KESKUSTELUALOITTEITA

DISCUSSION PAPERS

Suomen Pankin
kansantalouden osasto

Bank of Finland
Economics Department

MARIANNE STENIUS - MATTI VIRÉN

SOME FURTHER RESULTS ON ROSEN AND QUANDT'S LABOR MARKET MODEL

24.10.1984 KT 19/84

SOME FURTHER RESULTS ON ROSEN AND QUANDT'S LABOR MARKET MODEL*

by

Marianne Stenius** and Matti Virén***

* We would like to thank professor Kenneth Wallis and an anonymous referee for helpful comments and professor Richard E. Quandt for providing his data. Financial support from the Finnish Cultural Foundation, the Co-operative Banks' Research Foundation and the Yrjö Jahnsson Foundation is gratefully acknowledged. This paper will appear in European Economic Review.

** University of Helsinki, Helsinki.

*** Bank of Finland, Helsinki

1. INTRODUCTION

At the beginning of the 1970's, there was a great deal of optimism with respect to the empirical applications of disequilibrium econometrics. This was true in spite of the fact that many important theoretical aspects of disequilibrium models were - and are still - open to criticism.[1)] With the passing of time, this optimism has diminished, however. It is difficult to say why this has been so. One reason could be the fact that there are only a few empirical applications of disequilibrium econometrics, which, moreover, do not appear to be indisputably superior to standard equilibrium models. The application which is perhaps most often mentioned as a promising example of the performance of disequilibrium econometrics is the study of Rosen and Quandt (1978) on the U.S. labor market. This study made use of annual time series data covering the period 1929-1973. Even though the parameter estimates were quite reasonable, there were some anamalous results in terms of the predicted excess demand and excess supply periods. The model predicted excess demand for labor during the Depression years, and excess supply of labor from 1954 to 1973. Later two "explanations" were given for these anomalies: Yatchew (1981) showed that the model performs better if the sample is restricted to post-World War data, while Romer (1981) showed that dropping the asset variable from the supply equation produces much better excess demand predictions (the early 1930's now became an excess supply period and the years 1965-1968 an excess demand period). Quandt (1981) and Eaton and Quandt (1983) subsequently produced two sets of estimates with this same data using the Romer specification without any marked difference in the results.

Even though Quandt and others have thus succeeded in producing results which on the whole are rather reasonable, this does not mean that the case as regards the U.S. labor market is settled. This is because we have no idea of how robust the results thus far obtained in fact are. The first thing one should check in this connection is the possibility of multiple local maxima, which is known to be a "standard" problem with disequilibrium models irrespective of the minimum condition.

Another question is whether the results thus far obtained are robust with respect to the minimum condition itself. That is, whether the results change markedly if the Maddala-Nelson- minimum condition is replaced by the Ginsburgh-Tishler-Zang (stochastic) minimum condition.

Finally, one can ask whether the results of Rosen and Quandt et al pass "standard" checks of robustness in the sense that, for instance, the results can withstand differencing the data, splitting the data sample into, say, two segments, and estimating the model with only the central observations.[2)]

All these checks are carried out in the subsequent and it turns out that the results of Rosen and Quandt et al are, in fact, far from robust. Some further experiments suggest that this might be due to misspecification of the behavioral equations and incorrect assumptions with respect to the labor market disequilibrium hypothesis.

2. EMPIRICAL RESULTS WITH THE U.S. LABOR MARKET DATA

The model used by Rosen and Quandt consists of the following equations:

(1) $$\ln D_t = a_0 + a_1 \ln w_t + a_2 \ln Q_t + a_3 t + e_{1t}$$

where labor demanded at time t is a function of real wages (w_t), the level of aggregate output (Q_t), and a time trend variable (t);

(2) $$\ln S_t = b_0 + b_1 \ln w_{nt} + b_2 \ln P_t + e_{2t}$$

where labor supplied is a function of real wages, net of taxes (w_{nt}), and the potential number of hours of work available in year t (P_t). P_t is calculated by multiplying the number of civilians between the ages of 16 and 64 by the average number of hours worked per year;[3)]

(3) $$\ln E_t = \min(\ln D_t, \ln S_t)$$

where the quantity of labor (E) traded in year t is the minimum of supply and demand. The error terms e_{1t} and e_{2t} are assumed to be normally and independently distributed (relaxing this assumption in terms of auto-correlation does not seem to have a noticeable effect on the results, cf. Quandt (1981)). In some applications, equations (1) - (3) are completed with a wage adjustment equation of the type: $\ln w_t - \ln w_{t-1} = c_1(\ln D_t - \ln S_t) + c_2 X_t + e_{3t}$, where X represents some exogeneous shift variable such as the percentage of the labor force that is unionized. We do not use this equation here is mainly because of our desire to simplify computations and to make possible the application of the GTZ-minimum condition.[4)]

