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Notes on consumption, investment and effective demand: I

Part II of this article will be published in a subsequent issue.

Pierangelo Garegnani*

The purpose of these Notes is to reconsider the theoretical problems raised by the question of the long-run influence of consumption on investment.

Current economic theory does not appear to provide a generally accepted answer to this question: its position on the issue is ambiguous and contradictory. Pre-Keynesian theory gave a simple answer: the level of investment is determined by the community's decisions to save, allowance always being made for frictions not dissimilar to those admitted in other parts of economic theory. In order to obtain a larger volume of investment, consumption should be discouraged. The criticism by Keynes has shown the weakness of this traditional answer. But while Keynes's different conclusions have been generally accepted for the analysis of trade cycles and other short-period phenomena, the theoretical situation remains uncertain with respect to the long period, which is our primary concern here. With respect to long-period analysis some discussions of Keynes's theory, conducted on the assumption of flexible wages and prices—or, more realistically, on the assumption of a flexible monetary policy—have, in fact, created a climate of professional opinion by no means hostile to a reaffirmation, in less rigid terms, of the traditional theory—though they have not succeeded in restoring to that theory the confidence it once enjoyed.

Our consideration of the problem has seemed useful because the terms in which the question has been discussed so far may be significantly modified, in the present

* University of Rome. These notes are an abridged version of a paper first published in Italian in *Economia Internazionale*, 1964 and 1965. The translation has been prepared by Jan Kregel, Ian Steedman and the present author. The original paper was itself taken from the theoretical part of a study conducted in 1961 for the 'Associazione per lo Sviluppo del Mezzogiorno' (SVIMEZ). The subject of that study was the relationship between consumption and investment in the Italian economy. The theoretical part included, besides the material of this article, an analysis of how the independence of investment from the capacity to save may assert itself in the course of a process of accumulation. This was done with particular regard to economies with a large reserve of labour which either is unemployed or utilises traditional methods of production. The theoretical part was followed by an empirical part in which a comparison between unutilised capacity and the additional outputs required, directly and indirectly, by hypothetical additional investment (for 1955–60), specified in volume and composition, seemed to suggest that the limit to investment in Italy in that period was set by the incentive to invest and not by the level of consumption, contrary to what was then often argued. The results of the study are available as a mimeographed volume from SVIMEZ (via di Porta Pinciana, 6, Rome), which I thank for permission to publish the part contained in these Notes. I also wish to thank Claudio Napoleoni, Sergio Steve, Paolo Sylos-Labini and Volrico Travaglini for their comments on the manuscripts of this work.

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writer's view, by the recent criticisms of the notion of 'capital' as a factor of production.

The traditional doctrine, in which planned investment adjusts to planned savings, appears to be centred on the idea of an investment demand function elastic with respect to the rate of interest. This idea has not been disputed in the course of the Keynesian controversy, at least with respect to long-run conditions. Keynes himself adopted it in the form of the 'marginal efficiency of capital' and focused his criticism on the notion that the rate of interest would be flexible enough to be the equilibrator of saving and investment decisions. This particular course, followed by the Keynesian controversy, is important, we believe, for an explanation of the present theoretical uncertainty concerning problems of capital accumulation. The notion of a demand function for investible resources has, in fact, provided the main basis for attempts to confine to short-period conditions the obstacles which impede the equilibrating role of the rate of interest and has thus favoured the persistence, in part of the literature, of a confidence in the traditional theory of accumulation.

We shall argue in these Notes that this notion of an interest-elastic investment demand function has its basis in the conception of capital as a factor employable in production in proportions which will increase, relative to other factors, as the rate of interest decreases. It follows that the recent criticism of this conception of capital has an important bearing on the question of the influence of consumption on investment. We shall indeed argue that such criticism provides a firmer ground for the rejection of the long-period dependence of investment on decisions to save.

These Notes will consist of two parts. In Part I we shall investigate the premises from which traditional theory derived the assertion that there exists a tendency for effective demand to adapt to productive capacity. We shall see in section 1 how this is the question which lies behind the problem of the relation between consumption and investment. The analysis will begin, in section 2, by distinguishing between two theoretical approaches which Keynes included in what he called the 'classical school': that of Ricardo and the 'classical school' proper, on the one hand, and, on the other, that of the later marginalist theories to which Keynes was in fact referring. In sections 3–6 we shall then proceed to argue that it is in these latter theories only that we can find premises supporting the traditional thesis. In section 7 we shall then discuss the validity of these premises, and conclude that, even if we remain within the limits of an analysis conducted in 'real' and 'static' terms—abstracting, that is, from the obstacles which the monetary system and the state of expectations may raise for an equilibrating process —economic theory does not seem to provide a sufficient basis for the idea that market forces can ensure the adjustment of decisions to invest to decisions to save in the long period.

In Part II the question will be taken up in the context of monetary theory, within which Keynes conducted his criticism of traditional theory. We shall then examine the subsequent attempts to support the traditional doctrine by means of an analysis founded on the hypothesis of flexible money wages or, alternatively, a flexible monetary policy. We shall seek to show that these attempts rest crucially on the hypothesis of a high interest elasticity of investment. At this point we shall refer back to the results of the analysis in 'real' terms conducted in Part I and conclude that even in long periods and in normal situations, investment will be independent of saving decisions, at least below the limit set by the community's saving in conditions of full utilisation of productive capacity and constancy of the level of prices.

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PART I: 'REAL' ANALYSIS

1. The tendency to a full utilisation of productive capacity

As is well known, the position of traditional theory on the relation between consumption and investment derives from the idea that the aggregate demand for output tends to the level which ensures the full utilisation of the available productive capacity. Let us in fact assume a rise in the relevant part of the curve representing the community's propensity to consume. If productive capacity always tended to be fully utilised, the increased output of consumption goods could only be obtained by decreasing the output of capital goods, i.e. by decreasing investment.† Traditional theories did not, of course, ignore the possibility of 'frictions' capable of delaying the achievement of full utilisation of productive capacity; it was in terms of these 'frictions' that trade cycles were explained. But this admission did not alter the conclusion that the volume of investment, taken as an average over a normal succession of periods of prosperity and depression, would be determined by the community's decisions to save.

However, when we admit, as Keynes did, the possibility of equilibria with partial utilisation of productive capacity, the traditional thesis can no longer be maintained. An upward shift of the schedule of the propensity to consume might in fact result in an increased utilisation of productive capacity and might therefore result in a constant, or even an increased, volume of investment. The question of the effect on investment thus remains open: investment might decrease if production is close to the limit of productive capacity, but the opposite effect is also possible—and indeed probable if there are margins of unutilised productive capacity, whether they be large or small.

