How Pigou Converted to IS-LM:

Pigou's Macroeconomic Theories in the 1930s and 40s

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1. Introduction

In September 1936, several months after the publication of Keynes's *The General Theory,* three economists made a joint presentation on that book at the Econometric Society meeting at Oxford, as Warren Young's (1987) lucid account tells us. The contributors—John Hicks, James Meade, and Roy Harrod—presented models and a diagram that captured the message of *The General Theory*. Papers by those economists were subsequently published in *Econometrica* (Harrod 1937; Hicks 1937, the famous SI-LL article) and *Review of Economic Studies* (Meade 1937). David Champernowne, who attended the symposium, also made a parallel attempt even before the publication of *The General Theory* by submitting a paper to the *Review of Economic Studies,* which would be published in June 1936. Thus, many economists, especially young ones, looked in the same direction and tried to create a simple coherent model that connects employment, the interest rate, and money supply. In this study, we will discuss a rather belated, same attempt by the most unexpected person.

One would be struck by the fact that A. C. Pigou, who was the archrival of J. M. Keynes in the unemployment theory, used essentially the equivalent of IS-LM model in his later work *Employment and Equilibrium* (1941). Although Pigou did not adopt the liquidity preference function, he did employ the IS equation with the investment function dependent on the interest rate and the saving function dependent on real income. Thus, if we draw a diagram, which he did not because he preferred the

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analytic method, we could render a downward-sloping IS curve and a upward-sloping curve that links money wages and money income, on the plane with the interest rate on the vertical axis and real income on the horizontal axis. This would make a striking similarity with the normal IS-LM diagram. Pigou was surely aware of what he was doing, i.e., betraying his earlier theory. How did this happen? How did Pigou convert to the Keynesian camp? This is the question this study will engage with.

Since the late twenties, A. C. Pigou had been fixated on the analysis of wage adjustment, and his 1933 work *The Theory of Unemployment* reflects his devotion to this issue. At this stage, Pigou's concern was quantitative. He attempted to estimate how much employment a given rate of wage adjustment will bring into existence, with many specific assumptions to facilitate this estimation. Later, his point of focus in the unemployment theory changed after Keynes challenged the effectiveness of money wage adjustment in the *General Theory.* Pigou was now interested in building up a model that connects money wages, the interest rate, and employment because interaction between money wages and the interest rate was crucial for the issue. This attempt is more likely to be made in the separate context from the above attempts of young economists.

This solitary work was turned into the direction shared with above young economists when Nicholas Kaldor jumped into the debate. Keynes first responded to Pigou's model by writing a draft of reply paper. It was concerned with difference in assumptions between his own and Pigou's theories and criticized the latter was unrealistic. This would have been unable to do what Kaldor's paper did. Kaldor submitted a criticism and succeeded to frame the discussion that arose in correspondence between Keynes, Pigou, Robertson, Richard Kahn, and Kaldor himself. His criticism was solely concerned with the mathematical issue of how the model behaves. Thus Kaldor offered the way to read Pigou's rather badly worded, confusing paper, and the whole debate revolved around this way of reading it. The debate

thus converged to the rather technical issue rather than what are proper assumptions for the model or, much less what is the proper policy response to the unemployment issue.

Pigou's famous retraction occurred after all this debate. The way Kaldor framed the debate was instrumental. He turned the debate into the one about a model, not the one directly about the reality. By so doing, Kaldor provided the common ground both sides in the debate could agree on. In the end, Pigou was won over by this method, and he came to pursue the modelization of the economy as a whole more or less in line with IS-LM model, as I noted above. *The General Theory* might have stayed as something unintelligible for Pigou, but through the contact with Kaldor, he acquired the way of doing macroeconomics that was collectively pursued by young economists, even though he was not in that community.

This paper also sheds some light on Pigou's theory that came to be termed the Pigou effect. I call attention to the similarity between this theory and the old ad hoc theory discussed in *The Theory of Unemployment.* Those two theories have an important common aspect, although the difference is also important. The difference was that while the old theory relies on a specific condition and one-off formalization, the Pigou effect was expressed as a modification of a function in the general model. This was the way it was presented that Patinkin (1948) picked up this theory.

What follows proceeds chronologically. The next section discusses what motivated Pigou into the analysis of wage adjustment throughout the thirties. I will note that behind his persistent effort in this matter was mass unemployment of the twenties. Section 3 touches upon theories on money wages in his 1933 work *The Theory of Unemployment.* We will have a glance at his theory based on the existence of non-wage workers. The subsequent four sections are on the controversy in and off print. Pigou's 1937

article, which started the whole episode, was ambiguously worded and seems to contain more than one models behind it. However, Kaldor framed the debate with mathematical analysis on Pigou's article. After the famous retraction, Pigou used this illumination to present a general model and its modifications in his later work *Employment and Equilibrium* (1941). In this work and later articles, he presented the theory that was to be termed the Pigou effect, which will be the subject of the last section.

2. Motive for the Analysis of Wage Adjustment

As will be clear from what follows in this paper, Pigou was concerned with analyzing the effect of wage adjustment throughout his later life. The motive behind this long-standing devotion could be found in the unemployment issue in the 1920s. In Britain, unlike in the United States, unemployment stood around 10 percent through the 1920s until it further worsened after the great crash in 1929. As I claimed in the previous paper (Takami 2011), Pigou attributed the large part of this high unemployment to the fact that money wages were more or less fixed even in the face of large unemployment. He claimed that the rigidity of money wages in the twenties was due to the strengthened bargaining power of workers backed by newly introduced social legislation such as public unemployment insurance.

