

BANCO DE PORTUGAL
Economics Research Department

**Why should Central Banks avoid the use
of the underlying inflation indicator?**

Carlos Robalo Marques
Pedro Duarte Neves
Afonso Gonçalves da Silva

WP 5-00

August 2000

The analyses, opinions and findings of this paper represent the views of the authors, they are not necessarily those of the Banco de Portugal.

Please address correspondence to Carlos Robalo Marques, Economics Research Department, Banco de Portugal, Av. Almirante Reis, nº 71, 1150-012 Lisboa, Portugal Tel.#351-1-3130000; Fax#351-1-3143841; e-mail: cmrmarques@bportugal.pt.

Why should Central Banks avoid the use of the underlying inflation indicator?

Carlos Robalo Marques (*)

Pedro Duarte Neves (*)

Afonso Gonçalves da Silva (*)

August 2000

Abstract

This paper assesses the usefulness of the commonly used underlying inflation indicator, in light of the criteria proposed in Marques et al. (2000). Empirical evidence for a group of six countries strongly suggests that the use of underlying inflation as an indicator of trend inflation should be avoided.

Keywords: core inflation indicator; underlying inflation; evaluation criteria

JEL classification: C43, E31, E52

(*)We would like to thank Maximiano Pinheiro and José Ferreira Machado for helpful comments on a previous draft of this paper. The usual disclaimer applies.

1. Introduction

The “CPI excluding unprocessed food and energy” indicator, also known as “underlying inflation”, was one of the first core inflation indicators ever proposed in the literature. Blinder (1982) uses the CPI excluding food, energy and mortgage interest costs to estimate the underlying inflation for the USA in the 1970s, as these components were largely responsible for the inflationary shocks of 74 and 78-80. During the 1980s and early 1990s, this type of indicators became extremely popular amongst Central Banks.¹ The procedure is motivated by the high volatility of the excluded categories, which is supposed to be caused by temporary, non-monetary phenomena.²

However, recent research on core inflation has cast some doubts on the usefulness of this indicator. Other core inflation indicators have been developed – such as trimmed means – and most of them seem to outperform the underlying inflation measure. See, for instance, Bryan and Cecchetti (1994), Freeman (1998) and Marques *et al.* (2000). On the other hand, since there is no economic model explaining the construction of the indicator, the selection of the excluded items is a purely subjective decision. From a theoretical point of view, although we can think of core inflation estimation as a signal extraction problem, it seems highly unrealistic to assume that some categories contain no information at all.

This paper presents further evidence against the use of the underlying inflation indicator, resorting to the concept of desirable properties of a measure of core inflation, as defined in Marques *et al.* (2000). The empirical evidence presented below shows that the underlying inflation indicator systematically fails these conditions, for a reasonably large number of different countries.

¹ The monitoring of such an indicator is common practice in the United States. Banco de Portugal [see Nascimento (1990)], Banco de España, Banca d'Italia, the Deutsche Bundesbank, De Nederlandsche Bank and Banque Nationale de Belgique have, among others, commented either on a regular basis or in a case-by-case basis the evolution of such a type of indicator. See Álvarez and Matea (1999) for a complete list of references. Finally, the European Central Bank regularly mentions a similar measure of inflation in its Monthly Bulletins.

² Empirical evidence that unprocessed food and energy prices are more volatile, on average, than the remaining components of the CPI is provided for instance in Álvarez and Matea (1999). Bryan *et al.* (1997) also provides empirical evidence that fresh food and energy goods are more likely to be trimmed than the average component of the CPI in the computation of their selected trimmed inflation measure.

This paper is organised as follows. Section 2 describes some conditions that a core inflation indicator should verify. In section 3, some arguments against the use of the underlying inflation indicator are presented. The empirical results are shown in section 4. Section 5 concludes.

2. The properties of core inflation indicators

Assume that for any given period t the inflation rate, say π_t , is broken down into the sum of two components: a permanent component named core or trend inflation, say π_t^c , and a temporary component represented by u_t . Therefore, we have:

$$\pi_t = \pi_t^c + u_t . \quad (1)$$

In equation (1), we assume that the temporary disturbances in the inflation rate, u_t , are caused by developments such as changes in weather conditions, disturbances in the demand and supply of goods, etc. By definition, u_t is expected to have zero mean and finite variance, and therefore non-stationarity is excluded on theoretical grounds. Notice for instance that, if u_t were allowed to exhibit a nonzero mean, then π_t^c would not be capturing the whole systematic component of π_t .