Equation (3) represents the Maddala-Nelson-type (MN) minimum condition, which has been systematically used in the context of the U.S. labor market model. An alternative way of specifying the minimum condition is to use the Ginsburg-Tishler-Zang-type (GTZ) condition (4), which is based on the assumption that the stochastic elements are connected with transactions, not with the "planned" demands and supplies:

$$(4) \qquad \ln E_t = \min(\ln D_t^e, \ln S_t^e) + u_t$$

where the index e refers to the expected value of D_t and S_t, and u_t is the composite error term of the model. It is assumed that the corresponding variance does not differ between supply and demand observations; this assumption was, however, subsequently relaxed by allowing for heteroscedasticity (see footnote 8 below).[5)]

We now turn to the estimation results. Equations (1), (2) and (3) or (4) were estimated with annual U.S. data covering the period 1930-1973 (see Rosen and Quandt (1978) for details). The results are presented in Table 1.[6)]

Column (1) corresponds to the estimates obtained by Quandt (1981); those presented in column 1 of Table 1 below are obtained by us, and there are only minor differences between these and those presented in Quandt (1981), p. 60. What is important about this set of results is the fact that they represent only a local optimum.[7)] A set of results corresponding to the global optimum with specification (1), (2) and (3) is shown in column (2), and some very important differences between these results can be observed. According to the results in column (2), the supply equation breaks down completely; the elasticity with respect to the scale variable rises to 3.2. On the other hand, the negative slope of the demand schedule

Table 1. Maximum Likelihood Estimates of the Aggregate U.S. Labor Market Model

Parameter	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
$\hat{a}_0$	-.316 (.399)	-.254 (.357)	.390 (.070)			.939 (.501)	1.183 (.148)	na	-.490 (.169)	2.618 (.609)	.680 (.284)	.238 (.430)	1.186 (.085)
$\hat{a}_1$	-.431 (.105)	-.449 (.088)	-.180 (.023)	-.315 (.292)	-.234 (.046)	-.011 (.170)	.053 (.046)	na	-.387 (.043)	.031 (.189)	-.174 (.087)	-.077 (.122)	.188 (.029)
$\hat{a}_2$	.925 (.072)	.911 (.065)	.811 (.012)	.654 (.139)	.632 (.017)	.716 (.086)	.676 (.025)	na	.960 (.033)	.408 (.109)	.733 (.047)	.852 (.078)	.685 (.014)
$\hat{a}_3$	-.011 (.003)	-.010 (.002)	-.016 (.001)	.007 (.009)	-.005 (.001)	-.016 (.004)	-.018 (.001)	na	-.013 (.002)	-.012 (.006)	-.005 (.002)	-.021 (.004)	-.021 (.006)
$\hat{b}_0$	-1.859 (.984)	-12.417 (.504)	-8.960 (.961)			-8.109 (2.064)	-15.959 (1.435)	na	3.957 (12.466)	-11.531 (.243)	.234 (.657)	-12.379 (.508)	-1.477 (.347)
$\hat{b}_1$	-.215 (.066)	-.473 (.050)	-.469 (.035)	.756 (.208)	.722 (.024)	-.594 (.105)	-.325 (.091)	na	-.546 (2.785)	-.446 (.023)	-.182 (.027)	-.472 (.049)	-.260 (.018)
$\hat{b}_2$	1.221 (.182)	3.163 (.286)	2.527 (.177)	1.740 (.563)	1.411 (.063)	2.370 (.379)	3.814 (.264)	na	1.630 (2.522)	3.000 (.045)	.836 (.121)	3.156 (.277)	1.152 (.064)
$\hat{s}_d^2$	.0006 (.0002)	.0005 (.0001)		.0007 (.0003)		.0005 (.0002)		na		.0003 (.0001)		.0004 (.0001)	
$\hat{s}^2$			.0004 (.00002)		.0008 (.00004)		.0003 (.00003)	na	.0002 (.00002)		.0003 (.00003)		.0003 (.00002)
$\hat{s}_s^2$	.0002 (.0001)	.00002 (.00002)		.001 (.0006)		.0001 (.00005)		na		.00003 (.00002)		.00002 (.00002)	
lnL	108.8	110.1	95.7	101.6	99.8	57.0	54.8	na	23.7	66.7	59.8	92.9	86.9
minimum condition	MN	MN	GTZ	MN	GTZ	MN	GTZ	MN	GTZ	MN	GTZ	MN	GTZ