Pigou did not point out this cause for unemployment because he thought public unemployment insurance should be abandoned. The prescriptions he offered to the Macmillan Committee in 1930 were essentially all on the demand side, including increase in public expenditure. He pointed out the money wage rigidity in twenties because he had not expected it to occur in the early twenties, when he endorsed the return to the gold standard. Pigou seems to maintain this concern for money wage adjustment even though he took a quite opposite approach to the unemployment issue in the public sphere (e.g., the above-mentioned committee and letters to the Editor of *The Times*). One can say that Pigou's theoretical

interest was trapped into this very specific issue, that is, how money wage adjustment would have contained unemployment in the twenties. Let us look at the variety of his theories on money wages in what follows.

3. *The Theory of Unemployment*

The book *The Theory of Unemployment,* published in 1933, was consisted of five parts. In the second part, Pigou attempts to estimate the elasticity of aggregate labor demand and put the estimate at substantially more than one. Along the way, he offered the following argument to defend the effectiveness of money wage adjustment. The theory he offers here may be called the distribution effect.

The common counterargument goes that a reduction in money wages will cause a proportionate decline in commodity prices, resulting in real wages kept unchanged. To counter it, Pigou employed one condition that aggregate income is not entirely consisted of wages but includes incomes for non-workers. Now suppose money wages are cut down and this will not directly affect those non-workers' incomes. Then, aggregate income will only decrease by the reduction of money wages and so in a less proportion than the decline of money wages. Therefore, the new ratio of money wage rates to aggregate money income is lower than the original ratio. Thus, what will happen now is: "either the real wage-rate is reduced, or the value of non-wage-goods relatively to wage-goods is increased. Hence the system is not in equilibrium. Additional labour must be employed" (Pigou 1933, 102). This effect hinges on the existence of people who are not affected by a wage cut and a rise of their real incomes after the wage cut. This is not an ad hoc dynamic argument based on the time lag between a money wage cut and a resultant commodity price decline. This is comparative statics under the particular condition.

Pigou goes on to discuss the quantitative effect of money wage reductions on employment. Here further assumptions are placed. Pigou notes that aggregate money income is affected by money

wage changes, depending on the kind of monetary policy in place. Monetary policy he discussed is (1) the one in which aggregate money income is kept constant at a money wage cut, (2) an isolated economy, and (3) an economy with a fixed currency exchange. Monetary policy that is the most unfavorable to money wage adjustment is the second one because there, aggregate money income is likely to shrink most with money wage cuts. Pigou thinks, however, that aggregate money income will not go down at the same proportion as money wages, so that employment will certainly increase.

> [W]hen real income grows because the real wage-rate asked for by labour is reduced, the real rate of interest on resources invested in working capital is increased: this tempts people to shift money out of passive into active balances, thus *augmenting the volume of money income per unit of time*, even though the stock of money is unchanged. (Pigou 1933, 104, emphasis added)

This stylization of monetary policy is quite distinct from the Keynesian one. In the latter, monetary policy determines money supply rather than money income itself. This difference of stylization comes from the difference of interest. Pigou was interested in the effect of a very specific cause, that is, wage cuts upon employment. Pigou's more elaborate treatment of monetary policy is found in another work, *Industrial Fluctuations* (1927). There he describes the forward-looking monetary authority constantly on alert to treat the cause of disturbances in its early stage. In *The Theory of Unemployment,* this type of stylization is enough for his purpose. The important points to be made here are that Pigou was adopting comparative statics, the same method that Keynes used in *The General Theory* and that Pigou noticed a difficulty related to the relationship between money and real wages that arose from a closed economy and offered a way to get around it.

4. The Controversy (1): What was at Stake?

The second stage in this study is the controversy between Pigou, Keynes, and Kaldor. First, let us briefly look at Keynes's discussion of money wages in *The General Theory* (1936). In Chapter 16 of the work, Keynes presented what he likened to "the fate of Midas." In a competitive monetary economy, the interest rate cannot go below a certain minimum level, and capital stock multiplies so rapidly that the decline of the marginal efficiency of capital is likely to outpace that of the interest rate. Consequently firms start to find the current level of employment unprofitable and cut down workers. Keynes argues that this process continues until people's incomes come to be sufficiently low to bring savings to zero. This is not merely a theoretical possibility for him. Keynes regards the economic stagnation after the First World War as partly a reflection of this secular downward trend instead of entirely a declining phase of a cyclical movement.[2] This argument corresponds to Chapter 19 of the same work. There Keynes discusses effects of a money wage change on employment and offers what is now called the "Keynes effect," which is the effect of a money wage decline to decrease liquidity preference and lower the interest rate.[3] Keynes further argues that this is the only channel through which money wage adjustment can affect employment, thus implying that a money wage reduction is neutral to the level of employment under the liquidity trap. By this argument, Keynes made a serious challenge to the view that the competitive economy will automatically achieve full employment.

