High levels of unemployment: A long-run reality for South Africa[1]

by

Dr CH Schoeman and Mr PF Blaauw[2]

September 2005

[1] Paper presented at the ESSA Bi-annual Conference, Durban, 7-9 September 2005

[2] Senior lecturer and Lecturer, Department of Economics, University of Johannesburg, South Africa, respectively

1. Introduction

Unemployment in South Africa takes on crisis proportions if one takes into consideration the persistent high levels of unemployment and the tempo at which unemployment was increasing since the mid 70's and especially since the beginning of the 80's. It seems as if the unemployment process developed a life of its own and that natural forces were unable to reverse the situation.

The aim of this paper is to determine what lies at root of the unemployment data generating process and the implications that it holds for unemployment in future. We want to put inferences from the literature study on path dependence to the test for South Africa in order to determine the role history played in the unemployment creation process since 1970.

Our hypothesis is that long run or equilibrium unemployment in South Africa is much more complex than what conventional theory on the natural rate of unemployment or even the NAIRU is postulating. We hold the view that unemployment is not only exogenously determined by a set of contemporaneous exogenous variables but that unemployment is an endogenous product or culmination of economic structure as well as the social, political and psychological behaviour of the participants in the past and present.

In section one of the paper we will analyse the possibility of handling the above-mentioned factors in a coherent economic model where actual unemployment determines equilibrium unemployment. In the second section we will analyse the persistence of there influences on unemployment. In the last section we will test our hypothesis that these factors do have a remanent influence on unemployment in South Africa.

2. An economic model to explain long-term multi-equilibrium

Multiple equilibria imply a wide range of equilibria consistent with a given set of contemporaneous exogenous variables or structural characteristics. Under the natural rate and NAIRU, in the long run, a state like this is not possible and each set of exogenous variables is associated with a unique equilibrium or natural rate of unemployment. Unique equilibrium is only possible where the actual rate of unemployment, which is the product of much more than economic reality, do not

have a permanent influence on an exogenously determined natural rate of unemployment. The natural rate of unemployment is invariant of time and is according to Friedman (1968: 9) "… *the level that would be grounded out by the Walrasian system of general equilibrium equation, ….. there is imbedded in them the actual structural characteristics of the labour and commodity market …"*

Multiple equilibria are the result of the lasting influence of actual unemployment (based on expectations formed under uncertainty, feedback and learning) on a stable long-run unemployment. The adjustment process is different from that in the neo-classical theory in that the decision-makers or agents is not representative agents but heterogeneous in terms of their individual micro structural positions, memories and expectations. Optimal structural positions differ and so do learning, memory and expectations about the future that will be littered with error: *"… the more the expectations of economic agents are revised in "a Bayesian" manner, the more the whole system will be path dependent"* (Archibald, 1995: 99). This not only stresses the inherent friction and costs in the adjustment process after a shock but also the idea of equilibrium being rather a range than a unique point.

Phillips (1958) lays the foundation of the multiple equilibrium idea in his seminal article in 1958. According to Desai (1975) and Cross (1995) Phillips was trying, in an esoteric manner, because there was at that time no procedure like the Error Correction Model (Sargan 1964), to extract unobservable long-run data from actual short-run (cyclical) data which allowed a long-run equilibrium relationship to emerge from short-run observations. The original Phillips curve is therefore a locus of long-run equilibrium points for unemployment associated with changes in nominal wages. Underlying this long-run unemployment equilibrium is not only Friedman's linear natural factors but also a non-linear reaction to economic and non-economic changes in the employment environment. The position and shape (unlike the natural rate) of the original Phillips curve is time variant or integrated.

Two different views exist on the permanence of a shock due to the adjustment costs after a shock. Both views anchored their arguments on the hysteresis[3] concept.

