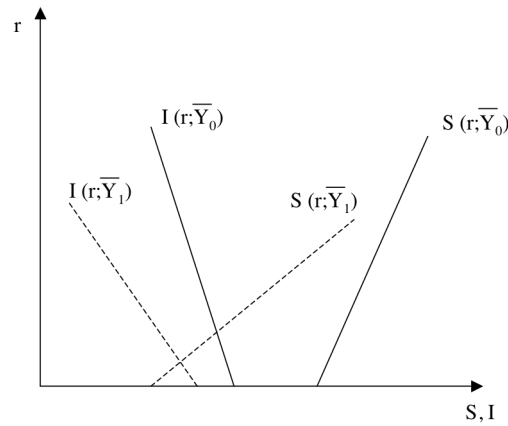
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<sup>2</sup> Born in 1920, he published 5 articles in *Econometrica*, two in the *Journal of Political Economy*, one in the *Review of Economics and Statistics* and two books between 1943 and 1950.

<sup>3</sup> Cf. Klein [1992] 1997, p. 100.

<sup>4</sup> One of the appendix's distinctive features was Klein insistence on giving Keynes's main concepts a choice-theoretical basis witnessing thereby to a micro-foundations preoccupation that was unusual at the time.

Figure 1 The lack of equilibrium between saving and investment at full employment income according to Klein <sup>5</sup>



This decrease in income will in turn have an impact on the labor market generating an excess of the labor supply over the labor demand at an increased real wage. Trading then takes place at a point off the supply curve, a conception that will be taken up by Patinkin *in Money, Interest and Prices* ([1956] 1965). This is involuntary unemployment in Keynes's sense.<sup>6</sup> In modern parlance, we should speak of short-side trading but Klein told another, more ideologically-laden, story by declaring it the result of 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. 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).

<sup>5</sup> Drawn from Klein 1947a, p.

<sup>6</sup> A state where some suppliers wish to work but are unable to make their optimizing plan come through. Cf. De Vroey (2004).

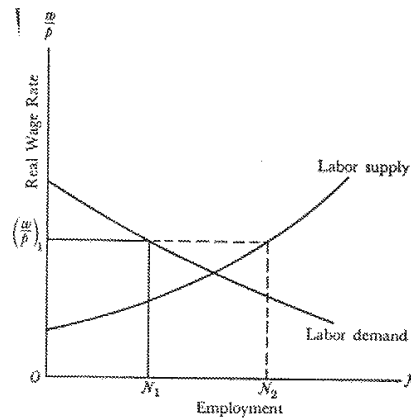
Figure 2 The labor market outcome <sup>7</sup>

Figure 5.

The point to be retained from our brief examination of Klein's book is that, in spite of the fact that he has a special story to tell, he nonetheless fully reasons within the framework of the standard IS-LM model. Since we shall argue that this is no longer the case in the 1947 article, it is worth pausing briefly to spell out what we conceive as the standard IS-LM methodology.

(a) The standard IS-LM model as exposed in macroeconomic textbooks from the 1950s up to the 1970s is not the same as Hicks's 1937 model. The definitive shape of the model is due to Modigliani (Modigliani 1944). <sup>8</sup>

(b) The usual view is that the IS-LM model deals with the short-period. However, this characterization is misleading. Let us put the matter in reference to Hicks's week device, wherein exchanges are confined on Mondays. In this device, the short period refers to a limited successions of weeks. Whenever, this definition is accepted, the IS-LM cannot be viewed as dealing with the short period if its object of analysis is the arising of involuntary unemployment. The latter is a phenomenon that arises during a specific unit period of exchange, that is, a given Monday.<sup>9</sup>

(c) It ought furthermore to be realized that the adjustment towards 'Monday equilibrium' occurs instantaneously. The problem here is not duration *per se* but rather the possibility that during the adjustment process exchanges take place at disequilibrium prices. As Walras and Marshall realized, such exchanges lead to income effects, which impede the economy or the market to converge towards the same equilibrium that would have been reached without disequilibrium exchanges. Hence they must be excluded. As a result, using Occam's razor,

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<sup>7</sup> Drawn from Klein (1947a, p.

<sup>8</sup> Cf. De Vroey (2000).

<sup>9</sup> We shall nonetheless keep to the usage and use the 'short-period' term but the reader should be aware that we have in mind the unit period of exchange!

duration ought to be assumed away as well. This is true for the two sub-systems of the standard IS-LM, the classical and the Keynesian system, the first of these comprising flexible wages, the second wage rigidity.

(d) In the prevailing practice of the 1950s and 1960s, the standard IS-LM model's concern with a given period of exchange was exclusive. In other words, the short period remained unconnected to the long period. A fine illustrations amongst others 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).

This is our reconstruction of the time framework of the standard IS-LM model. Admittedly, it will not be found in textbooks because, unfortunately enough, their authors hardly delved into the matter. Be that as it may, the standard model is hardly congenial for people who want to do empirical work. Confining the study to what goes on during a single period of exchange cannot do for their purpose. Klein's awareness of this drawback led him to extend the standard IS-LM model by making it dynamic. To us, this is a departure from the standard conception of the IS-LM model. Therefore, we find it useful to draw a distinction between the 'standard IS-LM' model, which has the traits described above, and the 'extended IS-LM' model inaugurated by Klein and pursued in Klein and Goldberger's model.<sup>10</sup>

### ***The Journal of Political Economy article***

Klein's aim in this article, entitled *Theories of Effective Demand and Employment*, was to compare three theories of employment, the classical, the Keynesian and the Marxian. Here we are interested only in the first two. At first sight, the article seems to repeat the ideas put forward in the book. However, upon scrutiny, this is not the case. Without making it explicit (and possibly without even being aware of it), Klein begins his shift from the standard to the extended IS-LM model, the result of his pragmatic concern. We start with presenting the contrast Klein drew between the classical and the Keynesian system. Table 1 summarizes.