In the following sections we shall examine the premises from which traditional theory derived the doctrine that market forces lead to the full utilisation of productive capacity. Before proceeding to this examination, however, an observation must be made. By productive capacity we have so far meant the equipment of capital goods‡ in existence in the economy in a given situation, together with only that part of the total supply of labour which is required for the full utilisation of this equipment. By this definition we have departed from the terms in which the controversy between Keynes and traditional theory was conducted. It was there assumed that a full utilisation of the existing capital equipment would allow for the employment of the entire labour force.

The more general notion of productive capacity we have so far used would seem to be the appropriate one in discussing long period tendencies, where unemployment of labour from below-capacity utilisation of equipment may itself generate so-called 'structural' unemployment unless it is quickly corrected; indeed this notion of capacity has been that on which the traditional thesis of the alternative between consumption and investment had to be based in order to apply it to economies with 'structural unemployment'. A difficulty however would be raised by using the general notion in the rest of this paper, for the assumptions by which such 'structural' unemployment has been reconciled with traditional theory (i.e., fundamentally, the existence of circumstances imposing a real wage higher than that which competition would enforce, and the lack of a sufficient variability in the proportions between capital and labour) would

† A closed economy will be assumed; we shall also abstract from all state economic activity other than monetary policy.

‡ As usual, productive equipment is assumed to be appropriate to the composition of aggregate demand at its full employment level, so as to abstract from problems of disproportions among industries. In what follows the concept of 'productive equipment' will refer only to fixed capital goods; it may be supposed that circulating capital (stocks and goods in process) can adapt rapidly to changes in the level of activity.

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interfere with an examination of the Keynesian controversy in its own terms. We have accordingly decided to separate the two issues: our examination of the Keynesian controversy will be carried out under the assumption that existing equipment suffices to employ the entire supply of labour, whereas the applicability of our conclusions to an economy with 'structural' unemployment will be considered later, at the end of Part II of these Notes.

2. Ricardo and 'Say's Law'

As soon as we consider the question of the premises from which the traditional theories drew the conclusion about the tendency to 'full employment', it becomes necessary to distinguish clearly between the two types of theories which Keynes included in what he called the 'classical school'. According to Keynes that school included Ricardo and 'the *followers* of Ricardo . . . who adopted and perfected the theory of the Ricardian economics, including (for example) J. S. Mill, Marshall, Edgeworth and Professor Pigou' (Keynes, 1936, p. 3). Now, the theory of Ricardo, on the one hand, and the theories of Marshall and Pigou (and more generally the theories developed in the last quarter of the past century), on the other, differ radically on the principle of full employment. While this is not the place to deal with the question at all exhaustively, we have to consider it because we shall find that we must confine our attention to the second group of theories alone.

Apart from Marshall's tendency to present his own doctrines as a continuation of Ricardian theory, what more specifically led Keynes to identify Ricardo's position with that of Marshall and Pigou in this respect, was a particular interpretation of the famous controversy between Ricardo and Malthus on the possibility of a 'general glut of commodities'. On closer examination, this interpretation appears to have been seriously misleading.

Malthus held that an accumulation of capital at the expense of 'unproductive consumption' (the consumption of classes other than the workers) would cause a rapid fall of the rate of profit and would thus eliminate the incentive to further accumulation. This fall would result from the decrease in prices due to the difficulty of finding outlets for the increased production. In Malthus's words:

> under a rapid accumulation of capital . . . the demand, compared with the supply of material products, would prematurely fail, and the motive to further accumulation be checked, . . . It follows that . . . it is necessary that a country with great powers of production should possess a body of consumers who are not themselves engaged in production (Malthus, 1958, p. 398).

Ricardo, for his part, rejected the idea that accumulation would be limited by a lack of outlets for the increasing output, asserting that 'demand is only limited by production' (Ricardo, 1951A, p. 290).

The question under discussion between Malthus and Ricardo thus exhibits undoubted similarities with that which was under discussion, more than a century later, between Keynes and Pigou. These similarities may be expressed by saying that Malthus, like Keynes (and numerous authors who were Malthus's contemporaries or predecessors), recognised the possibility that demand could set a limit to aggregate production, whereas Ricardo, like the 'orthodox' contemporaries of Keynes, denied that possibility. But it would be an error to move from acknowledging a similarity in the *question* under discussion to asserting a similarity in the *analysis* of that question. In particular, it would be an error to attribute to Malthus and Ricardo something akin to the theoretical

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core of the controversy between Keynes and the orthodox economists, i.e. the question whether the rate of interest can ensure that decisions to invest will adjust to decisions to save.†

The most evident deficiency of such an attribution is that both Malthus and Ricardo always identified decisions to save with decisions to invest:‡ there could therefore be no disagreement between them concerning the existence of factors capable of equilibrating decisions to invest and decisions to save. In Ricardo and Malthus, as in Smith before them, the question of a possible divergence between the two magnitudes had not been posed. They took it as a *fact* that anyone who had saved would have used his savings to employ productive labourers, or would have lent it to others who would have so used it.§

When we consider the position of the classical economists in this light, it should not come as a surprise that we cannot find in Ricardo the idea that the rate of interest would be the 'balancing factor which brings the demand for saving in the shape of new investment . . . into equality with the supply of saving' (Keynes, 1936, p. 165), which Keynes attributed to the 'classical school'. The rate of interest appears in Ricardo only as a phenomenon subordinate to the rate of profits and governed by the latter. No particular role is attributed to it, apart from that of distributing profits between those who lend money and those who bear the 'risk and trouble' of employing capital in production (see, for example, Ricardo, 1951A, pp. 296–298 and 363–364).

It seems that a more correct interpretation of the controversy between Ricardo and Malthus should begin by recognising that the question under discussion concerned the circumstances determining the rate of profits. Ricardo's theory of profits was being advanced against the vaguer dominant theory, which had its origins in Adam Smith and which Malthus adopted with some particular emphasis. Smith had asserted:

> When the stocks of many rich merchants are turned into the same trade, their mutual competition naturally tends to lower its profit; and when there is a like increase of stock in all the different trades carried on in the same society, the same competition must produce the same effect in them all (Smith, 1904, p. 89; cf. also pp. 352–353).

thus seeming to suppose that the limit which the market poses to the expansion of output in a single industry also exists for the expansion of aggregate output. It was from this theory of Smith that Malthus started in his defence, against Ricardo, of 'unproductive' consumption which, he argued, was essential in order to give a profitable outlet to production. In his words, unproductive consumption constituted 'a means to increase

† Keynes advanced this interpretation in his essay on Malthus written in 1933: see in particular the phrases 'Malthus's complete comprehension of the effects of excess saving on output' (Keynes, 1951, p. 118); or 'The whole problem of the balance between Saving and Investment had been posed in the Preface [to the *Principles* of Malthus]' (p. 122). This interpretation is again taken up in the *General Theory*, where Ricardo is considered as the originator of the 'classical theory' and, in particular, of the 'classical theory of interest' (Keynes, 1936, ch. XIV, especially pp. 190–192). This interpretation, which remains flexible in Keynes, becomes more rigid in some Keynesian literature (cf., e.g., Klein, 1950, pp. 125–130).

