

## Tilburg University

### Theo van de Klundert

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*Published in:*  
De Economist

*Publication date:*  
1989

[Link to publication in Tilburg University Research Portal](#)

*Citation for published version (APA):*  
van Gemert, H. G., de Groof, R. J., Peer, H. W. G. M., & van Schaik, A. B. T. M. (1989). Theo van de Klundert: A frontier economist. *De Economist*, 137(3), 257-278.

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## THEO VAN DE KLUNDERT: A FRONTIER ECONOMIST

BY

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‘In economic theory the main issue is understanding or generalization’ - (Van de Klundert, 1982b).

### 1 INTRODUCTION

Dr. Th.C.M.J. van de Klundert has now been a Professor of Economics for 25 years. For us, all graduated as doctors of economic science under his intellectual supervision, this anniversary is a welcome opportunity to review his comprehensive work and to evaluate his specific contribution to the study of economic science in The Netherlands.

Van de Klundert was born in Herwen en Aerdt in the year of The General Theory. After secondary school in Nijmegen he studied economics in Tilburg. In 1962, supervised by D.B.J. Schouten, he took his doctors degree from the same institution, defending an excellent thesis on growth and income distribution. For a while he worked at Staatsmijnen (State Mining Corporation, nowadays DSM), but it soon became clear that other ambitions would predominate. In 1964, while staying at Stanford University, Van de Klundert, only 28 years of age, was appointed as Professor of Economics at Tilburg University.

During the period he held his chair, Van de Klundert was continuously engaged in research and teaching in macroeconomics and microeconomics. His scientific production includes six books and about 50 articles (see bibliography below).

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Apart from his publications, Van de Klundert became known for his participation in several professional organisations and for a number of other activities. Since 1967 he has been on the Board of editors of *De Economist*, since 1988 as its chairman. In 1976 he was asked to become advisor for the Central Planning Bureau in The Hague. In 1981 he became a member of the Steering Group for Public Inquiry on Energy Policy in The Netherlands.

As an economist Van de Klundert was not primarily involved in applied economics. Pure economic theory he loved most and in that field we got to know him as a scientist, always in search of more fundamental questions and more powerful methods. He has read widely and always appears well-informed about the state of affairs in economic literature.

To review Van de Klundert's work is not an easy task and the reader will not be surprised that we have to limit ourselves. In this *scriptum amicorum* four topics which have dominated his research agenda during the past 25 years will be discussed. The items selected are: (1) growth and income distribution, (2) capital theory, resource economics and trade, (3) controversies between Keynesians and neoclassicists, and (4) open economy macroeconomics. A short note will treat on Van de Klundert as a teacher.

## 2 *GROWTH AND INCOME DISTRIBUTION*

In the early 1960s, when Van de Klundert started his scientific career, the main features of postwar theory on economic growth had already been established. Growth economics was developing at a fast rate indeed. Van de Klundert kept very much in touch with what was happening at this frontier. His PhD thesis (1962) dealt with problems of income distribution in a growing economy. Price flexibility, substitution, technical progress and the role of savings were studied profoundly. Not only macroeconomic growth models but also a two-sector and a two-country-two-sector model were used as tools of analysis.

The neoclassical macroeconomic model of balanced growth along with its imputation results, was, as would be done later by many authors, praised by Van de Klundert for its beauty but at the same time criticized for oversimplifying reality and therefore being limited with respect to direct empirical applicability or usefulness. The two-sector model was used to study the problem of how to stimulate inter-sector labour mobility, whereas the two-country model was adopted to illuminate the conditions under which a rapidly growing country could take in tow a country with a

lower growth rate. Van de Klundert pointed to the fact that growth economics produces no effective instruments for controlling income distribution. In their survey of economic growth theory, Hahn and Matthews (1964) came to the same conclusion.

After finishing his PhD thesis, Van de Klundert kept an interest in growth economics. He published several studies in this field. His 1963a article is a survey, which runs roughly along the same line which Sen would pursue seven years later in his introduction to *Growth Economics* (1970). As is well known, the vast amount of literature on the subject was triggered by Harrod (1939), who posed two related but nevertheless distinguishable problems. Firstly, what are the conditions for full capital utilization in an expanding economy? Secondly, what are the conditions for growth at full employment or at a constant unemployment rate?

The latter problem quickly occupied the central place in the literature on economic growth. The fundamental condition for balanced growth can be written as:

$$\frac{\sigma}{\kappa} = \pi + \varrho + \delta$$

where  $\sigma$ ,  $\kappa$ ,  $\pi$ ,  $\varrho$  and  $\delta$  represent the savings-output ratio, the capital-output ratio, the rate of growth of the labour force, the rate of Harrod-neutral technical progress and the rate of capital obsolescence, respectively. As we know now, any of these five variables individually is, under certain (sometimes very restrictive) conditions, capable of bringing about equilibrium growth. In this 1963 survey Van de Klundert extensively explored the ability of  $\sigma$  and  $\kappa$  to restore such an equilibrium. This was done within the framework of a macroeconomic model. The first variable belongs to the realm of neo-Keynesianism, while the second variable is the *piece de résistance* of neoclassical theory. The macroeconomic savings-output ratio may depend on the distribution of income between workers and capital owners, assuming that the latter category is saving a higher proportion out of its income than the former. If the ‘warranted rate of growth’,  $\sigma/\kappa - \delta$ , exceeds the ‘natural rate of growth’,  $\pi + \varrho$ , income distribution (under certain conditions) changes in favour of labour, which lowers  $\sigma$  and therefore  $\sigma/\kappa - \delta$ . Again, if the warranted rate of growth exceeds the natural rate, labour shortage makes labour more expensive relative to capital, which induces entrepreneurs to shift to less labour-intensive techniques.