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<sup>10</sup> Our notion of extended IS-LM model has often been referred to in the literature as the neo-Keynesian model.

Table 1. The classical and the Keynesian systems in the standard IS-LM framework<sup>11</sup>

	The classical system	The modified classical system	The simplified Keynesian system	The modified Keynesian system
Quantity equation (in the Keynesian system, liquidity preference equation)	(1.1) $M = kpY$	(1.1') $M/p = L(i, Y)$	(2.1) $M/p = L(i)$	(2.1') $M/p = L(i, Y)$
Saving-investment equation	(1.2) $S(i) = I(i)$	(1.2') $S(i, Y) = I(i, Y)$ $i > 0$	(2.2) $S(Y) = I(Y)$	(2.2') $S(i, Y) = I(i, Y)$ $i > 0$
Production function	(1.3) $Y = Y(N)$	(1.3) $Y = Y(N)$	(1.3) $Y = Y(N)$	(1.3) $Y = Y(N)$
Demand for labor	(1.4) $dY/dN = w/p$	(1.4) $dY/dN = w/p$	(1.4) $dY/dN = w/p$	(1.4) $dY/dN = w/p$
Supply of labor	(1.5) $N = f(w/p)$	(1.5) $N = f(w/p)$	(1.5) $N = f(w/p)$	(1.5) $N = f(w/p)$

Klein's classical system is standard, except for his proposal to generalize it slightly (second column). As to the Keynesian system, like Hicks, Klein distinguishes between two versions of it, the simplified and the modified one, the second being the most interesting one. Oddly enough, the modified Keynesian system as conceived by Klein turns out to be identical to the modified classical system! Their differences ought to be looked for elsewhere than in the above systems of equations.

In the article, Klein keeps the main claim of the book, that the distinctive trait of Keynesian theory is the low interest-elasticity of the investment function. This assumption, he claims, must be adopted because of its strong empirical validation. As in the book, this feature leads to the result that the economy lands on a less-than-full-employment level of activity. However, now Klein realizes that his story implies an additional equation, namely:

$$i > 0.$$

Adding this condition has the effect of making both the classical and the Keynesian systems overdetermined. Output is determined both by the saving-investment relation, on the one hand, and by the supply and demand for labor plus the production, on the other. Nothing insures that these two levels of output will coincide (1947b, p. 110). Since the problem concerns both the classical and the Keynesian systems, Klein's approach ceases to witness the sharp contrast between the classical and the Keynesian systems that was present both in the Hicksian scenario (a contrast between an upwards sloping LM curve and an LM curve with a horizontal section) and the Modigliani's scenario (a contrast between an upwards sloping labor supply and an inverse L-shaped labor supply).

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<sup>11</sup> The symbols have the usual meaning.

To Klein the contrast between a classical and a Keynesian analysis resides instead in the way in which they solve the overdetermination problem. The classical solution is nothing else than the Pigou effect (Pigou 1934), that is replacement of the saving-investment equation with a new equation:

$$S(i, Y, M/p) = I(i, Y) \quad (2.2')$$

While admitting that saving and investment could be interest-inelastic, Pigou claimed that this did not impede the attainment of full-employment equilibrium in as far as a new argument was added in the saving function, real cash balances. He assumed that saving varied inversely with the real stock of cash balances. If competition cut wages while the supply of money remains constant,  $M/p$  can be pushed upwards so that saving and investment are equal at full employment.

Klein is hardly convinced by Pigou's argument. In his words, "there is no 'proof' of Pigou's hypothesis" (1947b, p. 113). Pigou's view implies a damped dynamical system. Against this, Klein opposes a lack of evidence. The data fail to confirm the inverse relation between savings and cash suggested by Pigou. Cumulative deflation, fueled by expectations, and increased unemployment are, Klein claims, a more probable outcome.

Turning to the Keynesian solution, Klein now rejects Modigliani's special supply of labor curve (the inverse L) explanation to which he adhered in the book. At stake to him is to find a way of embodying the idea present in the book and which he maintains that workers are powerless with respect to capitalists.<sup>12</sup> For a neoclassical economist — and Klein claims to be one — this is a totally unconventional idea. However, when it comes to implementing it, he falls back on the trivial solution of modifying the standard supply curve of labor (1947b, p. 115). In the book, he viewed the supply of labor as having become inactive though keeping its standard shape. As a result, its existence, he claimed, was virtual. In the article, Klein is no longer satisfied with this solution, again, for an empirical reason: it cannot be tested.

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 (1947b, p. 117).

Klein's preferred solution is, in his terms, to drop the entire concept of the supply curve of labor (1947b, p. 116). Again, this looks a provocative statement but it ends up trivially: "The

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<sup>12</sup> Klein's powerlessness claim has a definite Marxian ring attached 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).



supply of labor is an exogenous variable represented by the labor force and determined by demographic factors” (p. 116). In other words, the labor force and the supply of labor are equated, working time being indivisible. Graphically, the supply of labor is a vertical line.

At this juncture, one equation is missing. It pertains to the relation between supply of and demand for labor. To fill the gap, Klein adds a wage adjustment equation.