‡ See, e.g., Malthus's acceptance of Ricardo's assertion that an increase of £10,000 in the income of an individual would bring about an increase in the demand for commodities of the same value, whether this increase were saved or consumed (Malthus, 1958, pp. 322–323). The fact that Malthus, like the other classical economists, tended to identify savings and investment, has been noted by R. L. Meek (1950–51, p. 156, n. *ii*); L. Robbins (1958, p. 248) and J. A. Schumpeter (1954, p. 641), and has been used by B. A. Corry (1959) for a more general criticism of the prevailing idea that Malthus was a precursor of Keynes.

§ Nor can we find in these authors an analysis of the possible changes in the intervals of time elapsing between the acts of purchase and sale; an analysis which would have led, by another route, to the admission of a possible divergence between planned savings and investment as they are defined today. A few decades after Ricardo's *Principles*, this kind of analysis brought Marx to reject 'Say's law' and the Ricardian position on the subject (cf., e.g., Marx, 1969, pp. 493–499).

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the exchange value of the entire product' and hence the rate of profits (Malthus, 1958, p. 398).

Ricardo opposed these views on profits (see Sraffa's introduction to Ricardo, 1951A; pp. *xxxi–xxxiii*). Arguing from the premise that, in the long run, the wage would be determined by the level of subsistence, he drew the logically consistent conclusion that the rate of profits could fall in the process of accumulation only as a result of the diminished productivity of the labour employed, on progressively less fertile lands, to produce the subsistence of an increasing population (Ricardo, 1951A, p. 292). No room was left for any permanent influence of demand on profits. Smith's argument concerning the influence of 'competition' on the rate of profits, on the other hand, consisted simply of an illegitimate extension, to an increase of aggregate output, of a proposition applicable to an increase in the output of a particular commodity. In the case of a single commodity, a part of the income generated by the additional production will be used for buying other commodities and will therefore not be available for absorbing the increased output of the commodity at an unchanged price. But this is clearly not so when a simultaneous expansion of all outputs occurs in the appropriate proportions. Since Malthus appears to have failed to add anything clear and consistent to Smith's argument†, their ideas on profits must have appeared to Ricardo to be the result of overlooking the necessary connection between production and income. Since Ricardo identified decisions to save with decisions to invest, to recognise the connection between production and income was the same as admitting Say's principle, that 'demand is only limited by production'.‡

It therefore seems possible to conclude that in Ricardo 'Say's law' was not the result of an analysis of the investment–saving process but rather the result of the *lack* of any such analysis.

It would perhaps be possible to go further and assert that, in this respect, Ricardo's theory of distribution is *open*, in the sense that it *neither* provides premises capable of justifying the tendency of investment to adjust to saving, *nor* depends on the existence of such a tendency.§ This 'open' character sharply distinguishes the Ricardian theory from the subsequent marginalist theories, which saw distribution as the result of forces of demand for and supply of 'factors of production'. As we shall argue presently, these theories provide the premises from which the role of the rate of interest as the equilibrator of decisions to invest and decisions to save was originally derived. At the same time, by determining distribution in terms of the equality between demand for and

† In Malthus's *Principles* (1st ed., 1820) it is stated that the productivity of labour on the least fertile land under cultivation does not determine the rate of profits, but only establishes a maximum above which profits cannot rise. Below this limit profits would be determined by the circumstances to which Malthus variously refers as 'principles of competition', 'principles of demand and supply', 'demand' sometimes specified by the adjectives 'effectual' or 'effective', etc. (Malthus, 1958, ch. V). Malthus expressly refers to Smith for his ideas on the subject: 'We can know little of the laws which determine profits, unless, . . . [we] have recourse to that very principle of competition brought forward by Adam Smith, which Mr Ricardo expressly rejects . . .' (Ricardo, 1951B, p. 269).

‡ The question is dealt with in ch. XXI of the *Principles*, in the form of a criticism of Smith's theory (cf. in particular pp. 289–296). Also in the 3rd edition of the *Principles* (1821), published after Malthus's *Principles*, Ricardo does not explicitly refer to Malthus's ideas on the subject. He seems to have thought that the criticism of Smith in ch. XXI was sufficient. In his letters to Malthus and in his *Notes on Malthus* (1820), his arguments keep close to those of ch. XXI, except when Malthus's ambiguities lead him to believe that Malthus's statements might coincide with his own (cf. Ricardo, 1951B, n. 201, p. 311).

§ Thus Marx had no difficulty in rejecting 'Say's law' while sharing the basic elements of Ricardo's theory of value and distribution (cf. n. §, p. 339 above). The Ricardian theory of distribution, while it excludes the possibility of permanent effects of aggregate demand on the rate of profits, is not incompatible with effects of that demand on aggregate output or the speed of accumulation.

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supply of factors of production, these theories depend for their validity on the absence of any long-run limits to aggregate production stemming from demand.

The absence from Ricardo's work of the notion of demands for the factors, elastic with respect to their prices, deserves to be stressed here, because it makes clear how little Keynes's 'Classical school' has in common with Ricardo. We have seen that the 'Classical' proposition criticised by Keynes concerned the existence of forces leading to the full employment of labour. But 'Say's law' did not lead Ricardo to any such proposition; it only led him to deny that demand could prevent the system from achieving that level of employment which was compatible with past accumulation, whether this level allowed for the employment of the entire labour force or only a part of it. Thus Ricardo admitted the possibility of the unemployment of labour and thought that it could only be eliminated by further accumulation of capital, or by a decrease in the population. Lower wage rates could therefore reduce unemployment only through higher profits and faster accumulation, or through a slower increase of population—and not, as marginalist theories were later to maintain, by causing such changes in the methods of production, or in the relative outputs of consumption goods, as would permit the employment of the entire labour force with an unchanged 'quantity of capital'.†

3. The marginalist theories

The search for premises capable of supporting the principle of a tendency to full utilisation of productive capacity must therefore turn to the theories developed in the final quarter of the last century around the twin concepts of marginal utility and marginal productivity. These theories determine the relative prices of commodities and the distribution of the social product by means of three groups of data: (a) consumers' preferences; (b) technical conditions of production; (c) the quantities of 'factors of production' available in the community. In equilibrium the relative prices of the commodities and of the services of factors of production would be such that the quantities of commodities demanded would be equal to the quantities produced and, at the same time, the quantities of factors' services required in production would be equal to the respective quantities supplied.‡ It is in *this* equality between demand for and supply of factors' services—and not in Ricardo's theory—that we find Keynes's 'classical' principle of the tendency to 'full employment' of labour and other factors.