According to Marques *et al.* (2000), when inflation is an I(1) process, an appropriate measure of core inflation, say π_t^* , should verify the following:³

- i) π_t^* is I(1) and π_t and π_t^* are cointegrated with unitary coefficient, i.e. $(\pi_t - \pi_t^*)$ is stationary with zero mean;⁴
- ii) there is an error correction mechanism for π_t given by $z_{t-1} = (\pi_{t-1} - \pi_{t-1}^*)$, i.e. $\gamma \neq 0$ in

³ Marques *et al.* (2000) also proposes a set of testable conditions when the inflation rate is a stationary variable.

⁴ This condition was first proposed by Freeman (1998).

$$\Delta\pi_t = \sum_{j=1}^m \alpha_j \Delta\pi_{t-j} + \sum_{j=1}^m \beta_j \Delta\pi_{t-j}^* - \gamma(\pi_{t-1} - \pi_{t-1}^*) + \varepsilon_t ; \quad (2)$$

iii) π_t^* is strongly exogenous for the parameters of equation (2).

Condition i) is a direct consequence of the definition of u_t in equation (1). Condition ii) may be interpreted as the requirement of π_t^* being an attractor for π_t , as the error correction mechanism forces inflation to converge towards its trend. In other words, π_t^* should act as a leading indicator for π_t . Condition iii) guarantees that the path of π_t^* is not influenced by past values of π_t , i.e. that π_t does not Granger cause π_t^* .

We test condition i) in two steps. First, we use a unit root test to establish the stationarity of $z_t = (\pi_t - \pi_t^*)$. We then test the null $\alpha = 0$ in the static regression

$$\pi_t = \alpha + \pi_t^* + u_t , \quad (3)$$

given that z_t is stationary. After establishing condition i), the verification of ii) is simple, just requiring the estimation of model (2). The hypothesis $\gamma = 0$ can then be tested with the conventional t-ratio of $\hat{\gamma}$. Condition iii) implies that in the error correction model for π_t^* ,

$$\Delta\pi_t^* = \sum_{j=1}^r \delta_j \Delta\pi_{t-j}^* + \sum_{j=1}^r \theta_j \Delta\pi_{t-j} - \lambda(\pi_{t-1}^* - \pi_{t-1}) + \eta_t , \quad (4)$$

the null hypothesis $\lambda = \theta_1 = \dots = \theta_r = 0$ should not be rejected. A necessary condition for iii) is weak exogeneity of π_t^* . This can be verified by testing $\lambda = 0$ in equation (4).

3. Why should one not expect underlying inflation to measure core inflation

The underlying inflation indicator is obtained by excluding some components of the CPI. Let us define

$$P_t = \alpha P_t^0 + (1 - \alpha) P_t^1 \quad (5)$$

where P_t stands for the CPI, P_t^1 for the items excluded from the CPI with the argument that they are more volatile, i.e. energetic products and unprocessed food, and $(1 - \alpha)$ for the weight of the remaining goods and services. Therefore, by definition, P_t^0 represents the price index used to compute underlying inflation. For monthly data this equation may be rewritten as

$$\pi_t = \alpha_t w_t + (1 - \alpha_t) v_t, \quad (6)$$

where

$$\pi_t = \frac{P_t}{P_{t-12}} - 1; w_t = \frac{P_t^0}{P_{t-12}^0} - 1; v_t = \frac{P_t^1}{P_{t-12}^1} - 1; \alpha_t = \alpha \cdot \frac{P_{t-12}^0}{P_{t-12}}. \quad (7)$$

Notice that w_t is our conventional underlying inflation indicator. Now we may ask under what conditions does w_t meet the first criterion for a core inflation indicator. Recall that this will be satisfied if, in the static regression

$$\pi_t = \beta w_t + u_t, \quad (8)$$

we have $\beta = 1$ and $u_t \sim I(0)$. Let us see under what circumstances we can approximate (6) by (8). If we define

$$\alpha_t = \mu + \varepsilon_t, \quad (9)$$

expression (6) can be rewritten as

$$\pi_t = \mu w_t + (1-\mu)v_t + (\alpha_t - \mu)(w_t - v_t) , \quad (10)$$

Now, if π_t is I(1), one expects w_t and v_t also to be I(1).⁵ If v_t and w_t are not cointegrated, then clearly π_t and w_t may not be cointegrated either. On the other hand, if v_t and w_t are cointegrated, we may write

$$v_t = \theta w_t + \eta_t , \quad (11)$$

with $\eta_t \sim I(0)$. Inserting (11) into (10), one gets

$$\pi_t = [\mu + (1-\mu)\theta]w_t + u_t , \quad (12)$$

where

$$u_t = (\alpha_t - \mu)(w_t - v_t) + (1-\mu)\eta_t . \quad (13)$$

Now, if $\theta = 1$, we are back to our definition of a core inflation measure presented in equation (1) of the previous section. So, in order to have $\beta = 1$ and $u_t \sim I(0)$ in (8), it is necessary and sufficient that both α_t and $(w_t - v_t)$ are stationary variables.