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). The mathematical model would be:

$$(2.4) \quad w = py'(N) \text{ (demand for labor)}$$

$$(2.9) \quad \bar{N} = \text{labor supply}$$

$$(2.10) \quad \frac{d\left(\frac{w}{P}\right)}{dt} = g(\bar{N} - N)$$

Equation (2.10), Klein goes on writing, could be replaced by

$$(2.10') \quad \frac{dw}{dt} = h(\bar{N} - N)$$

if all the other equations of the system are used also (Klein 1947b, p. 116).

This wage adjustment equation is a novelty with respect to the standard accounts of the IS-LM model. It applies to the two systems. The difference between them lays elsewhere, whether the adjustment process converges towards a zero unemployment or towards a positive level of unemployment end state. The classical system has  $h(0)=0$ , the Keynesian  $h(0) \neq 0$ . That is, when the adjustment comes to an end, there is still an excess of supply of labor in the Keynesian system. In the classical system, the adjustment is damped, in the Keynesian system it is not.

### **PART III. THE KLEIN-GOLBERGER MODEL (1955)**

#### **A general presentation of the model**

We now turn to end of the first (highly productive) decade of Klein’s career as a researcher by examining the Klein-Golberger volume. As stated, Klein’s main motivation was to go beyond the Keynesian model, which he dubbed as 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 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 co-authored with Goldberger (Klein and Goldberger 1955a) introducing 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 (19991):

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 a part of a more continuous program in which new data, reformulations and extrapolations were constantly being studied. The model consisted of 15 structural equations, five identities and five 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, 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. 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).

Let us sketch out the different steps involved in the implementation of their project. The first is to decide about the features of the model. In terms of its mathematical structure, theirs is a system of recursive difference equations most of which are linear approximations of the structural theoretical relations. Within each period, some circular interdependencies are supposedly present reflecting the simultaneous determination of the variables of the system. Other variables are predetermined by their earlier values. Flows are annual, due to the statistical material at the time. In other words, the year is taken as the unit period of analysis. The adjustment towards equilibrium (unit period equilibrium in our terminology, short period in the standard terminology) is assumed to occur instantaneously. Stocks are measured at the end of the period. At the end of this first, a fully specified system of equations exists. It is 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 last econometric techniques that had been developed at the Cowles Commission at the time. They were the first to apply the maximum likelihood with limited information apparatus to real data. The estimation task closed, there remains to run the model. It can be used for two purposes: as a predictive instrument, on the one hand, and as a tool for comparing the effects of alternative economic policies both in a retrospective and positive way, on the other.

To complete this short presentation of the Klein-Goldberger model, two additional remarks should be made. First, it should be underlined that Klein and Goldberger worked in a pragmatic spirit. This empirical inclination was certainly due to the circumstances they were facing, in particular the paucity of data, but also a matter of methodological state of mind, making it that to them modeling was definitely more data- than theory-constrained. Their overarching principle was the appropriateness between the model and reality. As a result, they had no qualms to engage in a go and forth process between the specification and the estimation of parameters, a practice that will later be vilified as 'data mining'. Second, to them, their model was in no way an all and for all construct. They rather viewed it as the first step of a broader program around which other economists' might rally — an invitation that came to be met beyond all their wildest dreams.

In view of our purpose, our attention will bear exclusively on the transition from the theoretical to the empirical model.<sup>13</sup> In their book, Bodkin, Klein and Marwah underline that the Klein-Golberger model had two basic features, it was Keynesian *and* neoclassical. In his famous Critique, Lucas will contest this second claim (Lucas [1976] 1981). We, for one, are interested in the first characterization. Is the Keynesian lineage of the Klein-Golberger 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 the divisions to be found in macroeconomic theory. Moreover, the names given to the equations echo Keynesian categories. But is there more 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 one, was affirmative. In the same year as the publication of the Klein-Golberger essay, he published an article in a volume edited by Kurihara (Kurihara 1955) the purpose of which was to enlighten the connection between Keynes's abstract model and the Klein-Golberger model. Our aim in this section is to assess this connection.

### **Klein's "Empirical Foundations of Keynesian Economics" paper (1955)<sup>14</sup>**

Klein's aim in this article is to recount the steps made 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, one 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).

Several points addressed by Klein in the introduction of the paper are worth considering. The meaning of the full employment notion is one of them. After having dismissed what he calls its pragmatic definition, he proposes to define full employment as "a situation in which all of

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<sup>13</sup> For a more detailed account, see Malgrange (1989).

<sup>14</sup> In his Kurihara volume article, Klein expresses his gratitude to Goldberger for having done the calculation for his model, which implies implicitly that he did just that and hence played a secondary role. ("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)). Thus, we may presume that most of the methodological choices underpinning the model were devised by Klein. Therefore in this section, we shall refer only to Klein rather than to Klein and Goldberger.

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 definition of involuntary unemployment. Here we are thus in the lineage of Klein’s early articles. The Keynesian claim of the existence of involuntary unemployment, he claims, ought to be tested not at every instant of time but as an equilibrium phenomenon — that is, in reference to his view as to 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).