The premises from which the marginalist authors derived—or, in Keynes's opinion, believed they could derive—the principle of a tendency to the full employment of factors are well known. They can be traced back to a particular conception of the social process of production. In this conception the elements required for production

† Of the numerous relevant passages of the *Principles*, the following, which summarises the conclusion of his famous ch. XXXI 'On Machinery', may suffice here: 'the discovery and use of machinery may be attended with a diminution of gross produce; and whenever that is the case, it will be injurious to the labouring class, as some of their number will be thrown out of employment, and population will become redundant, compared with the funds which are to employ it' and, a few lines above, 'But with every *increase* of capital he would employ more labourers; and, therefore, a portion of the people thrown out of work in the first instance, would be subsequently employed' (Ricardo, 1951A, p. 390; our italics). An interesting expression of the contrast between the Ricardian and the marginalist theories on the employment of labour is provided by Wicksell's criticism of Ricardo's thesis on the effects of the introduction of machinery. Wicksell argues that production will not decrease because 'as soon as a number of labourers have been made superfluous by these changes, and wages have accordingly fallen, then, as Ricardo failed to see, [other] methods of production . . . will become more profitable . . . and absorb the surplus of idle labourers' (Wicksell, 1934, p. 137).

‡ This is true under the assumption that the factor is scarce, i.e. that the quantity available does not exceed the quantity which entrepreneurs would demand at a price of zero.

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are treated as 'factors of production' which can be employed in the economic system in proportions which vary as the relative prices of their services vary. This is, in turn, the result of two characteristics of the economic system as envisaged in the marginalist theories. On the one hand, we have the 'substitutability' in consumption between goods which will generally require different proportions of the factors for their production. On the other hand we have, for any given level of technical knowledge, the possibility of producing any commodity with different proportions of the same factors; under the assumption of continuous variability of factor proportions, this leads to the well known conditions of profit maximisation in terms of the 'marginal products' of the factors. By either route we arrive at an inverse relation between the price of the service of the factor and the quantity in which the factor would be employed in equilibrium, given the quantities employed of the other factors†.

The way is then open for a second proposition according to which competition among the owners of a factor will modify the price of its service until the entire supply will be employed. With this second proposition, the inverse relation between the employment of a factor and the price of its service can be legitimately envisaged as a 'demand function' which, in conjunction with a 'supply function' of the same service, will give rise to the competitive tendency to an 'equilibrium' between such demand and supply.

The reasoning leading to a negatively elastic demand for the factor was conducted on the assumption that the quantity employed of the other factors remained constant, or more generally, remained equal to their supply (assumed not to fall drastically as their remuneration rises). But this assumption can now be seen to have been justified, for the same process which is at work in the market for the variable factor, assuming an equality between the quantity demanded and supplied of the other factors, will be at work in the market for the latter factors and will secure that very equality.

These, in summary, were the forces which would lead the economic system towards the full employment of all factors. Thus Pigou in his *Theory of Unemployment*, to which Keynes would later refer as his primary example of the 'classical' analysis, stated, not without reference to the unemployment afflicting England in the period between the wars, that

> With perfectly free competition among work people and labour perfectly mobile ... there will always be at work a strong tendency for wage rates to be so related to demand that everybody is employed (Pigou, 1933, p. 252).

The basis of this statement was fundamentally an application to labour, and to short-period conditions, of the basic argument that the quantities demanded and supplied of the factors would tend to equality by means of changes in the relative prices of their services.

4. Savings, investment and the marginalist theory of interest

But were the above premises regarding the productive process in fact adequate for the derivation of a tendency of the economic system to the full employment of labour and of the other productive resources? As is well known, Keynes denied this.

† The changes in the distribution of the social product which correspond to changes of the relative prices of productive services may themselves influence the quantities of the services demanded. Thus, a preference by workers for labour-intensive goods would tend to decrease the quantity of labour demanded as the wage decreases, and would therefore act in a direction contrary to the 'substitution effect' considered in the text. We have, however, ignored, here and elsewhere in the text, the circumstances which may cause an instability of the (non-monetary) equilibrium of exchange and production: we have therefore supposed that, as is usually assumed, such causes of instability do not generally raise serious difficulties in factor markets (cf. Hicks, 1946, p. 104).

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In the *General Theory* he starts from an examination of the idea that changes in the wage rate would lead to full employment and he distinguishes two 'postulates'. He accepts the first, according to which the wage must be equal to the marginal product of labour, *given the level of employment.* In doing so, he accepts the conception of the productive process found in traditional theory. However, he rejects the second 'postulate', which states that 'the utility of the wage when a given volume of labour is employed is equal to the marginal disutility of that amount of employment' (Keynes, 1936, p. 5). Market forces, that is, would not succeed in equalising the quantity demanded and supplied of labour.

The argument which Keynes uses to deny that the flexibility of the wage would lead to the full employment of labour is founded on the premise that market forces cannot ensure that investment will adjust to savings. Given that premise, one must conclude that decreases in the money wage rate—the only wage rate on which the competition of unemployed workers can act directly—cannot ensure a tendency to the full employment of labour. In fact, if entrepreneurs reacted to the decrease in wages by increasing employment, the level of real national income would rise and savings would then exceed investment.† Since the latter would not adjust to the former, aggregate demand would be insufficient to absorb the increased production at its 'supply price' and output would be decreased. Indeed, if the fall of money wages should leave the level of investment unaffected, the employment of labour would have to return to its previous level, the only one at which saving is in equilibrium with investment. The only effect of the fall of the money wage would be a proportionate fall of the price level, leaving both the real wage and the amount of employment unchanged.

A detailed consideration of Keynes's position on the effects of a fall in wages must be postponed until Part II of these Notes. We have referred to the problem here only in order to bring to light the conclusion that the marginalist notion of a demand for labour elastic with respect to the real wage rate does not suffice to support the conclusion that competition among workers will lead to full employment. The *further* condition that investment adjusts to the changes in savings consequent on changes in employment is also required.

This second condition, concerning the dependence of investment on saving, is that which was referred to above when we discussed Ricardo and Malthus. The marginalist context is, however, very different from that of those authors. The identification of decisions to save with decisions to invest, which explained Ricardo's acceptance of 'Say's law', is not to be found here. Instead we find the theory that the rate of interest is 'the factor which brings the demand for investment and the willingness to save into equilibrium with one another'.

Keynes's tendency in the *General Theory* was to consider this theory of interest as a further, unwarranted hypothesis that marginalist authors had introduced alongside the valid hypothesis concerning the variability of the proportions of factors of production in the productive process. It appears, however, that the theory of interest is in fact strictly dependent on those marginalist hypotheses.

† The concepts of national income, investment and saving used in the text are the generally accepted ones of gross national income, investment and saving. With regard to the well known ambiguity implicit in the use of the terms 'investment' and 'saving', it is sufficient to recall here that, while *realised* investment and saving are equal by definition, investment and saving may differ when we consider the quantities that would result from individual decisions *under hypothetical circumstances*, e.g. the amount of saving at a given level of real income, distributed in a *given* way, with a *given* system of relative prices, etc. The expressions 'decisions to invest' and 'decisions to save' or, alternatively, 'planned investment' and 'planned savings', will be used in the text to indicate investment and saving in this second sense.