Standard errors are in parentheses, lnL is the value of the log likelihood at optimum (computed by using the Maddala-Nelson likelihood function), (1) corresponds to the set of estimates obtained by Quandt (1981), (2) "new" estimates with the same data and the same minimum condition, (3) estimates with GTZ minimum condition, (4) and (5) estimates with differenced data, (6) and (7) estimates with the data for 1930-1952, (8) and (9) estimates with the data for 1953-1973, (10) and (11) estimates with 23 central observations, and, finally, (12) and (13) estimates with 36 central observations. In the case of equation (8), the variance of the supply equation went to zero when the accuracy was set below .0001.

is steeper than the slope of the supply equation; thus, wages would have to be increased in order to eliminate the excess supply of labor, which sounds somewhat unreasonable. Far more serious, however, is the fact that the new estimates presented in column (2) indicate that only 1943-1945 and 1953 are excess demand periods; these are, of course, the last years of World War II and the Korean War. All other periods are classified as excess supply periods (according to this crude classification system).

How do the results change when the GTZ specification is used? Column (3) in Table 1 indicates that they are very similar to those with the MN specification in column (2). The only notable difference is that the wage elasticity in the demand equation becomes much smaller (and the "second" excess demand period also includes the years 1954-1957).[8)]

Next we turn to the results obtained by causing some perturbations with the data. That is, the data are differenced (columns (4) and (5)), the data sample is divided into two parts (columns (6) - (9)) and, finally, only some "central" observations are used in estimation.[9)]

On the whole, these results display a great deal of sensitivity; in particular, this is true for the coefficient of the wage variable (compared e.g. with the values presented in Hamermesh (1984)). Moreover, the coefficient of the potential number of hours variable, $\ln P_t$, has in all cases unreasonably high values - obviously compensating for the high negative wage elasticity. In terms of robustness, there is no clear difference between the MN and GTZ minimum conditions; in terms of individual parameter estimates, there are, however, some substantial differences. Finally, mention can be made of computational problems; for instance, in the case of equation (8) in Table 1 the variance of the supply equation completely vanishes (irrespective of the initial values) when the iteration accuracy is set below .0001. Given this evidence, one might, first of all, suspect that the structural equations (1) and (2) are misspecified, in terms of dynamics, for instance. The problem is that handling the dynamic specification in the context of disequilibrium models is very difficult, especially in respect of the MN-minimum condition (this is emphasized by Richard (1982), in particular). However, we carried out some experiments by introducing lagged exogeneous variables into (1) and (2) as additional variables. In general, this did not produce meaningful results. It was only when a lagged $\ln Q$ variable was introduced into the demand equation and a lagged $\ln w_{nt}$ variable into the supply equation that the results thus obtained made sense. This result suggests that the behavioral equations of the Rosen and Quandt (1978) model might indeed be misspecified.[10)]

On the other hand, one can, of course, ask whether the failures of the Rosen and Quandt model result from the incorrect assumption that the labor market is never in equilibrium. Even though testing this assumption is beyond the scope of this paper, we carried out some sampling experiments generating data from an equilibrium model and fitting the disequilibrium model to this data. The results (which are available upon request from the authors) were to a large extent analogous to those presented in Table 1, indicating that the coefficient estimates of the price terms, in particular, are very imprecise and sensitive. We should, of course, bear in mind that, even if one succeeds in obtaining some "reasonable" estimates for a disequilibrium model, it does not prove the existence of disequilibrium.[11)]

3. CONCLUDING REMARKS

The results of Rosen and Quandt have, on occasions, been considered to be "promising". The analyses performed above cast some doubts on this conclusion. In order to obtain a more affirmative result one should at least try to respecify the disequilibrium model and try to carry out a formal analysis on the relative performance of an equilibrium and a disequilibrium model.

FOOTNOTES

1) One can, for instance, refer to the assumption of exogeneous prices, to the treatment of rationing schemes and to the problems of aggregation. The inability of disequilibrium models to produce unambiguous comparative statics results should also be mentioned here (cf. Hildenbrand and Hildenbrand (1978)), to speak nothing of the computational and conceptual problems arising with multimarket disequilibrium models (cf. e.g. Kooiman and Kloek (1981)).