Again, Klein starts we have confrontation of the Keynesian and the classical system. Here is his reconstruction of the classical system:

- |     |  |                          |
|-----|--|--------------------------|
| (1) | $C = C(i, Y)$                          | consumption              |
| (2) | $I = I(i, Y)$                          | investment               |
| (3) | $\frac{\bar{M}}{p} = M(i, Y)$          | money market equilibrium |
| (4) | $Y = Y(N, D)$                          | production function      |
| (5) | $D = D(Y, K)$                          | capital depreciation     |
| (6) | $N^D = N^D\left(\frac{w}{p}, D\right)$ | demand for labor         |
| (7) | $N^S = N^S\left(\frac{w}{p}\right)$    | supply of labor          |
| (8) | $Y = C + I$                            | goods market equilibrium |
| (9) | $K - K_{-1} = I$                       | 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:

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

Due to his will to emphasize dynamics, Klein reformulates (10) differently:

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

As to the Keynesian system, Klein wants it to be as close as the classical. Its only difference pertains to the wage adjustment equation where Klein replaces (10') with (10'').

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

Klein here departs from his *Journal of Political Economy* article by abandoning the assumption of an inelastic supply of labor ( $N^S$  instead of  $\bar{N}$ ). Note also that Klein remains keen to cast the Keynesian model in real terms as far as the supply of labor is concerned. However, to him, this trait is compatible with an account of the working of the labor market 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, this bargaining is over the money wage. Thereby, money illusion enters the picture during the adjustment process

while vanishing at equilibrium, where the classical properties of homogeneity are back in power (Klein 1955, p. 286).

The Keynesian system consists of equations (1-9,10''). However, with  $0 \neq f(0)$  equilibrium can be non-existing. Fortunately, Klein find a way out by treading Haavelmo's foofsteps (Haavelmo 1949-50):

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).

The central contrast between the classical and the Keynesian approaches thus bears on whether equation (10') or equation (10'') prevails, the first indicating a state of full employment equilibrium, the second one of involuntary unemployment equilibrium. Sorting out these alternatives is a matter that needs to be settled empirically.

A last introductory comment made by Klein is that his aim is to shed light on the validity of the Keynesian system leaving refinements for further studies. This is quite understandable in view of the pioneering character of his work. Additionally to the "testing of the association of zero unemployment with zero wage changes in the bargaining equation of the labor market", other queries that are important to him are the interest elasticity of investment, the effect of real wealth on consumption and the interest elasticity of the liquidity preference function (1955, p. 289). The first of these additional items refers to Klein's own pet explanation as to where it all begins. The second serves the purpose of assessing whether Pigou is right. The last one is a test of the Hicksian liquidity trap assumption. On each of these points, the empirical model should bend either towards the Keynesian or the classical outcome. Keynesian theory would win the battle if, for each of these, the Keynesian insight looks empirically stronger than the non-Keynesian one, the same being true for classical theory. Small wonder, Klein shall eventually claim that Keynesian theory is the winner.

### **The transition from the IS-LM model to the econometric model**

We are now able to confront the theoretical and the empirical models basing ourselves on Klein's 1955 article. We propose to do it equation by equation but we shall study only the most significant equations, instead of considering all of them: the consumption function, the investment function, the liquidity-preference function, the labor market relations.

#### *The consumption function*

Klein finds 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 is to envisage different

possible factors that might influence consumption or saving, searching whether they exert an effect and hence should be included in the model.

A first element is the observation that all income classes have not the same propensity to save. This leads Klein to separate three basic occupational groups: farmers, businessmen, and non-farmer non-businessmen people, the latter category comprising mainly wage earners. Klein ends 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 was alert to these. He introduces them in most of his equations. After having tried different fits, he comes 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 1955b, p. 291). Next, Klein introduces two additional arguments in the equations population and lagged year-end personal liquid assets, on the grounds of their good fit (at the time, one was not yet speaking of data mining!). On the other hand, he discards other plausible factors. This is the case for expectations, which are sidestepped because they are too difficult to incorporate. "It is an unsolved problem to develop a complete system in which expectations are endogenous" (Klein 1955, p. 291).<sup>15</sup> A second discarded factor is the interest rate. Klein declares that its direct influence has not been found significant (Klein 1955, p. 292). A third excluded factor excluded is wealth. Neither of these two exclusions is benign because the factors in point are theoretically central. We have seen the importance that Klein gave to the idea of an interest-inelasticity of saving. If facts were heavily leaning towards the opposite conclusion, this would be damaging for the vision that he held from *The Keynesian Revolution* onwards. The same holds about wealth since a high sensitivity of consumption on wealth would confirm the importance of the Pigou effect, thereby ruining the idea of underemployment equilibrium at least at the theoretical level.<sup>16</sup> After a lengthy discussion, Klein ends up admitting that the Pigou effect works for low income groups but is attenuated or reversed at high income levels. This mitigated result suffices for claiming that Keynesian theory is salvaged!<sup>17</sup>

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<sup>15</sup> On the other hand, it can be argued that the introduction of lags is an indirect way of taking expectations, in that case adaptive ones, into account.

<sup>16</sup> "The crucial arguments against the Keynesian hypothesis of the possibility of underemployment equilibrium have been based on the assumption that savings and wealth are negatively correlated, other things being equal" (Klein 1955, p. 293).

<sup>17</sup> "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).

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

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

where  $C$  is aggregate consumption,  $W$  is the real disposable wage income,  $\Pi$  is the real disposable nonwage nonfarm 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  $I = I(i, Y)$ . We recall that central in Klein's argumentation is a low interest-elasticity of investment (even if he admits that Keynes did not stress this point (Klein 1955, p. 298)). In his theoretical work, he off-handedly justifies this assumption on factual grounds without much entering into the matter. Addressing it again here, he is actually compelled to a more nuanced position. After having surveyed the literature, he must admit that industries such as railroads and electric utilities exhibit a significant interest elasticity of investment. Nonetheless he ends 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 allows him to drop the interest rate from the investment function.