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In order to clarify this dependence, it is convenient to start by distinguishing two propositions in that theory of interest. The first concerns the possibility of establishing an inverse relation between the volume of planned investment and the rate of interest. The second proposition concerns the possibility of supposing that the interest rate is sufficiently sensitive to divergences between investment decisions and full employment saving to ensure its equilibrating role.

It is to the first of these two propositions that we must now turn our attention. The proposition is essential to the traditional theory, particularly when we admit, as is generally done, that, given the level of real national income, the dependence of decisions to save on the rate of interest is uncertain in both direction and intensity. If we could not suppose that—on average and under normal conditions—a decrease in the rate of interest would bring about an increase in the volume of investment, we could not suppose that there would be a rate of interest at which planned investment would be equal to full employment saving. No ground would then be left for the second proposition above (on which Keynes was to focus his criticism), concerning the tendency of the rate of interest toward such an 'equilibrium level'.

It is in this relationship between the rate of interest and planned investment that the dependence of the traditional theory of interest on marginalist premises is most clearly manifest. To understand this dependence it will first be necessary to consider why, and in what way, marginalist theorists have to introduce a special 'factor of production' —capital—conceived as the value of the capital goods used in production.

5. Capital as a factor of production and the demand function for investible resources

We have seen how the marginalist theory of distribution hinges on the notion of factors of production which may be employed in variable proportions in the economic system. Capital goods have to find a place among these factors. However the application to capital goods of the notion of a factor, or factors, of production raises special problems. Capital goods, like other produced goods, have values which tend to equality with their supply prices. But free competition entails that the share of national income attributed to the owners of such goods, over and above what is necessary for their replacement, tends to be distributed in proportion to the value of those goods, so as to give rise to a uniform rate of return on all kinds of capital goods. If we consider this uniform rate of return from the viewpoint of these theories, in which each rate of remuneration is the price of the service of a factor of production, the various capital goods will *ultimately* have to appear as quantities, measured by their values, of a single factor of production, 'capital'. The net rate of return on capital goods, or rate of interest on 'capital', will then have to be determined by *ultimately* referring, in the forms considered below, to the conditions of demand and supply of this special factor.

We have so far identified a factor of production, 'capital', conceived as an amount of value which may assume the form of the specific capital goods appropriate to the situations considered. But, as an amount of value, 'capital' is not defined until we have specified the standard in which that value is to be measured.† Beneath the variety and,

† In the case of factors of production which can be measured in physical terms, the choice of the unit of measurement is unimportant because a change of unit only implies multiplying the quantities by a *constant*. However, this is no longer true in the case of capital and other value magnitudes since the relative values of the commodities constituting alternative standards of value will themselves be different in different situations (e.g. in the situations to which the different points of the demand function for a factor of production refer).

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at times, the vagueness of the indications given in this respect by the marginalist theorists, there lies a common idea. The capital goods, and hence the quantity of capital they represent, result from investment; since investment is seen as the demand for savings, 'capital' emerges as something which is homogeneous with saving. Its natural unit is therefore the same as we would use for saving, i.e. some composite unit of consumption goods capable of measuring the subjective satisfactions from which (according to these theorists) consumers abstain when they save. 'Capital' thus appears as past savings which are, so to speak, 'incorporated' in the capital goods, existing at a given instant of time. As a result of the productive consumption of those goods, these past savings will periodically re-emerge in a 'free' form and can be re-incorporated in capital goods of the same or of different kinds; alternatively, they can be turned back into consumption.

Marginalist theorists then proceeded to apply the argument described in section 3; this special factor, measured in value terms, now being included alongside the others.† In particular, they thought it possible to state that, given the quantities employed of the other factors, entrepreneurs would find it profitable to use a larger 'quantity of capital' the lower the rate of interest.

The application of this principle to the theory of distribution has taken two forms, which we shall now distinguish in order to show how either route leads to the idea of a demand function for investment elastic with respect to the rate of interest.

The first approach is that of authors like J. B. Clark, Böhm-Bawerk or Wicksell, who expressly aim at a general solution of the problem of distribution. These authors refer to an equilibrium situation in which the condition of a uniform net rate of return on the various capital goods is realised. Given this condition, it becomes impossible to take the physical capital stock, i.e. the available quantities of the various capital goods, as given.‡ The 'capital' incorporated in such goods, i.e. their value, has instead to be taken as given. Capital is thus allowed to change its 'form'—though not its quantity—in order to acquire the physical composition compatible with equilibrium conditions. The theory of distribution then follows along the lines already indicated in section 3. It may be described in terms of the forces envisaged to be at work in the capital market. We shall have a *total* demand for capital, i.e. for capital *as a stock*, as distinguished from the demand for investment, i.e. for capital *as a flow*. This 'total' demand function gives the quantity of capital which the system would employ at the various rates of interest, assuming that the markets for products and for the other factors are all in the

† Some marginalist theorists, such as J. B. Clark and, ultimately, also Marshall and his school, seem to have thought that the case in which a factor of production, 'capital', is conceived as an amount of value, could be treated similarly to that in which all factors are measurable in physical terms. A more interesting, indirect procedure was that adopted by theorists such as Böhm-Bawerk and Wicksell, who conceived of capital as a 'subsistence fund', used in order to 'advance' the remuneration to the 'original' factors of production (land and labour) during the time elapsing before completion of the consumption goods produced by them. In any given instant, this 'fund' would be 'embodied' in the capital goods, and it would be measured by their value in terms of consumption goods. As the rate of interest decreased (the wage increased), the 'time structure' of production was supposed to change so as to require a larger 'subsistence fund' in order to employ the same quantities of the 'original factors'. (Cf. the following footnote for Walras's still different approach.)

‡ A demonstration of the inconsistency between a uniform rate of return on the supply price of capital goods and the treatment of the quantities of the various kinds of capital goods as data has been given by the present author (Garegnani, 1960, Part II, chs. II, III and Appendix G). The problem is there considered as a criticism of Walras's theory of distribution which suffers from this very inconsistency.

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equilibrium corresponding to the rate of interest.† Given the amount of capital available, the rate of interest will be determined together with the rest of the system (cf. Clark, 1907, ch. 9; Böhm-Bawerk, 1930; Wicksell, 1934).

We thus find a demand function for capital elastic with respect to the rate of interest, but we do not immediately find a demand function for *investment* elastic with respect to the rate of interest. The latter is, however, implied by the former or, more exactly, the former represents, in the form of a demand for a stock, a time sequence of demands for investment through which alone that stock-demand can be manifested and can determine the rate of interest. In any given instant the available 'capital' will not in fact be a 'fluid' which may quickly assume a form compatible with the conditions corresponding to any point of the demand function for capital. On the contrary, in any given instant 'capital' is incorporated in a given set of capital goods and it can only assume the appropriate physical form *over a period of time* during which most of the capital goods in existence are consumed and the available capital becomes 'free' to be reinvested in capital goods suitable for use with other techniques or in other productive sectors.