[3] The term *hysteresis* was first coined for application to scientific phenomena by the Dundonian physicist – engineer James Alfred Ewing in 1881. The first application was to the thermoelectric properties of metals when subjected to stress by loading and unloading, shortly followed by the more celebrated application to the behaviour of electromagnetic fields in ferric metals when exposed to magnetizing cycles (Ewing, 1881a, 1881b, 1885, and 1893): *"these curves exhibit, in a striking manner, a persistence of previous state … to this action … the*

2.1 *Medium-term hysteresis or persistence*

At the heart of this view is the attractor property of actual unemployment in the short to medium term. It is possible, that increasing actual employment can lead to an increase in medium run unemployment equilibrium through disenfranchised labour that cannot exert demand pressure on wages after a shock that changes the structural characteristics of the labour market. This raises unemployment to a new rate, which reconciles wage- and price setting, to achieve a new (temporary) equilibrium rate (Blanchard and Summers, 1986, Nickell, 1987 and Layard and Nickell, 1987). In the absence of other shocks, though, actual unemployment will converge in a self-correcting manner to the unique long-run NAIRU (Layard, Nickell and Jackman, 1991: 10).

The complete history of shocks is therefore remembered, although the memory of this kind of systems is very short and history will therefore influence the behaviour of unemployment only for a limited period. The reason for this, according to Wyplosz (1989:12) and Cross (1993:67) is the unit root characteristics of the time series. If the root is less than one the influence of a shock will not permanently influence the equilibrium rate of unemployment and we have a situation of persistence rather than hysteresis (Franz, 1987 and Wyplosz, 1989). The learning and adjustment process after a shock is a bumpy but a convergent process towards the "truth" (Archibald, 1995: 98). Natural unemployment can, due to institutional frictions in the adjustment process, be temporally influenced by actual unemployment (Blanchard and Walters, 1999).

2.2 *Actual unemployment and its remnant influence on long-run equilibrium unemployment*

According to Cross (1994, 1997 and 1988) and Amable, Henry, Lordan and Topol (1995) it is the non-linear property of actual unemployment that determines equilibrium or long-run unemployment. Changes in actual unemployment because of non-linear reaction to changes in the underlying factors are remanent.[4] Actual unemployment therefore becomes equilibrium unemployment.

---

author now gives the name Hysteresis" (Ewing, 1881b, p.22). Ewing's assessor for the original Royal Society paper, Sir William Thompson (later Lord Kelvin), pressed for the phrase *"effects of retentiveness"* to be used instead of *hysteresis* (see Ewing, 1939) in Cross, 1993.

[4] Remanent and not permanent because the system can be changed (Cross, 1994).

The non-linear reaction or discontinued adjustment to temporary changes in the factors determining or underlying actual unemployment stems from the heterogeneous ways (due to differences in entrance and exit points across agents or for the same agent over time) in which agents reacted to temporary changes, inputs or shocks to the system (Amable et al., 1995: Dixit, 1992, and Cross, 1994). Only sequences of temporary extreme shocks influence unemployment. In the absence of an extremum of shocks the current actual unemployment will become, after an adjustment period, the new long-run unemployment. *"Unemployment do not return to the status quo ante once a temporary shock is reversed, but instead displays remanence: this means that the new equilibrium will not be the same as the old, but will remain displaced … unemployment retains a selective memory of past shocks: it neither forget all past shocks, as in the natural rate hypothesis: nor does it, like the elephant, remember all past shocks, as in the linear version of hysteresis … The selective memory property is such that only non-dominated extreme values of shocks effect the equilibrium path, the dominated value being erased from the memory bank"* (Cross 1995: 190). Unemployment mimics an elephant walk, only being influenced in its path if she is hit by significant strong shock which moves it to a new equilibrium situation (Davidson, 1993). Hysteresis is therefore a non-linear phenomenon (Cross, 1993).

Friedman's structural aspects as stressed in the natural rate literature are in this model affecting the entrance and exit values of firms. The more favourable a set of structural characteristics are the more likely firms will actively be employing labour for any given sequence of aggregate shocks. The shocks shape the rate of unemployment given the structural characteristics. A multiple or range of feasible equilibrium unemployment rates exists at a given set of structural characteristics. The weaker the structural characteristics are the more negative the influence of contractionary shocks and the less positive as an expansionary shock (Cross, Darby, Ireland and Piscitelli, 1998).

According to Cross et al., (1998) structural aspects are the only determinants in a shock less economy. In an economy plagued by extreme shocks a whole range of feasible unemployment rates exists. In a world of shocks macro policy measures will have potentially lasting influences on unemployment. This will not only be through direct linear influences but also through non-linear influences.