But  $\rho$  and  $\delta$  were also explicitly called to attention by Van de Klundert in the survey article under consideration. He felt that these parameters, too, could function as built-in-stabilizers, thus proving his ability to see quickly and sharply into the basic structures of complex problems. To be sure, the theory of induced technical progress was still in its infancy and the possibility that adaptation of the rate of capital obsolescence might restore equilibrium growth was not yet fully recognized.

In his PhD thesis Van de Klundert had already expressed his dissatisfaction with the assumption of exogenous technical change. Consequently, in his survey article, he showed interest in the very first steps, undertaken by Fellner, on the way to a complete theory of endogenous technical change. Later he managed to get the second author of this article to share his interest. This ultimately resulted in a PhD thesis on the subject (De Groof, 1977). Both the expected and the realised rates of change of labour costs and output proved to be possible driving forces behind labour saving technical progress. Van de Klundert contributed to a further integration of the concept of induced technical progress into macroeconomic models. He co-authored two papers (1977, 1978a), in which the macroeconomic consequences of induced technical progress were studied. The 1977 paper treated equilibrium growth paths, while the 1978 paper allowed for underutilization of capital. Incidentally, much later, in 1985, the mechanism of induced technical progress, along the lines indicated above, would find application in the Central Planning Bureau econometric policy models (Van den Berg *et al.*, 1988).

The last theoretical study that should be revisited briefly in this section is the 1967b paper in which a systematic presentation of economic growth is given by distinguishing positive and normative economics. Within the former domain, attention was paid to the difficulties caused by Harrod's first instability (*i.e.* the capital utilization) problem. The existence and stability of balanced growth was also analysed within the framework of a two-sector model. In the context of this model (with factor substitution ruled out) it was concluded, for example, that an increase in the capitalists' propensity to save raises the wage share, provided that the investment goods industry is not capital-intensive relative to the consumption goods industry. With respect to the theory of normative growth the problem of optimal saving was discussed. Here attention was paid to the concepts of 'the golden rule of accumulation' and Koopmans' work on the intertemporal preference function.

Yet, Van de Klundert did not confine himself entirely to pure theory. He also delivered a major empirical contribution on the subject (1965a). In view of the numerous and also recent quotations from it in many periodicals, this contribution deserves a more extensive review.

One of the teasing problems that occupied several reputed economists at that time was the existence of a residual in the growth of output which could not be accounted for by the growth of inputs measured in a conventional manner. In order to make this residual disappear, attempts (for example by Denison, 1962, Domar, 1962, and Griliches, 1961) were made to develop better input measures capable of accounting fully for the observed growth of output. These led to the embodying of technical change in capital inputs (Solow, 1960, 1962) or to the incorporation of superior technical knowledge and skill, as a result of education, into the labour force. These procedures, already criticized by Van de Klundert in 1963, proved to be unsatisfactory in view of the shifts in the distribution of the residual between labour and capital-efficiency growth proposed by the various statistical studies.

Van de Klundert, together with Paul David, intervened very successfully in this debate. They followed, more or less in the track of the by then famous ACMS article (1961), a different line of attack. They proposed to identify the *form* which the growth of conventional input-efficiency has taken, rather than to tackle the question of the *sources* of growth, such as technological advance in the design of capital, increased education and shortening of working time. A serious problem until then was the impossibility of imputing total factor efficiency to labour or capital. Lack of such information prevented the placing of prior restrictions upon the empirical identification of all the possible sources of factor-efficiency growth.

David and Van de Klundert found an ingenious way to infer the rate of labour and capital augmentation from conventional measures of inputs and output. Like ACMS, they investigated the aggregate production function of the CES form involving the simultaneous estimation of the elasticity of substitution and efficiency growth. Unlike ACMS they constructed a regression model, which allowed for an exponential bias in efficiency growth. This was the first of its kind; until then, Hicks-neutral technical change was the only possible outcome due to the fact that the standard regression model only accounted for the elasticity of substitution and the rate of growth of labour efficiency as parameters. The estimate of the latter then was considered to be identical to the rate of growth of capital efficiency, and hence equal to the rate of Hicks-neutral technical change. The

David-Van de Klundert model contains, among other things, the rate of growth in the *bias* of conventional input efficiencies as a regression parameter.