Economists responded critically especially to the argument in Chapter 16, as surveyed in

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[2] The thesis that there is an underlying trend of the decreasing marginal efficiency of capital was to be later developed by Alvin Hansen (1939; 1941). Pigou specifically addressed Hansen in his *Economic Journal* article of 1943.

[3] Laidler (1999) shows that Keynes's view in Chapter 19 of *The General Theory* was preceded by Hawtrey. Hawtrey stated that a money wage decline would enable a fall in prices, which, in turn, makes "a given amount of money-demand absorb a greater amount of goods" (Hawtrey 1932, 322).

Laidler (1999, 292–295). Ralph Hawtrey argued that in the long run, liquidity preference is not rigid but passively reacts to the trend in the marginal efficiency of capital, so that if the latter fell over time, the interest rate would also decline and prevent the imbalance of desired saving and desired investment from occurring (Hawtrey 1937). Dennis Robertson was of a similar opinion as shown in his review of *The General Theory* (Robertson 1936, 187–188). Pigou also touched upon the flexibility of the interest rate in the long term. He argued that the long-term interest rate could decline to almost nil in a situation of chronic stagnation.

However, as we can easily expect from the preceding sections, Pigou's main concern was with the discussion in Chapter 19. He claimed that high employment could be maintained through a money wage cut: "I should expect reductions in money wage rates to mitigate, though not to nullify, the associated damage to employment [in secular stagnation]" (Pigou 1936, 130). In this review article, Pigou did not explain how a money wage fall affects employment or state a definitive conclusion on this issue: "This whole matter is highly speculative, but I should not myself pay a high premium to insure against Mr. Keynes' day of judgment" (Pigou 1936, 130).

Shortly afterwards, in September 1937, came out Pigou's paper entitled "Real and Money Wage Rates in Relation to Unemployment" (1937). In the first few sections, he clarifies the problem. Pigou first reminds readers of the fact that the doctrine that money wage cuts—if not involving an expectation of further cuts—increases employment was being challenged recently[4]. Pigou goes on to contrast two different situations. One is the rapid economic downturn, the most striking example of which is the depression that began with the 1929 crash. For this situation, he states, "[e]verybody will

[4] Pigou only referred to Harrod's (1934) *Economic Journal* article on his own *The Theory of Unemployment* in this 1937 article for ones who challenged the effectiveness of money wage cuts. He referred to him in relation to the monopoly case. Actually, the number of pages spared for the discussion of the monopoly case is much larger than that for the discussion of the competitive case.

agree that at such a time any practicable wage cut, even though it did not create an expectation of further cuts, would count for little or nothing—a mop to stay the seas" (Pigou 1937, 405–406). The second situation is the economy that is stable but has large amount of unemployment. As an example of such an economy, Pigou refers to the British economy in the second half of the twenties, where unemployment maintained at a high level. By contrasting these two situations, he is making two points, first, that the effect of money wage cuts on employment is only a minor one, but second, that even this small effect could make a difference in the fairly stable economy. Pigou thus emphasizes that the paper would address the economy without violent disturbances and so susceptible to a weak correcting force like money wage adjustment.

There is a point worth mentioning, relating to Pigou's allusion to the late twenties. As I mentioned above, Pigou seems to have in mind that the extent of money wage flexibility in that period was less than he had expected it to be at the time of the early twenties. He attributed the large part of unemployment in that period to this rigidity of money wages. Pigou's mention to this period is important for another reason. As argued in my paper, Pigou was well aware of monetary causes of business cycles—he claimed in 1927 that the gold standard is not perfectly compatible with price stabilization because the gold standard restricts the range of monetary policy. Pigou would have been aware that interest rates in the late twenties were more or less fixed to maintain the gold standard. Therefore, one could make a claim that if Pigou needed to establish the validity of money wage adjustment under the condition of fixed interest rates, the reason might also be that the economy he had in mind was under such a condition.[5]

[5] Although I suggested that Pigou might have had the situations in the late twenties in mind in the 1937 paper, there is a simple way to prove the effectiveness of money wage adjustment under the conditions in that period, which is to assume an open economy. Later he talked about the British economy in the early twenties where almost similar conditions

5. The Controversy (2): the Inconsistency in Pigou's 1937 Article

The failure in Pigou's 1937 paper can be shown in what follows. The issue was whether an interest rate reduction is required if money wage cuts were to involve increased employment. Obviously there was a conflict between the verbal explanation and the model's implication: the model suggests an interest reduction is necessary, whereas Pigou verbally stated it is not (although the characteristics of the model is insufficiently explained in the article and allows for more than one interpretation without additional evidence, as I will mention shortly).

First, symptomatically, Pigou implied that the model he used in the article cannot by itself determine the level of interest rate. He said, "What will happen to the rate of interest and the volume of money income depend, of course, on the detailed circumstances" (Pigou 1937, 410). Instead, he relies on a quasi-dynamic argument in which he claims the interest rate first declines and then goes up to a new equilibrium rate after money wages are reduced. He did not make it clear whether the interest rate moves back to, stops short of, or goes beyond the original rate. However, in the review article of Keynes's *The General Theory,* he stated that the interest goes up beyond the original level (Pigou 1936, 129). Therefore Pigou seems to think that after money wage cuts, the interest rate declines but does not stay there but eventually rises above the original level. This corresponds very well with his remark in *The Theory of Unemployment*, namely, that the decline in real wages resultant of a money wage cut will eventually raise money income.