3. Unemployment in South Africa 1970 – 2002 – mean reversion, trend stationery, persistent, remanent or permanent?

3.1 A Box-Jenkins diagnosis of the unemployment data generating process.

To detect what lies at the root of unemployment data generating process in the period 1970 – 2002, the Box-Jenkins methodology was used. The emphasis of these methods is on analysing the probalastic or stochastic properties of economic time series on their own, under the philosophy "let the data speak for themselves" (Gujurati, 2003). It is assumed that past values of the series plus previous errors contain usable information and give us some historical perspective on how the series was generated.

One has to be cautious in terms of the way in which one structures the specific time series data. Trying to determine the structure (function) of a stationery time series is, according to Davidson (1993), an attempt by econometricians to discover a quantitative anchor for the series over time. If the series is non-stationery, the rules of the game require a search of sequence of the increments for stationarity – if still non-stationary; the increment in the increments will hopefully prove to be stationary. Something real or a natural force must underlie orderly behaviour of the aggregate, and have to be exogenous to the original process, changes in the variable or rates of changes of the variable. Mandelbrot (1967: 396 – 397) see this practice of letting the old "tropismatic predispositions" for a partitioning of a deterministic core and a subordinate stochastic explanation to dominate the enquiry as backsliding and furthermore regards it as non-scientific because it relinquished the search for a truly general law and phenomenological explanation. According to Yaglom (1986:391) the problem is that this structure function needs not to tell us anything about the original process, in this instance, the levels of unemployment. According to Cross (1993: 307) the introduction of successively higher-order time derivatives as explanatory variables are a way of removing hysteresis. What we want to do is to determine what lies at the root of the unemployment data generating process. Stationarity or trend stationarity in the initial data could give us an indication that only natural things underlie the unemployment level in South Africa for the period 1970 – 2002 and that shocks, be it real or nominal, do not have an influence on unemployment creation. Non-stationarity can lead us in two different directions. In terms of persistence,

shocks have a long-term influence but natural forces will ensure that we move in the direction of the long run natural rate. When the root is equal to unity though, we have in the words of Cross, Darby, Ireland and Piscitelli (1998) hysteresis as a special case. In such an event, all shocks will have a permanent influence on unemployment. Non-linearity in the time series generating process on the other hand, is an indication that only a non-dominant extrema of shocks influences unemployment and that the influence is remanent (not permanent).

To interpret the unemployment data it is necessary to add the concepts of natural rate, persistence and remanence to time series vocabulary. When analysing the time series structure of unemployment (drawing information and inferences from actual data) in a univariate autoregressive model (ARM), it is helpful to start with the ideal data series that would be associated with the different hypothesis. For the natural rate hypothesis an ideal series would be one where the mean value is a constant with a cyclical random actual rate movement around the mean. The mean will take the value of the natural rate of unemployment with cyclical random changes (actual unemployment) round the mean. No relation exists between actual levels over time. The data generating process is time-invariant. Typical of this stationary stochastic process is that the series will tend to return to its mean (mean reversion) and fluctuations around this mean will have constant amplitude. In unemployment and natural rate terms it means that actual unemployment is attracted by the natural rate. History therefore does not play any role in the formation of unemployment.

A less restrictive way of looking at the natural rate hypothesis, in line with Friedman's (1968: 9) idea on changing market characteristics, is to look at it as a trend stationary process (TSP; a non-stationary process). Although the mean of unemployment (natural rate of unemployment) is not constant, the variance is. In this view the natural unemployment rate will change over time as the market characteristics underlying the natural rate (that is man-made and policy-made) are changing (Friedman, 1968: 9). The amplitude (cycles of actual unemployment), though, will not have any influence on the trend/natural rate. Deviations (actual unemployment) from the trend line (natural rate) are purely random (depending on the economic and political climate then prevailing) and will die out quickly. What is important is that the deviations do not contribute to the long-run development of the series. The long-run development is determined by the trend component (Gujarati, 2003: 804).