The model was fitted to the data after the introduction of a number of modifications designed to cope with problems posed by cyclical variations in the rate of utilization of the capital stock, and lags in the response of the capital-labour ratio to alterations in relative factor prices. It was found that during the period 1899-1960 technical change in the U.S. Private Domestic Economy was not Hicks-neutral, but was instead biased in the labour-augmenting direction. To be sure, capital augmentation had occurred, but labour augmentation proceeded faster. This finding was in line with the estimate of the elasticity of substitution, which was lower than the corresponding ACMS estimate. The latter spoke in favour of the assumption of neutral technical change but there were good reasons for suspecting that the ACMS estimate of the elasticity parameter was too high.

### 3 *CAPITAL THEORY, RESOURCE ECONOMICS AND TRADE*

His thorough exploration of the one-sector and two-sector (two substitutable factors) neoclassical growth and distribution parable and his versatile knowledge of linear models and mathematical programming techniques provided an intellectual capital base and an analytical toolbox that enabled Van de Klundert to see quickly through the essentials of the theoretical and practical problems that academic economics had to face since the early 1960s.

In the 1960s and early 1970s several theoretical and methodological questions haunted a part of the economics profession. A first issue was neoclassical demand-supply pricing *versus* classical (Ricardian and Marxian) value theory. A second issue was the ‘perverse reswitching of techniques curiosum’ which seemed to contradict an almost universal neoclassical postulate: ‘as the interest rate falls, the capital-labour ratio increases’ and which seemed to question the logical foundations of aggregation of heterogeneous capital goods itself. A somewhat more remote, but nevertheless related problem is the issue of unequal international exchange, presumably caused by the inequality of wages in the trading countries.

In neoclassical price theory, factor-availability, technology and preferences jointly determine relative prices of factors of production and commodities. For example, whenever preferences shift towards the relatively labour-intensive product and away from the relatively

capital-intensive one, the price of labour will increase relative to the price of capital and the distributive share of labour will increase relative to the distributive share of capital, provided that the elasticity of substitution is smaller than unity. Price theory and distribution theory can in general not be separated: a change in relative prices will change the interest rate and *vice versa*.

However, given a Leontief technology, with labour as the only primary factor of production, absence of joint products and with constant returns to scale, one can (for a range of positive rates of interest) have a relative product price which is independent of final demand. In that case relative product prices are determined by minimum-cost techniques independent of demand changes. But with joint products, these non-substitution theorems may fail. [Building upon Van Schaik's PhD thesis (1973) the latter was demonstrated with the aid of a Sraffa model with durable capital of unequal efficiency (Van de Klundert and Van Schaik, 1978b).]

What the so-called capital debate between Cambridge US and Cambridge UK had achieved was to warn against the oversimplifications of the Clark-Ramsey parable of production with one homogeneous capital good only and no time-phasing of inputs. As soon as heterogeneity of capital is allowed for, and one takes into account the time-profile of the capital-inputs that enter into production, it may well be possible that as the interest rate increases, reswitching to an earlier abandoned technique, with a relatively high capital-labour ratio, occurs. As happened more often, Van de Klundert (1970a) was one of the few Dutch economists who looked into these issues at an early stage and who tried to shed light on them. In the process he remained open-minded, intellectually curious, and he was also prepared to study the philosophical foundations, the history of economic thought, and the methodological approaches of the competing scientific paradigms involved.

Later in the debate about these matters Van de Klundert recognized that the Sraffa-Leontief approach to (joint-)production of commodities by means of commodities (Sraffa, 1960), the specific planning approach to economics (Brody, 1970), the use of Marxian reproduction schemes by Emmanuel to understand unequal exchange between countries (Emmanuel, 1969), the neo-Austrian treatment of capital and time (Nicks, 1973, Van Schaik, 1973 and Van de Klundert and Van Schaik, 1974a) and the turnpike optimality in dynamic input-output systems (Tsukui and Murakami, 1979) could be considered as special cases of the open version of the general time-phased multi-sector model of Von Neumann, including its conditions for intertemporal production efficiency and its properties of dualistic competitive pricing. In this respect Van de Klundert's



'Optimal Capital Accumulation in Generalized Leontief Models' (1981b) should be mentioned. By means of numerical linear programming examples, he was able to examine the significance of time preference, stock activities and the heterogeneity of capital with respect to the available techniques for optimal economic growth. He showed that by proper respecifications (for instance by assuming that capital goods are specific with regard to the technology in which they are applied) some of the disadvantages of the traditional dynamic Leontief model could be removed, although at the end of the paper he admitted with regrets that fixed capital is dealt with in a more adequate way in the Von Neumann model, but that 'in applied work this elegant solution seems out of reach' (p. 39).

Although Van de Klundert's work in the 1960s and 1970s was mainly theoretical, it did not prevent him from trying to bridge the gap between the insights of pure economic theory and useful economic policy advice. Two energy crises, involving the emergence of the OPEC oil cartel and the quadrupling of oil prices, and growing environmental concerns, had suggested limits to growth and even the possibility of doom, due to the exhaustibility of natural resources. Moreover, uneven population growth rates and uneven rates of economic development between world regions asked for models that could handle these global interdependencies. Van de Klundert was very well aware of these developments in the 1970s and delivered his contributions in journals, books, committees and workshops, as the final part of this section can only briefly and very incompletely substantiate.