2) As is well-known, there are no formal specification tests for disequilibrium models. The procedures mentioned above are, in fact, only some kind of informal analogues for the Plosser-Schwert-White (1982) specification test, the Utts (1982) Rainbow- test and the Chow (1960) test. In the subsequent analysis we do not try to compute any test statistics but only scrutinize the behavior of the parameter estimates under these perturbations.

3) Notice that, in fact, this specification of the scale variable P_t leaves aside the supply-induced changes in average annual hours. Obviously this is a very strong a priori restriction for the estimation procedure.

4) The wage adjustment equation is used in Rosen and Quandt (1978) but not in e.g. Quandt (1981). A comparison made in Quandt (1981) reveals that the inclusion of the wage adjustment equation has only a minor effect on the parameter estimates of (1) and (2). Quandt himself argues in this connection that dropping the wage adjustment equation may also help to avoid anomalous results due to the fact that the real wage rose in all but three years during the sample period 1930-1973.

5) Cf. Maddala and Nelson (1974), on the one hand, and Ginsburgh, Tishler and Zang (1980), on the other hand. Notice that the GTZ specification can be obtained from the MN specification when the error distribution degenerates because of perfect correlation and equal variances of the error terms. Thus these two specifications represent two extremes in terms of the assumed correlation structure between e_{1t} and e_{2t}. This, in turn, motivates the use of both specifications in checking the robustness of results. The pros and cons of these specifications are discussed in Quandt (1982) and Sneessens (1981). Sneessens (1981) also contains a Monte Carlo study which indicates that the GTZ specification is more robust and produces smaller mean square errors than the MN specification.

6) The likelihood function was maximized using first the Davidon-Fletcher-Powell (DFP) algorithm and then the Quadratic Hill Climbing (GRADX) algorithm. Derivatives were evaluated numerically. Accuracy was first set to 1.0E-04 and then increased to 1.0E-12.

7) In fact, numerous local maxima could be found corresponding to different initial values and iteration accuracy. Convergence required that the initial values were fairly close to the final optimum. Furthermore, accuracy was very important. Only by increasing accuracy up to 1.0E-12 could one be sure that the final optimum was reached. To give some

flavour of the results corresponding to different local maxima we present the following two sets of estimates using the MN minimum condition and the GTZ minimum condition respectively.

$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{b}_0$	$\hat{b}_1$	$\hat{b}_2$	$\hat{s}_d^2$	$\hat{s}^2$	$\hat{s}_s^2$
.653 (.636)	-.125 (.195)	.761 (.110)	-.014 (.003)	-3.565 (1.040)	-.356 (.072)	1.536 (.192)	.0005 (.0002)		.0005 (.0002)

ln L = 108.7

$\hat{a}_0$	$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{b}_0$	$\hat{b}_1$	$\hat{b}_2$	$\hat{s}_d^2$	$\hat{s}^2$	$\hat{s}_s^2$
1.389 (.091)	-.082 (.031)	.619 (.015)	-.012 (.006)	-2.914 (.751)	.007 (.042)	6.318 (.138)		.0007 (.0003)	

ln L = 89.8

8) The results corresponding to column (3) in Table 1, but allowing for the distribution of the error term to vary from one regime to the other as follows: $u_t \sim N(0, s_1^2)$ if $D_t^e \leq S_t^e$ and $u_t \sim N(0, s_2^2)$ otherwise, are:

$$D_t^e = \underset{(.022)}{.421} - \underset{(.014)}{.160} \ln w_t + \underset{(.004)}{.806} \ln Q_t - \underset{(.001)}{.016} t$$

$$S_t^e = \underset{(.390)}{-8.832} - \underset{(.018)}{.464} \ln w_{nt} + \underset{(.093)}{2.503} \ln P_t$$

$$\hat{s}_1^2 = \underset{(.00002)}{.0005} \quad \hat{s}_2^2 = \underset{(.00001)}{.0001} \quad \ln L = 1609.9$$

(A comparable value of the log likelihood for column (3) in Table 1 is 1550.4). Clearly, the results are by no means better than those obtained by the original (homoscedastic) GTZ specification (nor do there exist less computational problems). The same is, in fact, true with the results corresponding to columns (5), (7), (9), (11) and (13) in Table 1.

9) The central observations were chosen so that the right-hand side variables of (1) and (2) only included observations such that $\bar{x}_i - zSD_i \leq x_i \leq \bar{x}_i + zSD_i$ for all i, $\bar{x}_i$ being the sample mean of x_i and SD_i the corresponding standard deviation. Columns (10) - (13) correspond to the following values of z: 1.5 and 1.0 (cf. Utts (1982)).