Thus this paper has many ambiguities as well as the point just mentioned about what will

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prevailed, stating, "[e]ven those economists who maintain that, in a closed community, general reductions in money rates of wages would not help employment, because they would entail corresponding reductions in prices and money income, do not maintain this for an open community whose prices are determined, as ours were during this period [NT: in the early twenties], by a monetary policy based in the main on foreign exchange considerations" (Pigou 1947, 199n).

happen to the interest rate, as will be clear in what follows. Let us first discuss why Pigou did not make a clear argument in the 1937 article? One general reason we might be able to point out is that this period was the time when full-blown institutionalization of the economics discipline was about to begin. Journal articles were meant for a limited number of well-connected people. Authors, especially ones with already established reputation, tend to be cryptic rather than explicit all the way. Another reason, particular to the current episode, is Pigou's apprehension to Keynes's health. Pigou said to Keynes in correspondence that he cut out the discussion on interest rate from his draft of the 1937 article because "it touched on your [Keynes's] stuff and, while you were ill, I didn't want to write anything that might seduce you out of the cow-life which you ought to be—but are not!—leading" (Moggridge 1973, 257). There is no way to tell how much this is the truth, but it is true that Pigou does not mention Keynes's name in the 1937 article at all. Yet another personal reason was Pigou's own health. Keynes was also concerned about Pigou's health. He wrote to Kahn, "[Pigou's 1937 paper] seems to me the work of a sick man" (Moggridge 1973, 234) and to Robertson, "I wish the Prof [Pigou] would make another attempt to secure more durable recovery" (Moggridge 1973, 251). Pigou also confessed, "I have been unable to concentrate on anything and haven't even looked at [Robertson's comments on Pigou's 1937 article]" (Moggridge 1973, 256). Therefore, it is in some sense no wonder Pigou would not write a consistent paper in 1937.

Next let us look at the model in the paper in question. Pigou sets up a model with the following assumptions: (1) perfect competition with one kind of labor, (2) fixed stock of capital, (3) the same production period for all goods, and (4) a closed economy. This model was an important extension of *The Theory of Unemployment.* In that work, money income was connected roughly with money wage changes, but in the 1937 model, money income was explicitly the function of interest rate. Money

income is consisted of the product of two components, the stock of money and the income velocity of money, both of which are functions of the interest rate. The idea behind this would be that the interest rate is a barometer of overall economic activity and so the faster money circulates or the less of the money stock is hoarded, the higher the interest rate is.

Now bringing in the interest rate as a new endogenous variable, we need another equation. This equation is the reason for the assumption of fixed capital stock. Investment is assumed away in this setting. Therefore, savings must be zero and the interest rate offered to savers must be equal to savers' time preference rate. Thus the second equation is $r = \rho$, where r is the interest rate and ρ the time preference rate. Pigou intended this assumption as the Marshallian short-run setting, "in the sense that we have taken the stock of equipment as fixed" (Pigou 1937, 421). Contemporary commentators divided on the interpretation of this assumption. Keynes called it a "frozen land" assumption and criticized it as highly improper for a model of short-term economy in the early draft of the reply paper, though he stopped mentioning this point in later drafts and the final version, which was published in the next issue of *Economic Journal*. On the other hand, Kaldor understood it as theoretical convenience and essentially the same as the assumption of positive and fixed investment (Kaldor 1937, 751–752). Kaldor further mentioned that the economy with variable investment is the "longer run" situation and that the discussion could be applied to that situation. Robertson was not as optimistic about the adoptability to the situation with variable investment (Moggridge 1973, 254).

Yet another problem arises here because it was not clear from his writing whether he considered the time preference rate was a constant. It is possible to read his writing as meaning the rate is a variable depending on real income. Pigou stated, "neither, so long as employment, and, therefore, real income is unaltered, can ρ be any different" (Pigou 1937, 409). Some scholars such as Ambrosi

(2003) interprets that Pigou thought the time preference rate was a constant. As the graph in Ambrosi (2003, 218) clearly shows, a constant time preference rate implies constant money income and constant money income guarantees an increase in employment for money wage cuts because in this case employment is essentially fixed money income divided by money wages. Keynes interpreted Pigou's argument this way as is evidenced by his correspondence and his eventual reply article to Pigou's 1937 article, but more on this point later.

If this is the case, i.e., Pigou assumed time preference rate to be independent of real income or employment, Pigou is presenting a different theory of money wages in his 1937 article. This theory could be termed as the constant consumption effect. For, in this setting, desired savings do not change with real income, and so newly created income will be all consumed rather than saved. Thus, under a stationary state condition where desired investment is constantly zero, real income could grow without causing excess savings leading to loss of income or a fall in interest rates. This theory surely would have served as a counterargument of Keynes's challenge.

However, this interpretation might not be well grounded because there is a couple of evidence that suggests the opposite, i.e., that Pigou regarded the time preference rate as a variable dependent on real income. First, he had argued in his earlier work *Economics of Stationary States* (1935) that an increase in real income would cause savings to rise—actually he made a stronger argument than this, that is, that such an increase would cause the proportion of savings to income to rise. Pigou based this relationship on his observation that, up to a certain level of income, people could not afford to set aside any portion of their incomes for savings but, as their incomes grow larger, they gradually acquire "a wider view and a more educated appreciation of the facts of life" (Pigou 1935, 171–172) and become capable of savings. People with more income are likely to have lower time preference rate and save more.