This relation between demand for capital as a stock and demand for investment can be seen in its most simple form if it is assumed that, in each industry, production takes place in an annual cycle and all capital is circulating capital (i.e. is entirely used up in the course of one year). If the wage rate and product prices are assumed to adapt without appreciable delay to the equilibrium compatible with the new rate of interest, the investment demand function at the end of each year will be nothing other than the demand function for capital as a stock. When there is fixed capital the analogous relation between demand for investment and demand for capital as a stock will be less simple but no less strict (see Appendix below).

The theory implies that such circumstances as delayed adjustments in the markets for labour and products, or irregularity in the age distribution of fixed capital, do not fundamentally alter the terms of the question. As a result, the interest elasticity of the sequence of demands for investment would reflect, on average, the elasticity of the demand for capital as a stock. Hence the significance of a demand for capital as a stock which exhibits, in a clear form, the basic tendencies which must emerge from the multiplicity of forces acting in any given moment of time.

By contrast, this multiplicity of forces is precisely what the second way of approaching the variability of the proportions between 'capital' and labour (and other factors) may

† Under more general assumptions, the 'demand function' for capital described in the text would result from the following procedure. We take as *data*: (a) the preferences of the consumers; (b) the techniques of production; (c) the available quantities of all factors except capital; (d) the criteria determining the distribution of ownership of capital goods (the quantities of which are among the unknowns of the equations) among the individuals; (e) the criteria determining the age distribution of fixed capital. For any level of the rate of interest—*the independent variable* in this system—the equations concerning the conditions of equilibrium in the markets for the products and for the factors *other than* capital will determine, in addition to the usual unknowns of a general equilibrium system, the physical quantities of the capital goods of the different kinds in use in the assumed equilibrium position. The prices of these capital goods being also determined by the equations, the quantity of capital employed in equilibrium for the given rate of interest can easily be obtained. By repeating this procedure for other rates of interest, we obtain the corresponding points of the demand function for capital. In short, we subtract from the usual equations of general equilibrium the one requiring equality between the quantity of capital employed and the quantity available; the degree of freedom which the system acquires permits the definition of the relationship between the quantity of capital employed and the rate of interest.

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seem to be dealing with. This second approach is that of Marshall and the tradition which he originated; it underlies both the controversy between Pigou and Keynes and the subsequent related literature. It is presented, less ambitiously, as a theory of the 'short period' and at times it seems that Marshall declines to claim it as a theory of distribution at all.† Unlike the version of Clark and Böhm-Bawerk, it appears to renounce the attempt to determine an equilibrium situation characterised by a uniform rate of return on the supply prices of the capital goods. It can thus avoid referring to the 'quantity of capital' available in the community as a given magnitude. Instead, it takes as given the productive equipment existing in the various industries, on which a 'quasi rent' is obtained, depending on the level of the wage and the demand for the products. The real wage, on the other hand, is determined by the relation between the supply of and the demand for labour, the latter depending on the available productive equipment. The rate of interest results, finally, from the equilibrium between the current demand for investible resources and the current supply of savings. It is here, in the analysis of the investment–savings market, that the notion of capital as an amount of value appears in this group of theories (cf. the distinction between 'quasi rent on an old investment of capital' and 'interest on free capital', Marshall, 1920, V, IX, 3; also VI, II, 4; VI, VI, 6).

Indeed, if we were to take literally the claims of these theories, and to confine ourselves to considering the capital goods as physically specified elements of a given productive equipment (modifiable only by means of current investment), it would be difficult to see how we could ever provide any theoretical basis for the notion, plausible as it may seem, of a demand function for investment elastic with respect to the rate of interest. We should be moving on the dubious ground of wages and prices determined according to a short-period analysis of the economy as a whole (for a critique of this particular group of theories, see Kaldor, 1955–56, pp. 90–91). In the course of such an analysis we would be faced by a multiplicity of factors, each of which may influence the demand for investment. We should thus have to take account of the disproportions between available equipment and the level of demand for products in each industry; the age structure of existing equipment and the connected irregular replacement requirements, etc. Above all, the hypothesis of a given productive equipment, whose physical composition in each industry, and distribution among industries, has not adapted to the state of demand for products, would force us to attribute a decisive role to the expectations which the entrepreneurs entertain about future changes in relative prices, demands for products, wage rates and the general level of prices. The attempt to determine the effects on investment of changes in the rate of interest on such indefinite grounds would seem liable to dissolve into casuistry concerning the influence of these changes on the expectations of entrepreneurs. And this influence would differ from situation to situation, thus making impossible any general and unambiguous conclusions concerning direction and intensity of the effects of interest on investment. Moreover, consideration of the influence of the rate of interest on the decisions of entrepreneurs regarding the techniques to be adopted for the new plant, and the

† In a well known passage coming after he has given an example to demonstrate why entrepreneurs will invest up to the point where the 'marginal product' of capital is equal to the rate of interest, Marshall says, 'But illustrations of this kind ... cannot be made into a theory of interest, any more than into a theory of wages, without reasoning in a circle' (Marshall, 1920, VI, I, 8).

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product to be obtained from it,† would not permit any conclusion to be drawn concerning the *amount* of investment involved, if the comparison between techniques and lines of production were conducted in terms of equipments defined in *physical* and not in *value* terms.

It is therefore evident that this cannot in fact be the basis on which the theories here described assert that 'the demand for the loan of capital ... obeys a law similar to that which holds for the sale of commodities ... When the price rises the amount that can be sold diminishes' (Marshall, 1820, VI, I, 8). It must then be supposed implicitly that the circumstances characteristic of the short period (the disproportions in the physical composition of the available equipment, and the influence of expectations) are classified with those to which Marshall referred as 'passing events ... and causes whose action is fitful and short lived', so that over a sufficiently long period of time they 'efface one another's influence' and allow the 'persistent causes' to emerge. And these 'persistent causes', to which we are thus referred as the basis for an investment demand elastic with respect to the rate of interest, are ultimately the same as those analysed by the first group of theories: i.e. the substitution between factors (through both alternative techniques of production and consumers' choices) as a result of which a fall in the rate of interest would lead to an equilibrium position such that the proportion in which 'capital' (the value magnitude) is combined with other factors is larger (Marshall, 1920, V, III, 7). The different starting point—i.e. the physically specified equipment—and the apparent realism of the second group of theories appears to have obscured but not altered the basis on which the supposed inverse relation between investment and interest, essential for both groups of theories, must rest in the last analysis.