As a first analysis of limits to growth, due to the exhaustibility of some natural resources, the neoclassical model of economic growth as developed by Solow et al. (1974) proved very useful again. According to *The Limits to Growth by Meadows* (1972) and to Forrester in *World Dynamics* (1971) it was not altogether unthinkable that some sort of apocalypse could occur during the lifetimes of the generations that then populated the world. Additionally, the ethical question was raised of whether or not these generations had the right to consume the patrimony of their forebears, or even consume out of loans from the resource base of the generations yet unborn at such an opulent rate.

This sounded uncomfortable, if not scary, to the world at large and the academic community, not the least economists at that, felt a professional duty to look deeply into the question. Although they did not 'solve' the problem of the exhaustibility of resources, they certainly asked the right economic questions and put the problem in more appropriate perspectives. They made clear that the mere existence of an exhaustible resource was not a reason per se for visions of doom. Only those resources that were essential in production, *i.e.* the output of final

consumption would be zero without that resource, had to be considered. For some people, the economist's answer, that feasible final output does not necessarily have to decline to zero if it is produced with an essential exhaustible resource, still comes as a surprise. Survival opportunities depend, of course, crucially upon the substitutability in production of the essential exhaustible resource for other reproducible factor inputs such as labour and capital. Moreover, the stock of technological knowledge is not a constant over time. It would be a rather limited point of view to rule out the possibility of finding substitutes for the essential exhaustible resource in the future. It may be expected that, if depletion of an essential exhaustible resource is foreseen, the market-price of that input-factor will increase and force the economy to look for substitutes. What is worrying, however, both for centrally-planned economies and for market-oriented economies, is the question of how to find the optimal intertemporal consumption plan when there is so much uncertainty about the future. One source of uncertainty is of course the actual availability of a substitute in the future, another, probably a more important one, is the uncertainty about future technology. Neither central planners nor markets may have sufficient information or the correct sets of market-signals to account for the future uncertainties in current decisions.

As a by-product of this research programme Van de Klundert (1983) co-authored with the third author of this *scriptum amicorum* one of the first introductions to energy economics in The Netherlands. And as a member of the Steering Group for Public Inquiry on Energy Policy in The Netherlands, he helped to defuse some of the social and political tensions that had built up in Dutch society around the energy and environmental problem, by infusing the economic point of view in this public debate and in the final report to the government.

For the study of the global interdependencies of developing and developed countries, Van de Klundert's theoretical knowledge of allocative efficiency and pricing in models of multi-sector closed economies, proved once again to be very useful. In the mid-1970s, Harris (1975) had argued that a convincing theory of economic development should include a theory of value and a theory of accumulation on a world scale. This was after Emmanuel (1969, 1972) had written *Unequal Exchange*. Not until later in that decade did the modern rigorous Sraffa-Leontief-like reformulations of Emmanuel's theory (Liossatos, 1979 and Marelli, 1980) appear. But results like these had already been achieved in the beginning of the 1970s in a research memorandum by Van de Klundert (1971) in which he was inspired by the linear models as developed by Schouten (1957). In that memorandum he showed that nothing mysterious happens in an international trade

model, in which labour is the only primary factor of production, and which is partly needed for the reproduction of commodities that are used up in production: it is not the initial real wage difference between the two countries that is responsible for disadvantageous exchange, and it is not the fact either that the world gets less product than is producible. The very cause of disadvantageous exchange between countries is the difference in the technically given input-proportions in production. In 1972, 'Le Groupe d'Etudes des Relations Economiques' (Van de Klundert, 1975a) organized a special conference on Van de Klundert's research memorandum. A direct 'fall-out' of these activities was a PhD thesis on these and other international trade problems (Thoben, 1973).

Later, when Van de Klundert and Kolnaar (1980b, 1982b) analysed patterns of international trade and economic growth in relation to the North-South dialogue, this theme, *i.e.* the possibility of immiserizing economic growth, occurred again. This time, a neoclassical Heckscher-Ohlin type of model was used to illustrate this position. [Much earlier in his career, Van de Klundert had already taught theories of international trade and growth at the 'VIII<sup>e</sup> Postuniversitaire Economische Leergangen' in Louvain (1966b)]. In this two-by-two-by-two model, the less-developed country was characterized by a low level of capital per head, and a low productivity level. The subsistence level of the real wage rate was set above the full-employment equilibrium wage rate to generate a labour surplus in the less-developed country in the initial situation. Thus by introducing real wage rigidity in the less-developed countries, the authors showed that international trade could be disadvantageous for these countries.

Given his impressive width and depth of knowledge of many different economic models and his dexterity in economic modelling, Van de Klundert was the right person to review critically several models that could be used by the Central Planning Bureau in The Netherlands, when modelling the shifting patterns of the international division of labour and the shifting patterns of international trade, in applied general equilibrium analysis. In a workshop, which was devoted to a review of these models, Van de Klundert (1987a) showed once more his versatility, his forwardness and his love for models that approach the theoretical ideal as closely as possible.