This means that Pigou admits there is a functional relationship between savings or time preference rate and real income. Second, in a letter to Keynes, dated October 18 1937, Pigou explained what he meant in the 1937 article with the following remark: "I don't assume or make any assumption which implies that money income is fixed" (Moggridge 1973, 256). As explained above, money income depends on the interest rate; the interest rate in turn is determined by time preference rate. A constant time preference would be exactly an assumption that implies money income is fixed. In this letter, Pigou clearly states he did not make such an assumption, which means he did not intend in the 1937 paper that time preference rate is a constant.

If this were the case, Pigou suffers from inconsistency between the model and the verbal exposition concerning the movement of interest rate. Savings increase with real income. Through this functional relationship, time preference rate (savings) must decline (rise) if real income is to increase. Or, real income cannot increase without an accompanying decline in time preference rate and therewith the reduction of interest rate. Therefore, the model conflicts with his verbal argument, where he describes a complex movement that would happen to the interest rate after money wages are cut down, namely, going down first and then rising again.

As far as the 1937 article is concerned, it is not sufficiently clear which of the above two interpretations is more credible. Pigou might have been assuming the time preference rate to be constant despite the above-mentioned evidence against this understanding. For, it is possible that he ensured the logical consistency by having a constant time preference assumption; but he did not make it explicit because it was squarely against Keynes's argument; and for some reason, he superimposed a more realistic argument on the interest rate based on the Marshallian monetary theory instead of entirely relying on the model. This is not impossible. This viewpoint itself is a hindsight grounded on Kaldor's

later analysis to begin with. In either case, later development takes a course that does not allow ambiguous interpretation.

6. The Controversy (3): Responses by Keynes, Kaldor, and Robertson

Keynes (1937) responded to Pigou's 1937 article, although probably this was not a result Pigou wanted when he wrote it because he did not wanted to disturb Keynes's convalescing. But Keynes did it anyway. The process of his response to Pigou's paper is another interesting part of this episode because of the following two reasons. First, Keynes seems to have learned the true problem in Pigou's paper from his exchange of letter with Kaldor. The argument present in his final reply paper is absent in his first draft that he had written by August 7 1937 before he read Kaldor's paper (Moggridge 1973, 235–238). This is very important because Keynes himself had not thought of his own theory in the way that was later to be considered as the Keynesian framework when he wrote *The General Theory.* Second, there was negotiation between Pigou and Keynes on whose papers should be published. Pigou wanted only Kaldor's paper to be published while Keynes insisted his paper be published as well. Obviously Pigou was thinking that Keynes's paper was not worth being published and also that he might not have to respond to the criticism squarely if Kaldor was the only critic.

The first draft that Keynes prepared in response to Pigou's 1937 article is not concerned with exactly the same matters that Keynes came to discuss in its final version. This early draft centers on the characteristics of the money supply (the quantity of money) function in Pigou's model. Although it is very cryptic writing and needs to be supplemented by its later version to make sense of it, he seems to argue that Pigou thinks a money wage cut does not affect the demand for money.[6] As we will see shortly,

[6] To make this point, he phrased it as Pigou making the money supply entirely depend on the interest rate when Pigou talks about a money wage cut while making it depend on

this point would be debated with Kaldor and Robertson in correspondence

Kaldor came into the scene when he submitted a criticism of Pigou's article on September 27 (Pigou's paper had been published in the September issue of *Economic Journal*). Kaldor was a lecturer at the London School of Economics during this period and not among the circle of young Cambridge economists Keynes often asked for advice. However, Keynes was in the position to receive this paper in an early stage because he was the editor of *Economic Journal*. Three days after Kaldor submitted his paper, Keynes replied to Kaldor, stating that the problem in Pigou's model was the constant time preference rate rather than what he took up in his early draft. "My belief is that the assumption that Pigou is fundamentally making is that the whole of yesterday's income will be spent today" (Moggridge 1973, 241). It may be too rush to jump to the conclusion that this Keynes's belief was shaped after he read Kaldor's paper, only with this remark. Now let us first examine Kaldor's criticism because Kaldor's paper was highly illuminating on the involved issues and also does not seem to have gone through much revision through the reviewing process and kept the form as it was submitted.

What Kaldor did in his paper was to identify the sign of derivative of each function required for different conclusions[7]. First, he turns Pigou's second equation $r = \rho$, which he calls the "old-fashioned savings-function in disguise," into a more straightforward form, $S = \psi(r, x) = 0$ (x is employment). Then, for Pigou's conclusion that a money wage reduction involves an increase in employment without accompanying a reduction in the interest rate, Kaldor claims that $\frac{\partial S}{\partial r}$ must be

money income elsewhere. However, this is irrelevant because it is nothing wrong that variable A (the quantity of money) is a function of X (the interest rate) and A holds a certain relation with another variable B (money income).