As to the role of expectations on capital formation, Klein dismisses them with a sleight of hands, declaring that empirical studies have failed to provide illuminating results about them, reckoning this casts doubts on the theory of the marginal efficiency of capital.

On the other hand, new factors enter the picture, namely gross corporate income, capital and corporate liquid assets, the first and third of these exerting a positive influence on investment the second has a negative one. These magnitudes appear with a one period lag. Again, this may be interpreted as an indirect way of incorporating expectations.

The empirical equation runs as follows:

$$I = \beta_0 + \beta_1 (Y_G)_{-1} - \beta_2 K_{-1} + \beta_3 (L_2)_{-1},$$

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 makes investment predeterminate; it depends only of past values.

#### *The liquidity-preference function*

A first remark made by Klein is that the liquidity preference function should be split in 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. Households' function is the most challenging one. Although Klein did not insist on the liquidity trap notion in his theoretical writings, he nonetheless views it as part of the Keynesian heritage. Therefore he



wishes that the empirical investigation confirms that the liquidity preference function has a high interest elasticity at low interest rates. To ascertain this, a delicate preliminary task ought to be addressed, namely to sort out active balances, which are linked to transactions, from idle ones. Fortunately, at the time the study of liquidity preference was a fashionable subject and several contributions were available. From their examination, Klein again draws a conclusion that is favorable to the Keynesian viewpoint (Klein 1955, p. 307).

He is then led to define 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. An additional factor considered is inertia. That is, idle balances should be related to lagged idle balances.

$$L_1 = \chi_0 + \chi_1(W + \Pi + A) + \chi_2(i_L - 2.0)^{-\chi_3}$$

with  $\chi_0 < 0$  and where  $W$  stands for total wage income,  $\Pi$  for profits and  $A$  for farm income;  $i_L$  is 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 has an infinite interest elasticity. So the liquidity trap is fully part of the picture. As to the liquidity preference of the business sector, Klein specifies it as follows:

$$L_2 = \delta_0 + \delta_1(W_1) - \delta_2 i_S - \delta_3(p - p_{-1}) + \delta_4(L_2)_{-1}$$

$$\delta_0 < 0$$

The business sector's preference for liquidity is a function of the wage fund ( $W_1$  designating total private wages), of firms' portfolio choice ( $i_S$  the yield on short-term commercial paper in per cent), due account being taken of inflation, and of its lagged value.

#### *The labor market relations*

Klein remarks that more satisfactory results are available for the demand for labor than for its supply. Hence his equating 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

$$N^S = N,$$

where  $N$  is decomposed in several components ( $N_W$ , wage-earner;  $N_G$ , government employees;  $N_F$ , farmers;  $N_E$ , non-farm entrepreneurs).

As to the demand for labor, he proposes the following equation:

$$W_1 = -\phi_1 + \phi_2(Y + T + D - W_2) + \phi_3(Y + T + D - W_2)_{-1} + \phi_4(t - 1929)$$

where  $W_1$  is private wage income,  $T$  indirect taxes less subsidies,  $D$  capital consumption allowance,  $W_2$  public wage income.

The wage adjustment equation is:

$$w - w_{-1} = \varepsilon_0 - \varepsilon_1(N - N_w - N_E - N_F) + \varepsilon_2(p_{-1} - p_{-2}) + \varepsilon_3(t - 1929),$$

The last term is a proxy for increases in productivity.<sup>18</sup>

This equation plays a crucial role because it allows Klein to strike a conclusion about the respective strengths of the classical and the Keynesian theoretical models. We recall that the second is supposedly winning the battle if the supply of and the demand for labor mismatch at equilibrium, i.e. when  $dw/dt = 0$ .

This is, Klein claims, what comes out from the empirical model:

In the author previous studies [Klein1950], 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 millions 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 changes in prices equal to zero. We then find a zero rate of changes 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:

A labor supply equation is not explicitly introduced. At this stage, the model assumes the labor force to be an exogenous variable, but obviously this approximation eventually will have to be dropped. 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).

Table 2 summarizes the two sets of equations, those of the theoretical and those of the empirical model.

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<sup>18</sup> For all their central character, the labor market equations are less commented by Klein than the others. We suspect that this might be the sign of some uneasiness.

Table 2 . A confrontation of the theoretical and the empirical model <sup>19</sup>

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: $L_1 = \chi_0 + \chi_1 (W + \Pi + A) + \chi_2 (i_L - 2.0)^{-\chi_3}$ (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	$N^D = N^D(w/p, Y)$	$W_1 = -\phi_1 + \phi_2 (Y + T + D - W_2) + \phi_3 (Y + T + D - W_2)_{-1} + \phi_4 (t - 1929)$
(5) Labor supply	$N^S = N^S(w/p, Y)$	$N^S = N$
(6) Wage adjustment	$\frac{dw}{dt} = f(N^S - N^D)$	$w - w_{-1} = \varepsilon_0 - \varepsilon_1 (N - N_w - N_E - N_F) + \varepsilon_2 (p_{-1} - p_{-2}) + \varepsilon_3 (t - 1929)$

We are ready to follow Klein's declaration that the transformations accompanying the construction of the empirical model imply no radical departure from the theoretical model, except for one case, the labor supply equation (and as a result, the wage adjustment equation). Unfortunately, this departure is hardly benign. It has far-reaching consequences.