#### 4 *CONTROVERSIES BETWEEN KEYNESIANS AND NEOCLASSICISTS*

Although Van de Klundert can hardly be labelled either Keynesian or neoclassical, he was definitely engaged in the academic debate about the relevance of the two approaches in

macroeconomics. The role of the price mechanism in coordinating demand and supply along various channels, the nature of unemployment as related to the behaviour of market participants and the case for or against stabilisation policies were all questions he was concerned with more or less intensively during his career.

Yet, it is remarkable that he entered the debate notably during the very first and the very last years of the period under consideration. In the meantime the scene had changed. In the initial post-war period the controversy concentrated on attempts to arrive at the so-called neoclassical synthesis. Elements of this consensus were the Hicksian IS/LM schedules, a Phillips curve mechanism endogenizing prices and the possible help of a real cash balance effect. Later on the discussion continued against another background. New classical economists holding the rational expectations hypothesis and the policy invariance view extended the classical laissez-faire conception, while disequilibrium economists, referring to Keynes' *General Theory*, called attention to the importance of quantity adjustment, rationing and the significance of involuntary unemployment.

In the early 1960s Van de Klundert's involvement with the controversy was primarily descriptive, sometimes philosophical. His main purpose seemed to be to point out the important methodological macroeconomic issues the international profession was deliberating on at that time. He turned out to be a very critical examiner who was well aware of what was going on and was quite reserved when it came to taking sides.

At times Van de Klundert suggested that both schools have useful work to do. The neoclassicists, emphasizing the rationality postulate, should examine the long-run developments of the economy where harmony and order could be assumed to predominate. The Keynesians on the other hand had a comparative advantage in studying the short-run impact of real world complexities and institutions. In doing so they could avail themselves of induction and econometrics.

At other times, however, Van de Klundert did not hide his inclination towards the neoclassical paradigm. In his opinion theoretical rather than factual analysis was the main vehicle to deepen our knowledge and understanding of the economic system and its interrelations. To him the concept of a general equilibrium filled a gap, as it helped to improve our insight where pure observations stopped doing so.

On one occasion, when elaborating on the scope of economics as an empirical science, Van de Klundert (1962) introduced Poppers criterion of refutation by experiment. Following Meade

(1962) he presented four observations that neoclassical theory could not easily cover: unbalanced growth, imperfect competition, heterogeneity of capital goods and final products and capital indivisibility, implying uncertainty and imperfect foresight. He discussed these observations at some length and concluded that they were not necessarily incompatible with the results of neoclassical deduction, provided one allowed for the distinction between the long run and the short run. Viewed in the proper time perspective the neoclassical theory was not falsified by the actual development of the economy. In this connection Van de Klundert liked to make a comparison with physics. He borrowed a formulation of Einstein as quoted by Popper (1959): ‘The supreme task of the physicist is to search for those universal laws from which a picture of the world can be obtained by pure deduction...’ For him the difference with the economist was only small.

Nevertheless, some of the neoclassical assumptions, especially the assumption of perfect competition, as well as some of its deficiencies, notably the explanation of the business cycle, kept puzzling Van de Klundert. This was recognizable in his inaugural address (1964), where he presented in a very impressive way his view on price theory and price policy. This lecture was quite comprehensive. It dealt with both economic and ideological questions. With respect to the Keynesian attack on the neoclassical model Van de Klundert elaborated on both the speed and the stability of the adjustment process and thereby on the case *pro* and *contra* an active economic policy. As to the adjustment process, much attention was paid to the Pigou effect in its role of restoring or maintaining full employment. The words he used resemble remarkably those of Tobin in his macroeconomic reflections (1980). With respect to economic policy, he made it clear that economic analysis alone was not sufficient for arriving at policy recommendations. Non-economic arguments as well as a personal view were necessary too.

The relevance of the direct transmission mechanism, as opposed to that of the interest channel, was also investigated in his eminent review (1967c) of Patinkin’s revised edition of *Money, Interest and Prices*. Here he argued that the logical necessity of Patinkin’s methodological critique is disputable, because spending need not be interest-inelastic.

In the late 1970s and 1980s, more than 10 years after the Patinkin article, one could observe a revival of Van de Klundert’s interest in the everlasting controversy. At least two important publications had stimulated his renewed, active and fruitful focus of interest.

First, in an original but not yet fully developed paper (1979a) Van de Klundert exhibited his sympathy with disequilibrium analysis as developed by Malinvaud (1977). Later on the

implications were made more explicit. It appealed to him because the approach included a microfoundation of macroeconomics, offered a more comprehensive framework for the understanding of unemployment and looked more promising than the natural rate hypothesis stemming from the monetarist and new classical challenge of the Phillips curve. It was explicated how disequilibrium analysis accepts the Keynesian proposition of price rigidities in the short run, how markets are cleared by rationing buyers or sellers and how the quantities actually traded are determined by the short side of the market. As noted, with goods, labour and money being the relevant commodities, three regimes can be distinguished: Keynesian unemployment, classical unemployment and repressed inflation. In a recent textbook (De Groof and Van de Klundert, 1988), following Benassy (1982), it was made clear how exogenous variables, particularly government spending, the money supply and the real wage, determine which regime actually prevails and how the Walrasian solution in which all markets are cleared is a special case appearing only in a long-term setting when prices are endogenous.