The fact that this may not occur means that the items excluded from the CPI in order to compute w_t , i.e. P_t^1 , may contain some information that systematically differs from the one included in z_t . Therefore, in computing the underlying inflation indicator, we may be excluding too much information, i.e., we may be excluding from π_t not only “noise” but also “signal”. If this is the case, w_t will not meet condition i) in section 2.

It is also easy to understand why w_t must not be expected to meet conditions ii) and iii), i.e. to be a leading indicator for π_t and not to be Granger caused by π_t . In order to compute w_t , we exclude from the CPI the prices of goods that enter as

⁵ If $v_t \sim I(0)$, then (6) states that $\pi_t - \alpha_t w_t$ is stationary. Therefore, it is not possible to have $\beta=1$ in (8), as $0 < \alpha_t < 1$.

intermediate inputs in the production process (energetic goods and unprocessed food). Therefore, changes in v_t are expected to direct and contemporaneously affect π_t , while affecting w_t indirectly with a lag. This being so, v_t is a leading indicator for w_t and as long as it affects π_t , this means that π_t also appears as a leading indicator for w_t . In practice, this situation would cause conditions ii) and iii) of the previous section not to be verified, since CPI inflation would cause, rather than be caused by, underlying inflation. As section 4 shows, this is the type of results obtained for the six countries considered in this study.

4. Empirical results

This paper assesses the empirical properties of underlying inflation for six different countries: USA, Germany, France, Italy, Spain and Portugal. For the cases of the USA and France, however, there is no available information for the unprocessed component of food and, therefore, the whole class of food was excluded. Data is described in Table 1.

Table 1 – Data Description

Series	Excluded items	Sample period
USA	Food and energy	1987:1 2000:2
Germany	Seasonal food and energy	1992:1 2000:4
France	Food, energy and public utilities	1987:1 1997:12
Italy	Fresh food and energy	1987:1 2000:5
Spain	Unprocessed food and energy	1987:1 2000:2
Portugal	Unprocessed food and energy	1987:1 1999:12

Preliminary testing showed that the null of a unit root in CPI inflation could not be rejected (by an ADF test) for any country. Therefore, we are able to use the testing

procedure described in section 2. Table 2 contains the main results of these tests.⁶ The stationarity tests on CPI inflation are shown in column 1. Columns 2 and 3 report the tests on condition i). Column 4 refers to condition ii), while columns 5 and 6 present the results on both versions of condition iii). Finally, column 7 shows the conclusions drawn from the tests.

Since the tests for conditions ii) and iii) are conditional on the verification of i), we did not test conditions ii) and iii) for the series that failed the first criterion (i.e. Italy and Portugal). For Portugal, we conclude that the series are not cointegrated with unitary coefficient, so it may be possible for CPI inflation to diverge from underlying inflation for substantial periods of time. For Italy, in spite of evidence showing a strong cointegration relationship, the test on column 3 reports a systematic bias of the underlying inflation measure, which naturally lessens its interest as a core inflation indicator.

For all other countries, condition i) is verified; however, condition ii) does not hold. Recall that this condition required the underlying inflation indicator to “attract” CPI inflation. The fact that this does not occur means that knowing CPI inflation is, say, below underlying inflation in a given period, does not convey any information on the future path of CPI inflation.

Given the results so far, one would of course expect condition iii) not to hold also. Since π_t and π_t^* are cointegrated and there is no ECM representation for π_t , the Granger Representation Theorem requires that an ECM representation exists for π_t^* . This is in fact verified (in column 5) for all countries but Spain. However, even in this case, the null would not be rejected at the 10% level of significance. This means that underlying inflation is not a leading indicator for inflation and, moreover, that it is the inflation rate itself that appears to lead the so-called indicator of underlying inflation, as the analysis in section 3 suggests.

⁶ In the testing procedure, we used significance levels of 10% for the ADF tests, and 5% for the t and F tests. We set the orders of the lag polynomials in the ADF and the ECM regressions such that the residuals were not autocorrelated. Although the ECM models presented in section 2 (equations (2) and (4)) do not include a constant term, we also tested conditions ii) and iii) with a nonzero constant. We show the results for this case only when the conclusions differ from the main test.