#### PART IV. AN ASSESSMENT

##### An impressive leap forward

The first remark that needs to be made is that the construction of the Klein-Goldberger is a real feat. The inaugural paragraph of Mariano's entry on Klein in the *New Palgrave Dictionary, Second Edition* is worth quoting:

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 macroeconometric models, his name is the first that comes to the mind. Spanning six decades, his research achievement have been broad, covering economic and econometric theory, methodology and applications. In emphasizing the integration of economic theory with

<sup>19</sup> Boldface characters indicate that the variable is exogenous.

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 evolutions concurred to make this new theoretical practice possible: the emergence of the IS-LM model on the theoretical side, new and more rigorous statistical estimation methods, the systematic construction of national data bases, the invention of new calculation methods eventually leading to emergence of computers. Klein took advantage of these innovations. At the end of the day, he almost self-handedly created a new sub-discipline, macroeconometrics. For the first time, governments had at their disposition a macrodynamic general equilibrium model that they could use for elaborating their policy. Moreover, Klein did not just conceive the first model (with Goldberger). He contributed significantly to the arising of the next generations of models. Moreover, his methodological standards remained in vigor for about two decades until their attack by Lucas.

### **An extension or a breach?**

Klein himself was confident that there was strong lineage between Keynes theory and his empirical extension of it:

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 [Note: great indebtedness is also due to the models of Frisch and Kalecki] 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).

There is no doubt that the Klein-Goldberger model has a Keynesian inspiration but what needs to be assessed is different. We need to appraise whether Klein's extension of the Keynesian theoretical into an empirical model involved a breach and whether the empirical model served its purpose of confirming the validity of the theoretical model.<sup>20</sup>

To begin, we must capture the essence of Keynesian theory according to Klein. The following seems to us a good summary:

The impossibility of having the savings and the investment schedules intersecting at a positive rate of interest requires that output shrinks to a less than full employment level. The causal link runs from interest rate rigidity to effective demand and, next

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<sup>20</sup> The last paragraph of the 1955 article runs as follows: "No matter he [the reader] feels by this presentation that the Keynesian system is firmly rooted in fact, he must assuredly agree that the empirical evidence is not superficial or casual. It has been carefully studied by a variety of competent scholars, and Keynes' original intuition has yet to be shown incorrect. In a positive note, it stands up well before the facts of life" (Klein 1955, p. 319).

from effective demand to involuntary unemployment. This is also the way in which the working the Keynesian sub-system is described in the standard IS-LM framework.

In addition, we must take in stock Klein's following proposition:

Our criterion of soundness of the Keynesian model must be whether the main conclusions of the hypothetical Keynesian system remain valid. 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).

Against this background, the result of our query hinges on the answers given to the following two questions: (a) what are the implications of Klein's introduction of the wage adjustment equation? And (b), is the unemployment concept present in the empirical model the same as that which is to be found in the theoretical model?

#### *The wage adjustment equation*

As seen, Klein ends his discussion of the Keynesian theory of effective demand by introducing the wage adjustment equation, which he claims solves the overdetermination of the Keynesian system problem. Although the latter is hardly benign since it is a central piece of the empirical model, Klein stops short of commenting it both in his 1947 and in his 1955 paper. We, for one, cannot leave it at that.

A first remark to be made is that there is an ambiguity as to the time framework adopted by Klein. Above, we have claimed that the proper understanding of the IS-LM model time framework is to state that this model's object of analysis is a single period of exchange and the adjustment towards its 'Monday' equilibrium state ought to be conceived of as occurring in logical time. Against this principle, Klein's standpoint is hard to decipher. Actually, he never bothered to make clear his time concepts. [Like all his contemporaries, he was unaware of the need to engage into such a task.] He result is a blurred state of affairs. Is he reasoning in a short-period or a long-period context? It is difficult to know. Since his is a IS-LM model, we expect it to be a short period model (i.e. really a unit period of exchange model). But then two oddities arise. The first is that, if our interpretation is accepted, the time derivative does not refer to a process occurring over real time. As a result, the wage adjustment equation adds nothing, and the puzzle of overdetermination remains unsolved. Second, in the standard IS-LM model, the Keynesian system reaches equilibrium differently from the classical. In the latter, we start from the labor market and go from there to the output determination. In the Keynesian system, we start from output as determined by the interaction between the IS curve in relation with the LM curve to determine the level of employment in a second stage. This difference is now lost: the labor market predetermines output in the Keynesian system as well as in the classical sub-system.

So, we are led to conclude that already in the 1947 paper, Klein had an inter-temporal adjustment in the back of his mind as the following passage suggests:

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).

An additional testimony is a passage in the 1947 article where he states that disequilibrium occurs in the classical system.

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).

Klein’s declaration that the classical system comprises states of unemployment is at odds with the standard interpretation of the standard IS-LM model.<sup>21</sup> If this model is concerned with a single period in which the end state of the economy is arrived at instantaneously, states of disequilibrium have only a virtual existence. Moreover, the first sentence of the quotation suggests that the model pertains to a long period equilibrium, the end result of an adjustment process extending over a number of Hicksian weeks. In this case, no differences are left between the classical and the Keynesian systems as far as the short period is concerned, a huge leap away from the standard IS-LM perspective.

To conclude on this point, we see that already in 1947 Klein turns away from the standpoint taken in the *Keynesian Revolution* book, where the IS-LM model has a definite short-period underpinning. His new vision definitely departs from the standard interpretation of the IS-LM model. Adopting it raises the question of how, with which model, should the short-period functioning of the economy then be explained.