10) The corresponding estimation results (with the Maddala-Nelson minimum condition) are:

$$\ln D_t^e = \underset{(.363)}{-.453} - \underset{(.094)}{.455} \ln w_t + \underset{(.083)}{.791} \ln Q_t + \underset{(.058)}{.160} \ln Q_{t-1} - \underset{(.002)}{.011} t$$

$$\hat{s}_d^2 = \underset{(.0001)}{.0005}$$

$$\ln S_t^e = \underset{(1.107)}{-3.334} + \underset{(.163)}{.150} \ln w_{nt} - \underset{(.195)}{.441} \ln w_{nt-1} + \underset{(.203)}{1.490} \ln P_t$$

$$\hat{s}_s^2 = \underset{(.00006)}{.0001} \qquad \ln L = 114.3$$

The predicted excess demand periods are: 1943-45, 1951-55, 1957 and 1966-68.

11) Obviously, there is a possibility that the labor market is characterized by excess supply, but that there are other types of parameter shifts. One way to deal with this possibility is to use so-called "threshold models" introduced by H. Tong (cf. e.g. Tong and Lim (1980)). These models make use of a threshold variable which divides the data into two parts using, for instance, the Akaike Information Criterion. Thus, in this connection we could estimate the demand function for the entire data sample (by using OLS) and then let the threshold model try to identify two sets of parameters for this function, and, finally, test whether the parameters are indeed invariant over all data points (given the "optimal" value of the threshold). This kind of exercise was carried out by using the deviation of GDP from a linear trends as a threshold variable (the "optimal" value of the threshold was chosen by the program on the basis of the AIC values). The corresponding estimates are tabulated below:

	Constant	ln w	ln Q	t	R^2	AIC
n = 45	.682	-.330	.735	-.008	.927	-288
	(.471)	(.148)	(.082)	(.003)		
n = 15	.656	-.479	.717	-.001	.994	-120
$q < \bar{q}$	(.460)	(.101)	(.089)	(.004)		
n = 30	1.870	-.482	.499	.004	.784	-192
$q > \bar{q}$	(.625)	(.218)	(.113)	(.006)		

Computing the Chow test statistic (given the value of the threshold $\bar{q} = -.033$) gives the following value: $F_{4,37} = 4.708$. Thus, one can conclude that the explanatory power of equation (1) can be increased by allowing for a change in parameters. Obviously, it is not necessary that, in general, the parameter shifts correspond to shifts from excess demand to excess supply, or vice versa. For instance, the fact that both Rosen and Quandt (1978) and Yatchew (1981) found the value of the likelihood function of the disequilibrium model to be higher than that of the corresponding equilibrium model does not really prove the existence of disequilibrium with regime shifting.

REFERENCES

CHOW, G.G. (1960) Tests for Equality between Sets of Coefficients in Two Linear Regressions, Econometrica, 591-605.

EATON, J. and R.E. QUANDT (1983) A Model of Rationing and Labor Supply: Theory and Estimation, Economica, 221-233.

GINSBURGH, V., TISHLER, A. and ZANG, I. (1980) Alternative Estimation Methods for Two-Regime Models, European Economic Review, 207-228.

HAMERMESH, D.S. (1984) The Demand for Labor in the Long Run, NBER Working Paper No. 1297, to appear in O. Ashenfelter and R. Layard, eds., Handbook of Labor Economics, North-Holland.

HILDENBRAND, K. and W. HILDENBRAND (1978) On Keynesian Equilibria with Unemployment and Quantity Rationing, Journal of Economic Theory, 255-277.

KOOIMAN, P. and T. KLOEK (1981) An Empirical Two Market Disequilibrium Model for Dutch Manufacturing, Working Paper, Erasmus University.

MADDALA, G.S. and F.D. NELSON (1974) Maximum Likelihood Methods for Models of Markets in Disequilibrium, Econometrica, 1013-1030.

PLOSSER, C.I., SCHWERT, G.W. and H. WHITE (1982) Differencing as a Test of Specification, International Economic Review, 535-552.

QUANDT, R.E. (1981) Autocorrelated Errors in Simple Disequilibrium Models, Economics Letters, 55-61.

QUANDT, R.E. (1982) Econometric Disequilibrium Models, Econometric Reviews, 1-63.