Secondly, in his research with Peters, Van de Klundert was attracted by the technique of multiple shooting, a new tool of analysis for the implementation of rational expectations in dynamic programming models (Lipton *et al.*, 1982), as applied by Blanchard and Sachs (1982). Undoubtedly, the integration of modern disequilibrium approaches with the theory of intertemporal choice, under the condition of perfect foresight of economic agents and taking into account the appropriate intertemporal budget constraints, has extended the generality of economic analysis. The technique of multiple shooting enabled Van de Klundert to obtain solutions for a considerable number of policy simulations.

One article (1986b) explored the incidence of several tax instruments in an economy where, by extending the Blanchard and Sachs model (1982), the labour supply was endogenous and scarce. It was investigated how external shocks could bring an economic system into motion, which, although characterized by a Walrasian equilibrium in the long run, shows in the intermediate run Keynesian unemployment, classical unemployment, repressed inflation or a switch of regimes. This article was referred to by Blinder (1988) because the authors 'coax a number of fascinating results... They find, for example that a sales tax given back in a lump sum reduces unemployment dramatically more in the Keynesian first period than in the classical steady state.'

Another article (1988a) examined a world with imperfect competition. Rather than assuming short-run price stickiness, inertia was explained by referring to the microeconomic theory

of monopolistic competition in which farms hesitate to adjust prices because these changes are costly. The model was confined to rationing in the goods market and rendered Keynesian unemployment in the short run. Classical unemployment was less likely because, as the authors explain, monopoly profits form a buffer in the event of unexpected shocks.

Yet, whatever the method and the model propositions, old questions have remained. In a very recent paper (Van de Klundert and Van Schaik, 1989a) one can observe a return to the Keynesian approach. Prices as well as capital are assumed to decrease gradually as a function of the rate of capacity utilization, thus exhibiting hysteresis. In an instructive graph ( $K$  and  $L$  on the axis), which is reproduced here in Fig. 1, it is demonstrated how a lack of effective demand might affect the employment situation.

*Figure 1*

A negative demand shock initially causes Keynesian unemployment, since the economy moves from  $F$  to  $G$ . In the long run the model settles at a new steady state equilibrium, for instance in  $H$ . The exact position of  $H$  and of the isoquant  $I_2$  depends on the extent to which the system suffers from capital decumulation and produces a price reduction and/or a real wage decline. In the end unemployment turns out to be an equilibrium phenomenon. Only if the Phillips curve can do its job completely, may full employment be possible, but in that case, too, capital and output cannot return to their initial positions.

From the research reviewed in this section it is not difficult to see how Van de Klundert participated in the debate between Keynesians and neoclassicists. Clearly, he was never shy to explore the extreme, be it above all in order to reveal whether proclaimed differences were fundamental or not. At the same time, however, the attempt to integrate apparently contradictory positions was intellectually most satisfactory to him.

## 5 *OPEN ECONOMY MACROECONOMICS*

Since World War II macroeconomics in The Netherlands has been strongly influenced by applied econometric model building according to the lines set out by Tinbergen, Verdoorn, Koyck, and their followers centered in and around the Dutch Central Planning Bureau. In the beginning of the

1970s, Van de Klundert, with his theoretical baggage, became involved. Actual developments in The Netherlands, *i.e.* the decline of employment accompanied by a high degree of utilization of capital and a remarkable rise of the distributive share of labour induced by the workings of the wage-price spiral, revealed a new set of problems which could not be fully understood by following the Keynesian strains of thought prevailing at that time. Just like many other Dutch economists, Van de Klundert got impressed by the combination of theoretical elegance and explanatory power of the empirical clay-clay vintage model of the Central Planning Bureau (Den Hartog and Tjan, 1974), stressing the capital shortage explanation of unemployment. He wrote an excellent survey dealing with this model as well (1974b), which was highly appreciated both by insiders and outsiders in the field of applied econometrics. This may explain why from 1975 onwards he became a scientific adviser of the Central Planning Bureau.

The clay-clay vintage production function indicates that the decline in employment can be related to an excessive rise of the producers wage, *i.e.* to increases in real wages exceeding the growth of labour productivity in the past, so that old vintages of capital goods are scrapped. This reduces capacity demand for labour which could of course have been compensated by new investment, but in the case of the Dutch economy it appeared that investment was too low for creating new jobs in a sufficient amount. The next step was to develop a more complete macroeconomic model around the vintage block by adding the explanation of demand, wages and prices. This research programme led to the ‘Vintaf’ model, developed by Van de Klundert, Den Hartog and Tjan, which was presented at the annual meeting of The Netherlands Economic Association (1975d). Since the mid-1970s this model and its successors are used by the Central Planning Bureau to analyse short-term, medium-term and even long-term developments of the Dutch economy and to evaluate policy alternatives. A recent version was presented in Van den Berg, et al. (1988), showing the integration of a separate monetary sub-model with a model of the real sector, the latter still based on the ‘Vintaf’ philosophy of extending the vintage block.