A short-run unemployment influence on long-run unemployment can, in time series structure vocabulary, be presented by a difference stationary process (unit root process). In the pure random walk model (RWM) the value or rate of unemployment at any specific point is determined by its original value plus the sum of all short-term changes in unemployment over time. In terms of the RWM there is no tendency for unemployment to return to the natural rate of unemployment in the short to medium run (persistence) and the rate or magnitude of unemployment at any point is determined by the sum of its past cyclical (short-run) behaviour (history) (Peel and Speight, 1995: 233). Shocks to unemployment do not die out quickly as in the TSP but keep on influencing the outcome of medium-run/long-run unemployment in a linear/non-linear way. A feature of the RWM is thus the persistent influence of random shocks. This model does not exclude the return to the so-called natural rate of unemployment or the dying out of a shock's influence (Amable et al, 1995: 167-168 and Cross 1995). What it does show is that the actual rate of unemployment does have a medium-run influence on the equilibrium unemployment rate and that shocks, real, monetary etc., have not only a short-run but also medium-run real influence. According to Amable et al (1995: 174) this kind of model cannot capture the idea of formal structural change. In a stringent sense this type of model explains persistence in change but not remanent or residual effects.

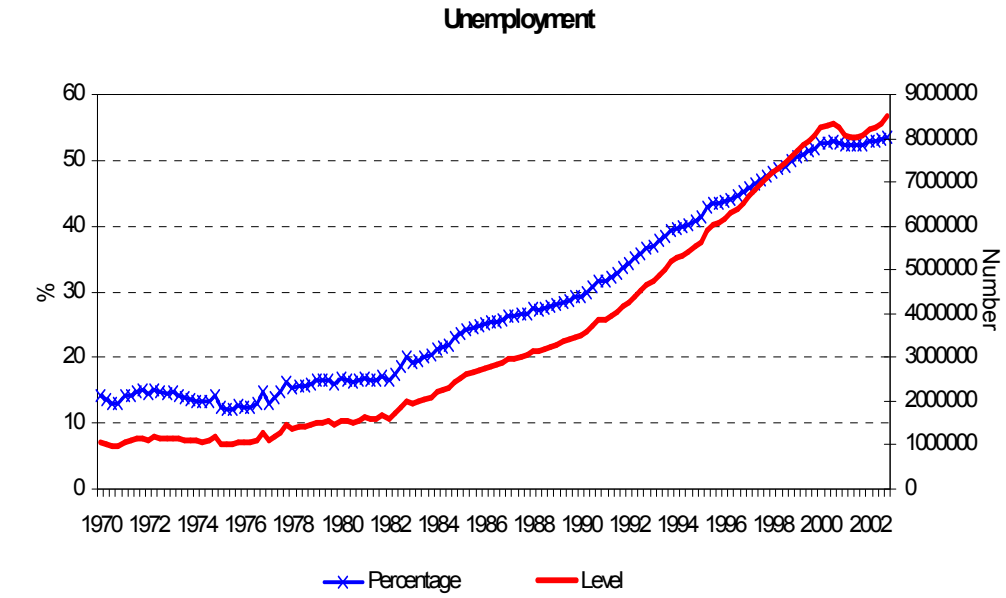
Remanence is a much stronger reaction: all changes in terms of persistence remain but there is more – the system's behaviour also changes. An opposite shock of the same magnitude will not bring the system back to its initial position. The structure and behaviour of the system has changed and it will react differently in comparison with its original position. The system or series, in its new position, will not react to an expansionary or contractions, of the same magnitude. Extensions of shocks are needed to influence the series. One needs therefore more than a unit root to indicate on the presence of remanence in a time series. The true structure of modelling a remanent influence of a shock on a variable (unemployment) is a model that can detect non-linearity in the process that generates unemployment (Krasnosel'skii and Pokrofskii, 1989 and Amable et al, 1995). For unemployment to display remanence there has to be non-linear dependence in the conditional mean. The time series model has to mimic the extremity of the shock necessary to have any influence on unemployment's behaviour and the permanence of the shock in the absence of other non-dominant extreme shocks. A standard time series model with a constant variance over time only describes linearity in the conditional mean and does not make room for non-linear changes in unemployment's mean. The way to describe