[7] According to Young (1987, 107–113), Kaldor had been shown the SI-LL diagram by Hicks when he submitted a criticism of Pigou's 1937 article. Interestingly, in the interview with Young, Kaldor seems to imply that Pigou's saving function was essentially the same as Keynes's, as opposed to what Keynes claimed.

positive and $\frac{\partial S}{\partial x}$ be zero. For, the second condition guarantees that all of the newly created incomes will be consumed, and the first ensures that the equilibrium is stable because, if an interest decline involves an increase in savings, a money wage cut and a resultant interest rate decline will create a negative spiral movement of incomes and the interest rate. On the other hand, if $\frac{\partial S}{\partial x}$ is positive, Pigou's conclusion no longer holds up. Under this condition, if employment and real income were to increase, this must involve an increase in savings, and the interest rate needs to decline to maintain savings to be zero. In this paper, Kaldor considers that Pigou took the above first case in which savings depend on employment and real income. Reading this analytical paper, Keynes told Kaldor that the problem in Pigou's model was that his savings function is not a function of real income. One could say that at least Keynes could make sense of Pigou's paper more clearly than he had been able to before he read Kaldor's paper. Keynes's final version that appeared as a two-page article in the December issue of the *Economic Journal* contained this criticism about the constant time preference rate. "Prof. Pigou implicitly assumes that, when (as a result of reducing money-wages) employment and real incomes have been increased, the rates of time-preference will remain the same as before" (Keynes 1937, 744).

There was another issue discussed in correspondence between Keynes and Kaldor. It was what Keynes criticized in his first draft, namely, Pigou's money supply function. Throughout their correspondence, Keynes insisted on this point while Kaldor did not agree. Keynes's concern was that money wage cuts will surely decrease the interest rate whereas Pigou seems to think they will not. Kaldor interprets Pigou's remark as a false condition in a reductio-ad-absurdum demonstration. If money wages are cut down and employment does not change, the latter condition leads to constant interest rate and some inconsistency arises. After receiving Kaldor's submitted criticism from D. H. Robertson, Pigou himself made sure that this was what he meant in his 1937 article, "Kaldor's article . . . interprets me, I

think, correctly" (Moggridge 1973, 256).

Robertson was consulted by Keynes. Robertson made several comments on all the articles in question, Pigou's 1937 article, and Keyens's and Kaldor's criticisms. Except for a few quibbles, he supports Kaldor's position that Pigou was inconsistent in saying that money wage cuts do not need a decline in interest rate to involve an employment increase. Robertson also points out that Pigou's stylization of money supply has nothing especially wrong. "[Pigou's] assumption about the public's desires [for holding money] is the ordinary Marshallian-Pigouvian one" (Moggridge 1973, 253). Young noted Robertson's letter to Kaldor dated two days after, which says Robertson could not "make anything of Keynes' note" (Young 1987, 111).

In the face of the opposition from Kaldor and Robertson and the disclaim by Pigou himself, Keynes now told Robertson and Kahn that he was deleting the paragraph on Pigou's assumption on money supply. However, Keynes's published article contains criticism on this issue in a very cryptic and congested way. In the penultimate paragraph, Keynes first admits that Pigou's argument was meant as reductio ad absurdum, but without stating what is wrong about this argument, he goes on to say Pigou should have made money supply depend on both the interest rate and money income instead of only on the former as Pigou did. Therefore, Keynes did not remove his original criticism in the end, but he stated it in the way that no one who had not read his earlier drafts could understand. In fact, Pigou confessed that he could not follow "the reasoning of Mr. Keynes' short note" in his later paper in the *Economic Journal* (Pigou 1938, 134n).

We turn to the second important point listed in the beginning of the current section. Pigou wanted only Kaldor's criticism to be published and not Keynes's. Pigou wrote to Keynes:

Trying to abstract myself from personal interest in the thing, I think it would be best for

> Kaldor's article to be published, but not yours [Keynes's]. If this were done, I should like, if I might, to add a short note saying (1) that his résumé of my § 8 itself very badly put and (2) that personal preoccupations made it impossible for me to discuss his article now, but I should like, if allowed, to take the matter up again. (Moggridge 1973, 256)

What Pigou is trying to achieve here seems to be the end of the controversy without definite conclusion on who won and who lost.[8] If the things had proceeded as Pigou said in this letter, Pigou might not have had to answer the criticism squarely. Keynes replies to Pigou definitely, "No, I am quite clear that my article ought to stand" (Moggridge 1973, 256) and was afraid that Pigou was trying to suppress his criticism. Pigou accepted it and suggested writing a reply not to the same issue but to the next issue, which he did actually.

7. Professor's Retraction and Illumination

As I have shown above, Kaldor's paper was analytical and unambiguous. The inconsistency in Pigou's model was clearly highlighted. With the assistance of David Champernowne, who was a former student of Keynes and lecturer at LSE in 1937 and one of the early pioneers for mathematical model building based on *The General Theory*, Pigou managed to understand Kaldor's criticism, even though he had at first prepared a long paper to counter the criticisms.[9] In a paper published in the March issue of

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[8] At this stage, as is clear from the other part of the same letter, Pigou did not fully understand Kaldor's criticism, and he only knew that Kaldor's paraphrase of his argument seems right. It also is clear that Pigou thought that Keynes's paper was based on misunderstanding. Therefore, it might be for a purely scientific reason that Pigou did not want Keynes's paper to be published.