The ‘Vintaf’ models have been discussed at length and have deeply influenced the economics profession in The Netherlands. After 10 years Den Hartog (1984, p. 326) could therefore remark that: ‘Contributions to this discussion came from some 30 authors and included total rejection of the approach, refinements, extensions and amendments of the vintage model and its estimation procedure, the integration of the approach in a more comprehensive model of the economy and an extensive discussion of its policy implications.’



With some exceptions Van de Klundert did not interfere in this public debate. Rather he grasped the most crucial elements of applied macroeconometrics as a source of inspiration for making ‘Neue Kombinationen’. One example is ‘Demand and Supply as Factors Determining Economic Growth’ (Van de Klundert and Van Schaik, 1978a), which stresses the use of the ‘Vintaf’ labour demand equation. The latter relates the degree of utilization of capacity demand for labour, *i.e.* the ratio between employment and jobs, to the rate of utilization of output capacity, *i.e.* the ratio between actual and potential output. Jobs and capacity were explained by the usual clay-clay production model, but here the rate of technical progress was treated as an endogenous variable positively depending both on real wages and the degree of capacity utilization. The model was closed by means of a simplified version of the wage-price and demand equations of the ‘Vintaf’ models, leaving the foreign sector aside. By using the method of comparative dynamics, it was shown how demand and supply could play a role in the process of long-run growth. In the long run the labour market is always cleared because of the appropriate workings of the Phillips curve, but equilibrium in the goods market may settle at an arbitrary level of the rate of capacity utilization, depending on the numerical values of the parameters of the model. To give an example of one of the results: in this model the expenditure effect of an increase in the propensity to invest induces an increase in the degree of capacity utilization, accompanied by a higher rate of technical change.

Another example of Van de Klundert’s returning to the ‘Vintaf’ models as a source of inspiration is ‘Distribution, Taxation and Employment in an Open Economy’ (1982b). This article can be considered the starting point of his recent work on small open economies. The methodology he had in mind has been described as follows (p. 10): ‘An empirical model such as ‘Vintaf’ is constructed for the purpose of prediction and evaluation of policy alternatives. In economic theory the main issue is understanding or generalization. The latter approach will be followed here. The problems raised will nevertheless be the same as in the debate around the ‘Vintaf’ model. More particularly, attention will be paid to the consequences of a wage push and the options of fiscal policy in a small open economy. The theoretical model used resembles the empirical one in many respects’. Unlike in empirical models Van de Klundert here resorted to the neoclassical assumption of the goods markets being cleared instantaneously, which ‘simplifies the analysis to a large extent’ as he remarked at the end of the paper.

The resulting model was a linearized version of a flex-price model for a small open economy, including capital accumulation. Compared with similar models in the literature the latter was long overdue. Following the ‘Vintaf’ models the exchange rate was assumed to be constant, whereas the labour market did not clear. The wage rate was explained by factors resulting from bargaining about the real disposable income, such as the passing on in wages of an increase in tax rates and the full indexation of wages for price increases. The analytical solution was very nicely presented in several steps. First, the demand and supply equations for a given value of the stock of capital were derived. Next, short-run equilibrium values for output and prices were obtained by equating demand and supply. This procedure was illustrated by a diagram in the terms of trade-real output-space, showing demand and supply shifts by particular shocks. For a sufficiently large value of the elasticity of substitution between foreign and domestic products, the substitution effect outweighs the terms of trade effect, in which case the demand curve has the usual negative slope. The supply schedule has a positive slope, because of the assumed real wage rigidity. For example, a tax-financed increase in public spending shifts the supply curve to the left and the demand curve to the right. The supply curve shifts because an increase in tax rates is passed on in wages: the price level rises, the effect on output is however indeterminate. Hence, the possibility of a negative balanced budget multiplier was illustrated with a numerical example based on plausible parameters values for the Dutch economy. In that case the shift of the supply curve dominates the scene, showing the picture of a stagflating economy even in the medium term and the long run. Of course the introduction of a Phillips curve mechanism exerts a dampening effect. However, this does not remove the possibility of the balanced budget multiplier being negative, not only in the short run but also in the medium run.

In his own comment on the model just mentioned, Van de Klundert remarked that theoretical models could be made more realistic at the expense of increasing complexity, so that analytical solutions may become out of reach. From the previous section we know how he handled this dilemma later on, namely by applying the technique of multiple shooting. After all, modelling the labour market remained the main issue. In the same comment he suggested that ‘something could be gained’ by allowing for partial price-indexation, thus referring to the case of nominal wage rigidity. Incidentally, in a small popularizing book on ‘Vintaf’ models Van de Klundert (1977) had already pointed at the possibility of the abolition of price compensation and the possible consequences of such an ‘institutional reform’ as a remedy for stagflation.