A second remark about Klein’s wage adjustment equation, is that he anticipated the natural rate of unemployment idea.

When made inter-temporal equation (2.10) becomes as follows:

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<sup>21</sup> That the classical system can witness disequilibrium is an idea that was present in Hicks’s 1937 paper but it vanished after Modigliani transformed Hicks’s initial model into the standard IS-LM model.

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

where  $\alpha$  and  $\beta$  are positive parameters,  $\bar{N}$  is the fixed labor supply,  $N$  is the short-period level of employment ( $N \leq \bar{N}$ ) and  $U$  the rate of unemployment.

The long-period equilibrium is obtained when the wage rate ceases to change:

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

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

where  $N^*$  is the equilibrium level of employment and  $U^*$  the corresponding equilibrium rate of unemployment.

Hence in short period equilibrium, the labor market is described by equation:

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

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

How can we characterize the unemployment arising in this system? On reading the 1947 article, there is no doubt that, to Klein,  $U^*$  is involuntary unemployment. As to  $U$ , the matter is different. As can be drawn from his remark stating that unemployment is possible in the short period in the classical system, we may presume that he assumes that  $U$  is frictional unemployment in the Keynesian as it is in the classical system. Batyra and De Vroey (2009) have argued that there is no room for frictional unemployment in a supply and demand framework. As a result, in a model economy such as the IS-LM model, there is room, if any, for just one category of unemployment, namely involuntary unemployment (more on this below). So, in our eyes,  $U$  should be seen as disequilibrium (or transient) involuntary unemployment.

Our conclusion that a shift in the order of determination has occurred from the Keynesian towards the classical mechanism still holds when we take the inter-temporal interpretation. Hence, the state of involuntary unemployment described above relates to the functioning of the labor market instead of following from aggregate demand deficiency. While as far as  $U$  is concerned, the most plausible explanation for its departing from  $U^*$  is money illusion, oddly enough, we are left with no explanation at all for a positive  $U^*$ .

At this juncture, a preliminary conclusion relating to Klein's Keynesian theoretical model as exposed in the 1947 article is in order. By introducing the wage adjustment equation in the model, an introduction that may look innocuous, Klein, it turns out, made an important step away from his initial Keynesian theoretical model, as exposed in the Keynesian revolution book. First, the IS-LM model has become a long-period model. Second, involuntary unemployment is no longer explained by aggregate demand deficiency.

*Which unemployment notion is to be found in Klein's empirical model?*

We now turn to the Klein-Goldberger model. Recall that in his Kurihara article, Klein makes it clear that he sticks to the Keynesian notion of involuntary unemployment. He seems to take it for granted that this is also the notion that is present in the empirical model. Other wise he would not have claimed that his model vindicates Keynesian theory. But is this so obvious? We do not think so. 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 main two ones being involuntary unemployment and frictional unemployment. This was a proposition pertaining to reality. However, Keynes did not endeavor to build a theory where the two main types (frictional and involuntary unemployment) were present at the same time. In his theory, only one form of unemployment is conceivable, 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 Keynesian system: the only possible type of unemployment it can integrate is involuntary unemployment.<sup>22</sup> In the theoretical reasoning, there can be not doubt that any unemployment 'observed' is involuntary unemployment since the latter is the exclusive possible form of unemployment. As far as reality is concerned, this is not so. No doubt, there will always be a positive level of unemployment but there is no easy way of ascertaining its type. It can be either frictional or involuntary unemployment. In other words, any empirical work undertaken along the line opened by Klein will actually be unable to verify Keynesian theory in its specificity, i.e. the claim that involuntary unemployment exists.<sup>23</sup>

Klein's mistake was to have believed that the existence of unemployment in the real world could have a state of market non-clearing as its theoretical counterpart. In order to really verify Keynesian theory, Klein should have addressed the question of what fraction of the

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<sup>22</sup> This is the case whatever the assumption made about the labor supply (the inactive supply or the inelastic supply), what shows, in our eyes, that the difference drawn by Klein between the two accounts of the supply of labor is of little importance. But to Klein, it mattered because it allowed him to give his theoretical notion an empirical counterpart, labor supply becoming equalized with the active labor force.

<sup>23</sup> Later, this problem was addressed by Lucas and Rapping (Lucas and Rapping 1969) for the sake of the opposite cause, in an argument aiming at bringing out that what may look as involuntary unemployment is actually voluntary unemployment.



existing unemployment was voluntary and what fraction was frictional unemployment. Instead, he took it for granted that all the observed unemployment was involuntary. This was and is still a widespread flaw, to associate real-world unemployment with excess supply. As Lucas used to write about Keynes, “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” ([1977] 1981, p. 220). To a present-day economist, Klein’s mistake may look gross but at the time it passed totally unnoticed. So, we should not blame him for it, but the fact remains that he painted a failure as a success.

Instead of Klein’s sanguine conclusion, we must rather conclude that there is no link between the unemployment category present in Klein’s empirical model (and undefined type of unemployment) and the category that is present in his theoretical model (involuntary unemployment). As a result, in so far as the claim made in the theoretical model pertains to the existence of involuntary unemployment, it cannot be claimed that the empirical model succeeds in verifying this claim.

Actually, Klein’s contribution is to have anticipated the natural rate of unemployment idea. But this hardly serves the Keynesian cause! Nothing proves that this rate consists of involuntary unemployment. One might be tempted to take the minimalist stance of stating that any unemployment level above the natural rate is involuntary but even this is unwarranted. Nothing forbids us to think that all unemployment, at and beyond the natural level, is frictional. The same objection applies to Klein’s other proposition picked up above, that the competitive system does not automatically lead to a stable solution of full employment or put differently that it can lead to a solution of involuntary unemployment.