[9] Aslanbeigui and Oakes (2007) suggest that Champernowne was told to approach Pigou by Richard Kahn. Their evidence is that Pigou wrote to Keynes, "Champernown was keen to see [Pigou's reply paper to Keynes and Kaldor]," and that Kahn told Keynes that he had "been keeping Champ. Carefully briefed" (Moggridge 265). Even if it is the case, Kahn would not have been perfectly happy about this maneuver, considering the fact that Kahn was not very keen on making mathematical models out of *The General Theory*.

The Economic Journal, Pigou accepted Kaldor's argument on how the model works and abandoned almost all the claims he made in his 1937 article. According to Kaldor in the interview with Young (1987, 109), Pigou's retraction surprised economists, especially Lionel Robbins, who opposed Keynes's views in the thirties. Pigou now accepted (1) that money wage cuts involves a fall in interest rates, (2) that such cuts would improve employment only insofar as it entails a fall in the interest rates, and (3) that monetary policy could serve as a substitute of money wage cuts in the sense that the latter affects employment through the same channel that the former does, namely the interest rate.

This complete surrender was solely due to the above equation $S = \psi(r, x) = 0$, which shows that if employment were to increase, interest rates must fall, or $\frac{dx}{dr} < 0$. As to whether a money wage cut involves a fall in interest rates, Pigou offered a further discussion by using calculus. By differentiating the other equation in the model, which I will relegate to a footnote[10], he demonstrated that except in extreme cases, a money wage reduction must entail a fall in interest rates, or $\frac{dw}{dr} > 0$. Combining these two results, Pigou concluded that: "[W]ithin the framework of our model, a cut in money wage-rates is fairly certain to entail a reduction in the rate of interest, and so an increase in employment" (Pigou 1938, 136–137).

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[10] The equation was: $\frac{f(r)V(r,x)}{F(x)} = \frac{(1+r)w}{F'(x)}$, where *f(r)* is money supply function dependent on the interest rate *r*, *F(x)* production function dependent on employment *x*. This equation represents the equality of general prices rendered in two different ways: the left-hand side shows the ratio of money income to real income and the right-hand side the ratio of marginal prime costs in money terms to those in real terms. Pigou made calculus on it and obtained the following equation:
$\frac{d}{dr}(1+r)w = \frac{dx}{dr}\frac{d}{dx}\left(\frac{F'}{F}\right)\cdot f \cdot V + \frac{F'}{F'}\cdot f' \cdot V + \frac{F'}{F}\cdot f \cdot \frac{\partial V}{\partial r}$ by assuming $\frac{\partial V}{\partial x}$ is negligible (Pigou 1938, 137). Since the right hand side is positive and $\frac{dw}{dr}$ is not likely to take the different sign from $\frac{d}{\partial r}(1+r)w$, $\frac{dw}{dr}$ is positive.

I call attention to the exact wording in Pigou's reply paper. He used a phrase, "within the framework of our model" two times in this short article. The use of this qualifying phrase suggests that he had a different idea on how the economy behaves than what the model tells. It also suggests that Pigou now acquired a way of economics in which one's argument solely depends on explicit models. Pigou's model understanding of macroeconomics developed into highly systematic analysis in his later *Employment and Equilibrium* (1941). To take the simplest model for illustration, the following model is a two-sector economy with the assumption that aggregate income is always proportional to its labor's share, where x is employment for consumption goods sector and y employment for investment sector, r the interest rate, F production function for consumption goods, I investment function, S saving function (the unit of I and S is the number of workers), C the fixed proportion between labor's share and total income, w the money wage rate, and g aggregate money income function (Pigou 1941, 152).

$$I(r) = S\{r, F(x)\}$$
$$y = S\{r, F(x)\}$$
$$Cw(x+y) = g(r)$$

In the general case where the signs of derivatives are as follows— $I' < 0, \frac{\partial S}{\partial r} > 0, \frac{\partial S}{\partial F} > 0, g' > 0$, one can derive the following result among all others Pigou listed in the tables in the Appendix of the book:

$$\frac{d(x+y)}{dw} = -\frac{\left(\frac{\partial S}{\partial r} - I'\right) - I'F'\frac{\partial S}{\partial F}}{C\left(\frac{\partial S}{\partial r} - I'\right) + F'\frac{\partial S}{\partial F}\left(g' - CI'\right)} \cdot \frac{g}{w^2} < 0$$

This, of course, shows that a money wage cut involves an increase in employment. Pigou seems to have been aided by his "computer" in compiling these tables. "The tables in the Appendix have been worked out and very carefully checked by Mrs. Galuert. . . To her, too, my best thanks are due" (Pigou 1941, vii).

Mrs. Glauert was Pigou's assistant (Collard 2002, xxxn1).

One thing to be noticed in this episode is that Pigou fought the battle in the field he did not belong to. The argument based on models is the way he was also moving in during the thirties, but his argument had been largely supplemented by statistics and institutional knowledge. Pigou could have brought the theory I have termed the distribution effect in Section 3 of this paper. However, he chose to engage with a general model without mentioning the distribution effect. Pigou came up with a new theory that Don Patinkin later termed the Pigou effect, as a counterargument of Keynes's and Alvin Hansen's secular stagnation thesis. We will see how close the theory is to his earlier distribution effect in the next section.