6. The premises of marginalist theory and the tendency to the full utilisation of productive resources

Our search for the premises of the traditional thesis that aggregate demand tends to adjust to the level of production thus seems to lead us to the marginalist conception of the process of production. This conception has, in effect, provided the theoretical basis for an inverse relation between the amount of investment and the rate of interest and hence for the first of the two propositions which we distinguished above (p. 344) in the traditional theory of interest.

That relation once admitted, the marginalist approach to the theory of distribution led naturally to the second step: to suppose a sensitivity of the rate of interest to a divergence between planned investment and planned savings sufficient to tend to eliminate that divergence. This step was in fact taken when the rate of interest was

† Numerous difficulties would be encountered in specifying this influence of the rate of interest. They would result from the short-period assumptions and the consequent indefiniteness of the effects which the rate of interest will have on real wages and the system of relative prices. On the other hand, with real wages and relative prices expected to remain constant, there is no reason why, assuming perfect competition and a fall in the rate of interest, the tendency to profit maximisation should lead entrepreneurs to change the techniques of production, rather than simply to expand the scale of production to profit from the gap between the rate of profits and the rate of interest. Under the assumptions of the theory, in fact, the individual producer always has the possibility of acquiring additional quantities of labour; the limit set by the available labour force can only influence the entrepreneur's decisions through increases in wages. More generally, investment decisions taken by the entrepreneurs in the expectation that the ruling rate of wages and the relative prices will remain unchanged could hardly be realised, since they would have to be revised as soon as the effects of the change in the rate of interest on prices and wages became perceptible.

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considered (sometimes more explicitly, sometimes less so) as the price for the service of 'capital', determined by the conditions of demand for and supply of that factor, simultaneously with the prices for the use of the other factors.†

Since the *General Theory*, it has been widely recognised that this second step hid serious and perhaps decisive difficulties for the traditional theory of distribution. As Keynes showed, money in its role as a store of value may deprive the rate of interest of a sensitivity sufficient to adjust decisions to invest to decisions to save. A more powerful equilibrator between the two kinds of decisions can then act: variations in the level of employment of labour. And the controversy concerning the validity of the traditional thesis of the tendency to full employment has in fact been centred principally on problems related to the sensitivity of the rate of interest.

The basic idea of a demand function for investible resources has not been questioned, however. Nor is it surprising that criticism of the full employment thesis took this particular course. When, in the period between the two wars, the contrast between this thesis and the fact of large unemployment in the chief capitalist economies was particularly acute, criticism of the received theory naturally turned to the more empirical and less thoroughly explored monetary side of the theory, rather than to premises of pure theory which had by then acquired unchallenged acceptance. But the question we must now ask ourselves is whether those premises were in fact as solid as Keynes himself seems to have supposed. As we shall see in the next section, this question cannot be answered affirmatively.

It thus becomes possible, and necessary, to criticise the traditional view that interest is the equilibrator between saving and investment, while remaining within the confines of that analysis of 'real forces' in which this view was supposed to have its basis. The remainder of Part I of these Notes will be devoted to this question. The other criticism which Keynes conducted in terms of a monetary economy, and the controversy which ensued from it, will then be discussed in Part II. We shall there see how the uncertainty of the conclusions of that controversy with respect to long-period tendencies will lead us back to the questions of 'real theory' discussed in Part I.

7. The validity of the marginalist postulates and the theory of interest

We have seen in section 5 how the competitive tendency to a uniform rate of profits ultimately brings the marginalist theorists to the notion of a factor of production, 'capital', measured in value terms; we also saw how the corresponding demand function finds concrete expression in a demand function for investible resources, elastic with respect to the rate of interest. What we must now discuss is the validity of these notions.

The difficulties arise from the fact that the introduction of the factor 'capital' is incompatible with the logical basis on which the marginalist schema of factors of production rests. The principle that the proportions in which the factors are employed vary with the prices of their services, so as to give rise to demand functions of these services, can in fact be deduced from the conditions of equilibrium in production only if the quantities of the factors can all be defined independently of the system of prices.

† We may note, in this connection, the contrast which Keynes pointed out in these economists, between the general acceptance of the notion that the rate of interest is 'the factor which brings the demand for investment and the willingness to save into equilibrium with one another' and the difficulty of finding a treatment or even an explicit statement of the notion (cf. Keynes, 1936, pp. 175f). These authors rarely conducted a detailed analysis of the process by which savings are turned into increments of the capital stock; they derived their position on the question largely from the idea that the prices of the productive services are determined by the equilibrium between the respective quantities demanded and supplied (cf., e.g., Marshall, 1920, VI, II, 4).

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But this *cannot* be done when one of the factors is the value of the magnitude 'capital'. As the rate of interest and the wage rate vary, the switch of techniques or the change in the relative outputs of consumption goods might well change the proportions between the two factors in a direction contrary to that asserted in marginalist theory. [See the 'Symposium' in the *Quarterly Journal of Economics*, 1966, and Garegnani, 1970 (eds).]

In fact, when we recognise the dependence of the value of capital goods on distribution, it becomes meaningless to compare the proportions of capital to labour required by different techniques, or in different lines of production, in the unqualified way characteristic of traditional theory, and the same applies for any comparison of the proportions in which the two factors are used in the economy at different rates of interest and wages. With respect to the first type of comparison, the *order* in which the techniques for the production of a commodity are placed with reference to their proportions of capital to labour will depend on the system of relative prices, and thus on the rate of interest or wages at which the comparison is made. As for comparisons between ratios of capital to labour in the economy, the very direction in which this ratio will change with distribution will depend on the commodity in terms of which the value of the capital goods is measured. (The assumed change in the rate of interest may indeed change the relative value of two alternative standards of value in such a way that, when using one standard we have an *increase* in the ratio of capital to labour, whereas the use of the other standard will give a *decrease* in that ratio.)

If the marginalist principle concerning the way in which the proportions of factors change with distribution is incorrect, we may ask what theoretical basis, if any, remains for the notion of demand functions for factors. In section 3 we examined the relation between the price of the service of a factor and the quantity of it employed with a constant quantity of the other factor. We then considered how the *negative slope* of that function, and the analogous form of the corresponding relation for the other factor, allowed these relations to be viewed as 'demand functions' capable of determining, in conjunction with the 'supply functions' of the factors, the prices of their services. Let us now follow the same line of argument, assuming that the two factors are 'capital' and labour.

Consider first the relation between the rate of interest and the value of the capital goods in use, assuming a constant quantity of labour employed and equilibrium in the markets for the products.† The value of the capital goods employed will vary with the rate of interest for two different reasons, which we must now attempt to distinguish.

In the first place, we have changes in the value of the physical capital employed to which there corresponds no physical change in capital: these changes will be due purely to a change in the value of the capital goods relative to the commodity used as the standard of value.