To drive a final note, Klein’s unwitting departure from core Keynesian theory is hardly surprising in view of his empirical bent. We have mentioned above his pragmatic state of mind. He was mainly preoccupied with solving practical issues related to finding data and estimating them. Nothing was more alien to him than the present-day view that theory might be ahead of measurement and that theory has to prevail in case of a discrepancy. For somebody having this pragmatic state of mind, it is normal to take the existence of unemployment as granted rather than raising questions such as the emergence of involuntary unemployment from scratch on a hypothetical pristine first period or sorting out whether unemployment is involuntary or voluntary.

### **Klein 1947, Patinkin 1956 and the neoclassical synthesis**

This last comment pertains to Klein’s earlier pieces (1947a, 1947b). To readers familiar with disequilibrium theory *à la* Patinkin and Barro and Grossman, they have a familiar ring. One

has the feeling that Klein anticipated the ideas that Patinkin was to expound in chapters 13 and 14 of *Money, Interest and Prices* (first edition 1956).<sup>24</sup> Patinkin's claim is that involuntary unemployment results from a spill-over into the labor market of a rationing phenomenon occurring in the goods market and due to a shift in households' demand from goods to bonds. As seen, such a spill-over process is also present in the Kleinian version of the IS-LM model. But there are also differences. First, the two scenarios evoke distinct causal factors, sluggishness in Patinkin's case, inelasticity of the investment function and workers's powerlessness in Klein's case. A second difference is worth pointing out. To Patinkin, the specificity of the Keynesian system is a slow adjustment towards long-period equilibrium. Disequilibrium trading and involuntary unemployment are present as long that this long-period equilibrium remains unattained. In contrast, this long-period is reached quasi-instantaneously in his classical system. Nonetheless both systems adjust to same state of long-period equilibrium, a market-clearing state. Klein's story is different. To him, both the classical and the Keynesian system feature disequilibrium trading. The difference between them is that the former converges to an end-state without unemployment while the latter converges to an unemployment end-state. Thus, it turns out that Klein's 'classical system' actually corresponds to Patinkin's 'Keynesian system' while Klein's 'Keynesian system' has no counterpart in Patinkin's analysis!<sup>25</sup>

This bring us to a last topic, the neoclassical synthesis. This term designates an alleged relationship of complementarity between macroeconomics and microeconomics. The study of the short period, where disequilibrium is supposedly prevailing, is assigned to macroeconomics and that of the long period, where equilibrium is supposed to reign, to microeconomics. While the neoclassical synthesis term was launched by Samuelson in 1955 in the third edition of his economics textbook, its underlying idea was already present in his *Foundations of Economic Analysis* published in 1947 (Samuelson 1947). Here, following Walras, Samuelson separated two distinct objects of study, the static theory, describing equilibrium as the result of economic agents solving maximum problems taking prices as parameters, and the dynamic theory dealing with price adjustments towards equilibrium after the occurrence of shocks. In this process, prices move in the direction of excess demand functions, proportionally to these functions' magnitude. In this light, the neoclassical synthesis ought to be viewed as the piecing together of Walrasian general equilibrium (rather than microeconomics more broadly understood), on the one hand, and Keynesian theory, on

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<sup>24</sup> They were together at the Cowles Commission. The nature of their interactions is a fine topic for further research.

<sup>25</sup> To compound the matter, when Klein's outcome is compared to Malinvaud's typology (Malinvaud 1977), it turns out that Klein's involuntary unemployment is case of classical unemployment rather than Keynesian unemployment!

the other. Patinkin's chapters on Keynes can be viewed as an attempt to vindicate the neoclassical synthesis.

The Klein-Goldberger model is also sometimes credited for having achieved the neoclassical synthesis. Is this characterization adequate? The answer is 'No' at least if the term is understood as above. If we are speaking of Klein's theoretical analysis in the 1947 article, the model that achieves a short-/long-period synthesis is the classical sub-system of the IS-LM model. However, its short-period can hardly be characterized as Keynesian as the type of unemployment it features is frictional unemployment. A similar negative conclusion emerges when we discussing the Klein-Goldberger model since its steady state is not Walrasian. We may understand that this model achieves a synthesis of some sort, the piecing together of short- and long-period analysis but then the term 'neoclassical synthesis' receives a meaning different from the Samuelson-Patinkin meaning. Samuelson and Patinkin wanted to reconcile Keynes and Walras (without success), the Klein-Goldberger model, in contrast, pertains to the piecing together of 'Keynesian' short-period disequilibrium and 'Keynesian' 'long-period equilibrium (whatever the dubious quality of the Keynesian modifier).<sup>26</sup>

## CONCLUDING REMARKS

In the introduction of his *Studies in Business Cycle Theory* book, Lucas makes the following remark about Klein:

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 it began long ago.

It is often the case that people who do empirical work have never been interested and knowledgeable about theory to begin with. This was not the case of 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 dynamical. Perhaps, after all, Keynesian theory was less crying for empirical extensions than Klein had presumed?

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<sup>26</sup> The above remark shows the ambiguous nature of the neoclassical synthesis notion. Hence it is small wonder that confusion reigns. For example, in the preface of his book, Kurihara states that Klein's article is concerned with the integration of the Keynesian 'building blocks theory' and the 'Walrasian' mutual dependence theory' (Kurihara 1955, p. X).

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