8. The Pigou Effect: New Theory Old Idea

In one chapter of the same work *Employment and Equilibrium,* Pigou discusses the theory for which Patinkin later coined the Pigou effect. As in his 1937 *Economic Journal* article, Pigou chose a stationary state setting for this theory. Therefore, Pigou seems to intend this theory for a stable economy in which even a weak cause can make a significant effect. However, the setting he used for the new theory is slightly different. Now people save money not only for future consumption but also for the sake of savings itself. The latter motive is referred to as "amenity." More specifically, this is a "sense of power, sense of security and so on, which the possession of them carries" (Pigou 1941, 126). People's savings thus depend on this amenity value of savings as well as the time preference rate. His ideas here are that this amenity value will decrease with the increase of real value of assets and that asset value in real terms will increase with a price decline. Therefore, even if the interest rate is already on the lower bound, a price decline can increase consumption and thus still activate a self-correcting force in the economy.

> [Once deflationary pressure sets in,] since money income is continuously contracting, and prices, therefore, falling, the existing stock of money is continually becoming more and more valuable in terms of consumption goods.[11] . . . Money income, after the critical point has been reached, falls, perhaps substantially, and prices with it; but presently a new high-level full employment stationary state may, nevertheless, establish itself. (Pigou 1941, 128–129)

In the first edition of *Employment and Equilibrium,* Pigou was very cautious on how effective this effect might be. He stated after the above quote, "This is always a possibility;" and admitted that Keynes's scenario, a "vision of the Day of Judgment" in Pigou's terms, is an alternative possibility because it cannot be definitely claimed that the amenity value will decrease with a price decline to the sufficient extent to bring the economy back to full employment. Interestingly, Pigou came to take a more secure attitude to his own theory. In the 1943 *Economic Journal* article, he concluded, "[The] stationary state [with full employment], provided that wage-earners adopt a competitive wage policy, is always possible; indeed it is the goal to which, granted this proviso, the economic system necessarily tends" (Pigou 1943, 350).[12]

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[11] In the second edition of *Employment and Equilibrium* (1949), the following phrase is inserted in the middle of this sentence: ". . .the existing stock of money—as also the stock of land and of some other sorts of property, such as Old Masters, which are especially suitable as embodiments of, or receptacles for, saving—is continually becoming more and more valuable . . ." (Pigou 1949, 132). This change might reflect a criticism to the Pigou effect on the difference between internal and external money. Kalecki (1944) made this point with harsh tone, and Robertson also seems to point it out to Pigou.

[12] Melitz (1967) gives an unconventional interpretation to Pigou's 1943 article. Melitz focuses on what he terms as the "convenience yield effect", which operates on investment at the occasion of a money wage cut when the interest rate is on the minimum level. According to Melitz, Pigou argued that at the time of the minimum interest rate, the convenience obtained from holding more money cannot fall further and therefore that a money wage reduction cannot raise money hoarding and will increase the demand for investment goods. While Pigou indeed mentioned such an process, he himself denied it right after noting it: "[T]he circumstances we have been contemplating . . . are such as cannot in fact occur"

This change of his attitude can be attributed to a different way of formulating the theory. In this 1943 *Economic Journal* article, Pigou presents it as a modified saving function rather than a separate microeconomic argument based on individual utility maximization as he used in *Employment and Equilibrium*. The new saving function is: $S = f(C, x, r, T)$, where *C* is capital stock, *T* the real value of money stock, and $\frac{\partial f}{\partial T} < 0$, so that a price decline causes T to increase and, through it, savings to decrease. Along with these clarification, he states, " $f(C, x, r, T)$ can assume a nil value, if *T* is sufficiently large, for no matter what values of *C* and *x* and *r*" (Pigou 1943, 350). A new way of theorization gave him a heuristic benefit. With the microeconomic reasoning, he was not sure whether the amenity value of savings will decrease sufficiently to activate the effect. But now he is able to turn on the story that if the real value of money stock becomes sufficiently large, this will necessarily cause savings to go down to zero. This theorization had another importance because this saving function was later adopted by Don Patinkin (1948, 547). This was the way his theory was framed that spread widely among economists.

This theory, which came to be called the Pigou effect, is now regarded as an asset effect in which the increase of asset value stimulates consumption. This is entirely true for the way to describe Pigou's theory. However, in connection with his earlier theory, there is another way to look at it. Let us remember what I termed the distribution effect. It is the effect in which a money wage cut and a resultant commodity price decline raise the real value of some people's incomes. Aggregate income is not consisted entirely of wages or salaries. Non-wage workers' incomes are, by definition, not wages and do not decrease at a money wage cut. Therefore, these people's incomes will increase in real terms. This stimulates their expenditure in real terms. This scenario could be parallel to what will happen in the

(Pigou 1943, 349). Pigou did suppose that money wage cuts would increase money hoarding and diminish money income: "As money wage-rates fall money income must fall also" (Ibid).

Pigou effect. Both theories highlight price declines enlarging the purchasing power of the general public. The distribution effect requires a less general condition of constant non-wage workers' incomes and also difficult to incorporate into such simple macroeconomic models as they used in the late thirties and forties. Although there is a difference of stock and flow between the two theories, it would not be totally out of place to suggest that the distribution effect in the early thirties was adopted into the Pigou effect in the forties.

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