ROSEN, H. and QUANDT, R.E. (1978) Estimating a Disequilibrium Aggregate Labor Market, Review of Economics and Statistics, 371-379.

RICHARD, J.F. (1982) Econometric Disequilibrium Models: Comment, Econometric Reviews, 81-87.

ROMER, D. (1981) Rosen and Quandt's Disequilibrium Model of the Labor Market: A Revision, Review of Economics and Statistics, 145-146.

SNEESSENS, H. (1981) Alternative Stochastic Specifications and Estimation Methods for Quantity Rationing Models; A Monte Carlo Study, London School of Economics, mimeographed.

TONG, H. and LIM, K.S. (1980) Threshold Autoregression, Limit Cycles and Cyclical Data, Journal of Royal Statistical Society, Series B, 245-292.

UTTS, J.M. (1982) The Rainbow Test for Lack of Fit in Regression, Communications in Statistics - Theory and Methods, 2801-2815.

YATCHEW, A.J. (1981) Further Evidence on Estimation of a Disequilibrium Aggregate Labor Market, Review of Economics and Statistics, 142-144.

KT 1/84 Erkki Koskela och Matti Virén
Hushållens sparande och penningmarknaderna
16.3.1984

KT 2/84 Erkki Koskela and Matti Virén
Inflation, Hedging and the Demand for Money: Some Empirical Evidence
23.3.1984

KT 3/84 Olavi Rantala
Reaalikorkojen kehityksestä
29.3.1984

KT 4/84 Erkki Koskela and Matti Virén
On the Role of Inflation in Consumption Function
30.3.1984

KT 5/84 Erkki Koskela and Matti Virén
Anticipated Versus "Surprise" Inflation in Household Consumption Behaviour
30.3.1984

KT 6/84 Marianne Stenius och Matti Virén
Budgetunderskottet och statsskulden: En nordisk jämförelse
26.4.1984

KT 7/84 Heikki Solttila
Työllisyyslohkon ennustemalli
7.5.1984

KT 8/84 Erkki Koskela and Matti Virén
The Goldfeld Demand for Money Equation Revisited
10.5.1984

KT 9/84 Paavo Peisa ja Heikki Solttila
Suurten teollisuusyritysten investointikäyttäytyminen.
Aikasarja- ja poikkileikkaustarkastelu vuosilta 1977 - 1982
10.5.1984

KT 10/84 Erkki Koskela and Matti Virén
Time-Varying Hall Consumption Function: Some Empirical Evidence
29.6.1984

KT 11/84 Matti Virén
Korot, inflaatio ja tuotanto eri maissa 1920- ja 1930-luvulla: vertaileva analyysi
2.7.1984

KT 12/84 Erkki Koskela and Matti Virén
Consumption Function, Labour Supply Rationing and Borrowing Constraints
9.7.1984

KT 13/84 Matti Virén
Inflation, Relative Prices and Household Saving Behavior
18.7.1984

KT 14/84 Timo Tyrväinen
Palkanmuodostusprosessi pohjoismaissa
27.7.1984

KT 15/84 Matti Virén
Determination of Employment with Wage and Price Speculation
9.8.1984

KT 16/84 Matti Virén
Expected Inflation and Interest Rates: Some Cross-Country Evidence
9.8.1984

KT 17/84 Paavo Peisa ja Heikki Solttila
Koron, rahoituksen saatavuuden ja velkaantuneisuuden vaikutus suurten yritysten investointikäyttäytymiseen: diskreetin valintamallin sovellutus
7.9.1984

KT 18/84 Matti Virén
Inflation, Hedging and the Fisher Hypothesis
3.10.1984

KT 19/84 Marianne Stenius and Matti Virén
Some Further Results on Rosen and Quandt's Labor Market Model

---

Luettelossa mainittuja keskustelualoitteita on rajoitetusti saatavissa kansantalouden osastolta. Kokoelma sisältää tutkimusprojekteja ja selvityksiä, joista osa on tarkoitettu myöhemmin julkaistavaksi sellaisenaan tai edelleen muokattuna. Keskustelualoitteina taltioidaan myös vanhempaa julkaisematonta aineistoa. - Koska keskustelualoitteet joissakin tapauksissa ovat raportteja keskeneräisestä tutkimustyöstä tai ovat tarkoitetut lähinnä sisäiseen käyttöön, mahdollisiin tekstilainauksiin tai -viittauksiin olisi varmistettava kirjoittajan suostumus.
Tiedustelut: Seija Määttä, puh. 183 2519