Still using the assumption of output prices being fully flexible, Van de Klundert later on analysed open economies with real wage rigidity *versus* economies with nominal wage rigidity. A good example is found in the proceedings of the Bielefeld conference (1988c), co-authored by Van der Ploeg. Focussing on the demand and supply schedule in the terms of trade-employment-space it was shown that nominal wage rigidity implies that the long-run supply curve is inelastic, because the labour market will be in equilibrium at the natural rate of unemployment. Real wage rigidity causes the aggregate supply curve to be upward-sloping. Here an improvement of the terms of trade reduces the relative price of foreign goods, diminishing the wedge between consumers' and producers' real wage and therefore increasing employment and output. At the end of the paper the authors concluded that, as nominal wage rigidity may not be unrealistic for the US, a reduction in the long-run rate of unemployment in the US requires supply-side measures affecting the natural rate. The situation is different for Europe, where real wage rigidity may prevail. The outcome of supply-side policies is uncertain here: 'In that case there remains scope for a two-handed approach where the demand side and the supply side both receive due attention,' as the authors remark.

In studying a single open economy one is easily invited to link at least two of these economies within a closed system. Recently Van de Klundert provided us with some nice examples (1986a, 1988b and 1989c). The last paper reconsidered the policy conclusions derived from ad hoc Mundell-Fleming models. In particular, one is faced with the intertemporal aspects of the view that a European fiscal expansion is a locomotive policy whilst a US fiscal expansion is, typically, a beggar-thy-neighbour policy. The dynamic effects of these policies were studied by means of simulations, using the multiple shooting algorithm. This is a very eloquent paper indeed. It shows the progress made in open economy macroeconomics since the beginning of the 1980s.

## 6 VAN DE KLUNDERT AS A TEACHER

As a Professor, Theo van de Klundert has continuously been involved in teaching, both to graduate students and undergraduate students, at the Department of Economics of Tilburg University. In his eagerness to teach modern topics which took a central place in economic literature, he used to change his courses rapidly. Therefore he covered a great variety of subjects, too numerous to sum up. The extensive list of his publications gives adequate information on the subjects he was lecturing about. However, in the beginning of the 1970s Van de Klundert's publication activity

stagnated for a while. It is then in teaching that he delivered ample proof of how much knowledge he had gathered. Generations of students from that period will remember his teaching on normative and microeconomic growth theory, regional growth economics, capital theory, the economic theory of labour-management and the neo-Ricardian theory of international trade. Each subject was dealt with in a direct and an effective manner uncovering its core by simplifying matters as far as possible, using simple algebraic models and preferably graphical analysis.

Van de Klundert was engaged in the writing of three textbooks, in which he proved his substantial didactic abilities. The first book (1968), aiming at undergraduate students, dealt with both microeconomics and macroeconomics. Henderson and Quandt's *Microeconomic Theory* (1958) and Bailey's *National Income and the Price Level* (1962) inspired him in the writing of this book. Meanwhile the author incorporated some important new theoretical developments in his book. We refer to the appendices on monetary economics, investment, general equilibrium, economic interdependence, and technical progress. No contemporary textbook in Dutch contained such a broad variety of modern mainstream subjects. It is a pity he did not try to get this book published in English.

The second textbook (1974), of which Van de Klundert was the leading author, concerned microeconomics. In fact the microeconomic part of his first textbook is elaborated substantially here. Again modern topics, (with hindsight some of which seem just fashionable), were included. Mathematical programming was consequently put forward as the method of analysis. Classical programming as well as linear programming, the latter as a consequence of working with Leontief technology, was explained and applied. General equilibrium for both capitalist and socialist economies was dealt with.

In the third textbook (De Groof and Van de Klundert, 1988) the problems of planning and labour management were replaced by problems of intertemporal choice and price stickiness, both debouching in a general equilibrium presentation. In doing so, Van de Klundert showed didactically the interrelationship between microeconomics and macroeconomics. The latter problem has long challenged him.

## 7 EPILOGUE

Koyck, in his preface to Van de Klundert's PhD thesis, stated about the author 'that he knows the present state of science including very recent papers, that he is able to criticize and frequently presents own original contributions' (translated from Dutch). In our view his work during the period 1962-1989 gives ample justification to recall Koyck's appreciation today. Indeed, he never hesitated to abandon a specific research programme, whenever the core issue was understood and clarified, or when it did not promise additional fruitful results, or when new scientific challenges were looming on the horizon. His intellectual faculties and his restless attitude enabled him to penetrate into economic reality, which in itself is infinitely complicated. 'A frontier economist' is the most concise and appropriate label we can find to characterize Van de Klundert on the occasion of his jubilee.

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## *Summary*

### THEO VAN DE KLUNDERT: A FRONTIER ECONOMIST

Twenty-five years ago, Dr. Theo van de Klundert was appointed as Professor of Economics at Tilburg University. On the occasion of this jubilee the authors review Van de Klundert's contribution to the study of economic science in The Netherlands. The article focuses on four topics: (1) growth and income distribution, (2) capital theory, resource economics and trade, (3) controversies between Keynesians and neoclassicists, and (4) open economy macroeconomics. A short remark is made about his teaching. Van de Klundert is praised for the quality and the comprehension of his scientific work.