In the second place, we have those changes in the value of physical capital to which there correspond *physical changes* in capital, which are due either to changes in the techniques adopted for producing the commodities, or to changes in the proportions in which those commodities are produced. The traditional thesis was that these changes in physical capital would ensure a *rise* in the value of the capital goods employed as the rate of interest falls, and *vice versa*. However, we now know that the analysis underlying this conclusion is invalid and that there is no reason why this second kind of change should have one sign rather than the other.

† This relationship between the value of the capital goods and the rate of interest results from the procedure indicated in n. †, p. 346 above.

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When we combine the two kinds of value changes that we have just considered separately, it seems that little or nothing of general validity can be said concerning the form of the relationship between the value of physical capital and the rate of interest. If we represent the relationship on a diagram, with the rate of interest on the vertical axis, the curve may just as well slope up to the right as down to the right, and it may alternate such slopes any number of times. Moreover, the form of the curve will depend on which commodity is used as the standard of value.

It seems, then, that even if the initial hypothesis of a constancy in the quantity of labour employed were well founded, the form which the relationship between the value of the capital goods and the rate of interest could assume would make it difficult to envisage it as a 'demand function' for capital—i.e. as the basis of a demand function for investible resources, capable of determining, together with a supply function of such resources, the rate of interest.

Yet the considerations which make this true of the relation between the rate of interest and the quantity of capital also undermine the validity of the assumption of constancy in the quantity of labour employed. As we have seen above, the traditional theory assumed a mechanism which equalised the quantity demanded and supplied of labour and thus ensured that the quantity employed would remain constant—or that it would change in accordance with the supply function of labour if this had some elasticity. But this equilibrating mechanism of demand and supply can no longer be assumed: the relationship between the real wage and the labour employed with a constant quantity of capital would show the same characteristics as the relationship between the quantity of capital and the rate of interest and hence it could not be interpreted as a demand function, any more than could the first relationship.

What we have attempted to argue here throws doubt on the entire explanation of distribution in terms of demand and supply for factors of production. It does so for reasons altogether independent of any 'Keynesian' argument regarding the obstacles which money or the state of expectations may raise to the tendency towards 'equilibrium' in the markets for labour and investment. The questions in the theory of distribution which are thus opened up are the subject of the current debate on capital, and to these questions we shall have occasion to return in our Part II. Our concern here is only that of showing the weakness of the premises underlying the notion of a demand function for investment elastic with respect to the rate of interest. Thus deprived of its theoretical foundation, that notion cannot, on the other hand, find genuine support on any purely empirical ground.†

It therefore seems possible to assert that—even if the rate of interest could be assumed to be sufficiently sensitive to divergences between planned investment and planned savings—there would not be sufficient ground for arguing that the rate of interest could ensure that decisions to invest will adapt to decisions to save: nor would there be sufficient ground for arguing that aggregate demand will adapt to the level of production compatible with the full employment of the productive resources available in

† The changes in the rate of interest discussed here would imply changes in most of the variables of the system (the relative prices of the products, the levels of output, the labour employed, etc.), each of which may in turn react on the level of investment. It would therefore seem that the question of the influence of interest on investment can only be meaningfully discussed within a theoretical scheme which accounts for the relations between these variables. It seems unlikely that all these interrelationships could be accounted for in an empirical study. As it happens, the results of the numerous empirical investigations concerning the *direct* influence of the rate of interest on entrepreneurs' decisions to invest are known to be negative (cf. Andrews, 1938; Sayers, 1940; Ebersole, 1938–39; Brockie and Grey, 1956).

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the economy. We shall return to these considerations in Part II, after discussing the criticism of the traditional principle of a tendency to the full employment of labour, which Keynes raised on the different ground of monetary analysis.

Appendix

This appendix deals with the relationship between the demand for capital as a stock and the demand for investment in the case of fixed capital.

Suppose, for example, that all capital goods last for 10 years, being of constant efficiency throughout their lives and that the initial capital stock is of a uniform age structure. Each year 1/10 of the initially existing set of capital goods will be used up, 'freeing' 1/10 of the workers employed in the economy. Each year, therefore, 1/10 of the initial physical capital can be replaced in the most appropriate form, and in 10 years the replacement cycle will be completed. If the initial prices were equilibrium prices and if conditions remain unchanged, the entrepreneurs will demand each year capital goods identical to those which have been used up during the year. At the interest rate prevailing in the initial situation, there will thus be an annual demand for investment equal in value to a given fraction (lying between 1/10 and 1/5 and depending on the interest rate) of the value shown by the demand for capital function at that interest rate. If the supply of gross savings is equal to that value of investment, the equilibrium will be maintained. Suppose now that—the supplies of the other factors, technical conditions and consumers' tastes all being unchanged—the rate of interest falls and the wage rate and product prices adapt without appreciable delay to the equilibrium compatible with the new rate of interest. The entrepreneurs will then have an incentive to employ the 1/10 of the workers ('freed' each year by the using up of the physical capital) with the techniques and in the industries which are most profitable at the new rate of interest;† they will thus demand each year capital goods with a value equal to a given fraction, slightly greater than the previous fraction,‡ of the value shown by the demand for capital function at the new rate of interest. Because of the form which the theory attributes to that function, the demand for investment will thus be greater than it was at the previous level of the rate of interest and will be able to absorb a greater volume of savings. By considering other possible levels of the rate of interest, one could thus define an investment demand schedule. It would no longer be identical to the demand curve for capital as it was in the case of circulating capital; it would nevertheless be a scale copy of it—but for the effect of the rate of interest on the fraction of the value of the total stock which is represented by the value of the yearly replacement—and would indeed reproduce its fundamental property of elasticity with respect to the rate of interest.

† It is assumed here that the increase of wages and the changes in the prices of the products consequent on the decrease in the rate of interest are not so drastic as to drive the gross income from the operation of the not yet fully depreciated initial physical capital to zero. The demand for investment could then no longer be a scale copy of the demand for capital, since the early scrapping of existing physical capital would presumably cause an additional demand for investment. (It should be noted that this additional investment would not result specifically from the *decrease* in the rate of interest, for additional investment due to this cause could equally well result from sufficiently drastic *increases* in the rate of interest.)

‡ At a rate of interest (profits) $r = 0$, the value of a fixed capital of constant efficiency decreases linearly (i.e. by an equal fraction in each year) during its lifetime of n years. For $r>0$, however, the same value traces a step curve which will be the more concave toward the origin the higher the level of r (see for example, Sraffa, 1960, p. 71). The area below the curve constitutes a measure of the value of a stock consisting of a multiple n of pieces of that fixed capital of uniform age distribution between 0 and $n-1$. The vertical intercept will then measure the yearly replacement which will keep the stock intact year after year. The decreasing concavity of the curve as r falls makes it evident that the ratio between the value of the replacement and that of the stock will increase, as was asserted above. (This may be checked from the algebraic value of this ratio which, for $r>0$, will be given by

$$\frac{p(1+r)^n(rn-1)+1}{r(1+r)^n-1}$$

where p is the value of the replacement and n indicates the life of the fixed capital.)

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