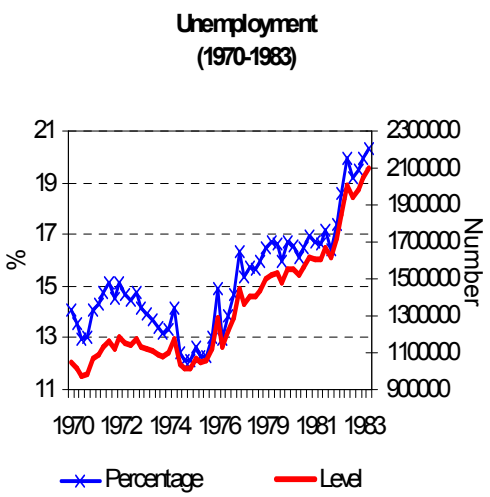
non-linearity in the conditional mean is through a non-standard time series model that makes room for changes in variances (Engle, 1982: 989). In this way one can detect non-linear dependence. The ARCH model or ARCH effects in the residuals of linear models give an indication of non-linearity in the data-generating process. The presence of ARCH effects in, for instance, an AR-RWM, gives an indication of non-linearity in the generating process of the conditional mean. Small and large errors (shocks) in this type of model also tend to cluster together indicating the interdependence of extreme shocks. According to McNees (1979) there is also serial correlation in episodes of large variance. In hysteresis or remanence terms it intuitively means that traces left by extreme shocks do influence the present. Not all historical events therefore have an influence on the present but only extreme episodes in history.

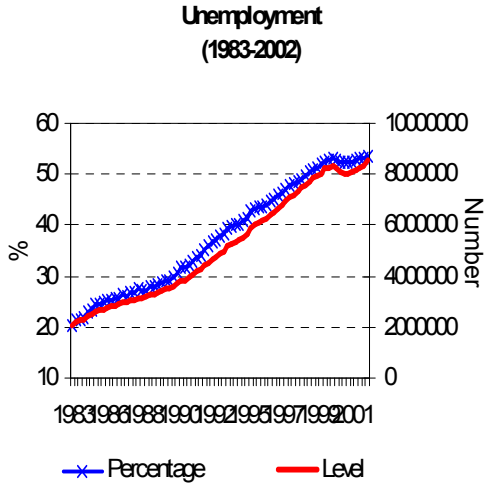
3.2 The dynamics behind unemployment behaviour in South Africa

The unemployment time series data used in the analysis was obtained from Quantec. The data used is extended unemployment data on a quarterly basis (formal unemployment plus informal employment) of the sample period 1970(1) – 2002(4). A remarkable feature of the unemployment data plotted in Figure A is the way in which unemployment was plagued by extreme shocks between 1970 and 1983.

Figure A: Extended unemployment rate in South Africa


Unemployment
60
50
40
30
20
10
0
%
9000000
8000000
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
Number
1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002
Percentage
Level


Unemployment
(1970-1983)
21
19
17
15
13
11
%
2300000
2100000
1900000
1700000
1500000
1300000
1100000
900000
Number
1970 1972 1974 1976 1979 1981 1983
Percentage
Level


Unemployment
(1983-2002)
60
50
40
30
20
10
%
10000000
8000000
6000000
4000000
2000000
0
Number
1983 1986 1988 1990 1992 1995 1997 1999 2001
Percentage
Level

The unemployment data-generating process after 1984 was steadier. Unemployment increased sharply after 1984, from about 20 percent in 1984 up to about 53 percent in 2002. What is also remarkable is that there were no indications in the data-generating process after 1984 that unemployment would revert to the average unemployment level of the 1970's.

Unemployment's behaviour changed dramatically after the period 1970 to the end of 1983. Unemployment seemed to be bounded between 10 percent and 20 percent for this period. From 1970 to 1977, unemployment cycled around, or reverting to a near constant mean. It seems that actual unemployment did not have any influence on its mean during this period. The period 1977 until the end of 1983 is characterised by unemployment moving to a higher and changing mean level. The negative shock in 1977 did not only put unemployment on a higher level, it also seems that actual unemployment now started to influence the mean of unemployment. In the period after the negative shock in 1983 unemployment becomes totally dependent on its past values. What is also characteristic of this period is that unemployment was increasing year after year. Unemployment, it seems, developed a life of its own and was not distracted in any way from the path it followed.

The South African unemployment time series, it was found, was of a univariate nature and difference stationary of integrated order 1. The generating process of the series can at best be described as an AR (1) – RWP with ARCH effects in the residuals at a two percent level of significance. The ARCH effects in the residuals of linear models are an indicator of non-linearity in the conditional mean of the underlying regression model (Engle, 1982 and Weiss, 1986). The conclusion therefore is that the unemployment time series in South Africa is generated in a non-linear way. As demonstrated by Krasnosel'skii & Pokrovskii (1989), hysteresis will be exhibited by any system containing a non-linear relationship. The South African unemployment time series data therefore exhibited hysteresis. The implication is that the system's current behaviour depends on selective past shocks or episodes in history. The influence of non-dominant extreme shocks on unemployment is remanent, implying path dependence in the unemployment data generating process. For South Africa this implies that extreme episodes in the history of unemployment are presently still influencing the unemployment generating process.

4. Conclusion

The purpose of the paper was to determine whether the high levels of actual unemployment currently experienced could give us an idea of what can be expected of unemployment in the future. This was done by testing for hysteresis in the unemployment generating process. We find evidence that the generating process is a non-linear process. The non-linearity confirms that hysteresis underlies the unemployment generating process in South Africa. In practice it means that actual unemployment in South Africa gives a good indication of what we may expect in terms of equilibrium or long-run unemployment. The effect of extreme shocks that influenced unemployment in the past is still being felt today. All macro-economic policy makers must keep this in mind.

5. References

Amable, B., Henry, J., Lordon, F. and Topol, R. (1995). Hysteresis Revisited: A Methodological Approach in Cross, R. (Ed) (1995). The Natural Rate of Unemployment. New York, Cambridge University Press.

Archibald, C.C. (1995). Hysteresis and Memory in the Labour Market in Cross, R. (Ed) 1995. The Natural Rate of Unemployment. New York, Cambridge University Press.

Blanchard, O. and Summers, L. (1986) Hysteresis and the European Unemployment Problem in Fischer, S. (ed) NBER Macroeconomic Annual. Cambridge, MIT Press.

Corry, B. (1995). Politics and the Natural Rate Hypothesis: a Historical Perspective in Cross, R. (ed) (1995). The Natural Rate of Unemployment New York. Cambridge, University Press.

Cross, R. (1993). On the foundations of hysteresis in economic systems. Economics and Philosophy, Vol 9:53-74.

Cross, R. (1995). Is the Natural Rate Hypothesis Consistent with Hysteresis in Cross, R. (ed) (1995). The Natural Rate of Unemployment. New York, Cambridge University Press.

Cross, R., Darby, J., Ireland, J. and Piscitelli, L. (1998): Hysteresis and unemployment: A preliminary investigation. University of Strathclyde and ICMM.

Davidson, P. (1993). The elephant and the butterfly. Journal of Post Keynesian Economics, Vol 15:309-322.

Desai, M. (1975). The Phillips Curve: A Revisionist Interpretation. Economica, Vol 42:1-19.

Friedman, M. (1968). The Role of Monetary Policy. American Economic Review, Vol 58(1):1-17.

Gujarati, D.N. (2003). Basic Econometrics. New York, McGraw Hill.

Layard, R. and Calmfors, R. (eds) 1987: The fight against unemployment. MIT Press.

Layard, R., Nickell, S. and Jackman, R. (1991). Unemployment: Macroeconomic Performance and the Labour Market. Oxford. Oxford University Press.

Layard, R. and Nickell, S. S. (1987). In Dornbusch, R and Layard, R. (eds) (1987). The Performance of the British Economy. Oxford, Oxford University Press.

Mandelbrot, B. (1967): The variation of some other speculative prices. Journal of Business, Vol 40: 393-413.

McNees, S.S. (1979). The Forecasting Record for the 1970's. New England Economic Review, Vol 63:33-53.

Nickell, S.S. (1987). Why is Wage Inflation in Britain so High? Oxford Bulletin of Economics and Statistics, Vol 49:103-128.

Peel, D. and Speight, A. (1995). Non-linear Dependence in Unemployment, Output and Inflation: Empirical Evidence for the UK in Cross, R. (ed) (1995). The Natural Rate of Unemployment. New York, Cambridge University Press.

Phillips, A.W. (1958). The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957. Economica, Vol 25:283-299.

Sargan, J.D. (1964). Wages and Prices in the UK: A Study in Econometric Methodology in Hart, P.E., Mills, G. and Whitaker (eds) (1964). Econometric Analysis for National Economic Planning: London, Butterworth.

Yaglom, A.M. (1986): Correlation theory of stationarity and related random functions New York: Springer Verlag, 1986.

Wyplosz, C. (1987): Comments in Layard R. and Calmfors (eds) 1987. The fight against unemployment. Cambridge. MA.

---oOo---