5. Conclusions

This paper shows that the so-called measure of underlying inflation, which is used by several Central Banks as a measure of trend inflation, does not meet the necessary conditions set out in Marques *et al.* (2000). These conditions posit that any core inflation measure should be cointegrated with inflation (with a unit coefficient) and act as an attractor for inflation, i.e., to Granger cause inflation but not to be Granger caused by it. Therefore, it appears to be inappropriate to use this indicator to analyse the current status of inflation or to make inference about its likely future path.

References

Álvarez, L.J., Matea, M.L. (1999) “Underlying Inflation Measures in Spain”, Banco de España, Working Paper 9911.

Blinder, A.S. (1982) “The Anatomy of Double-Digit Inflation in the 1970s”, in *Inflation: Causes and Effects*, R.E. Hall (ed.), University of Chicago Press for NBER, pp. 261-282.

Bryan, M.F., Cecchetti, S.G. (1994) “Measuring Core Inflation”, in *Monetary Policy*, N.G. Mankiw (ed.), University of Chicago Press for NBER, pp. 195-215.

Bryan, M.F., Cecchetti, S.G., Wiggins II, R.L. (1997) “Efficient Inflation Estimation”, NBER, Working Paper 6183, September.

Freeman, D.G. (1998) “Do core inflation measures help forecast inflation?”, *Economics Letters* 58, pp. 143-147.

Marques, C.R., Neves, P.D., Sarmiento, L.M. (2000) “Evaluating Core Inflation Indicators”, Banco de Portugal, Working Paper 3/00, April.

Nascimento, T. (1990), “Indicadores de Inflação”, *Boletim Trimestral do Banco de Portugal*, vol. 12, nº 4, December.

Table 2 – Evaluating the underlying inflation indicator^(a)

	Stationarity of π	Stationarity of $(\pi - \pi^*)$	$\alpha = 0$ given $\beta = 1$	$\gamma = 0$	$\lambda = 0$	Strong exogeneity $\lambda = \theta_1 = \dots = \theta_r = 0$	Conclusion
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
USA	No ADF(1) = -2.00	Yes ADF(1) = -2.81 *	Yes P = 0.163	Yes P = 0.250	No ^(b) P = 0.024	No ^(c) P = 0.045	Fails conditions ii) and iii)
Germany	No ADF(1) = -2.46	Yes ADF(1) = -3.12 **	Yes P = 0.277	Yes P = 0.378	No P = 0.001	No P = 0.018	Fails conditions ii) and iii)
France	No ADF(1) = 0.52	Yes ADF(1) = -2.73 *	Yes P = 0.079	Yes P = 0.824	No ^(d) P = 0.038	Yes P = 0.520	Fails conditions ii) and iii)
Italy	No ADF(1) = -0.28	Yes ADF(1) = -3.62 ***	No P = 0.033	---	---	---	Fails condition i)
Spain	No ADF(1) = -0.53	Yes ADF(1) = -2.93 **	Yes P = 0.099	Yes P = 0.287	Yes P = 0.093	Yes P = 0.258	Fails condition ii)
Portugal	No ADF(1) = -0.39	No ADF(1) = -1.91	---	---	---	---	Fails condition i)

(a) The significance level of the ADF tests is marked: * for 10%, ** for 5%, *** for 1%. In all other tests, P stands for the corresponding p-value.

(b) We have $\lambda=0$ in the model with constant term, with P=0.064

(c) We have $\lambda=\theta_1=\theta_2=\dots=\theta_r=0$ in the model with constant term, with P=0.071

(d) We have $\lambda=0$ in the model with constant term, with P=0.131

WORKING PAPERS

- 1/90** PRODUTO POTENCIAL, DESEMPREGO E INFLAÇÃO EM PORTUGAL
Um estudo para o período 1974-1989
— Carlos Robalo Marques
- 2/90** INFLAÇÃO EM PORTUGAL
Um estudo econométrico para o período 1965-1989, com projecções para 1990 e 1991
— Carlos Robalo Marques
- 3/92** THE EFFECTS OF LIQUIDITY CONSTRAINTS ON CONSUMPTION BEHAVIOUR
The Portuguese Experience
— Sílvia Luz
- 4/92** LOW FREQUENCY FILTERING AND REAL BUSINESS CYCLES
— Robert G. King, Sérgio T. Rebelo
- 5/92** GROWTH IN OPEN ECONOMIES
— Sérgio Rebelo
- 6/92** DYNAMIC OPTIMAL TAXATION IN SMALL OPEN ECONOMIES
— Isabel H. Correia
- 7/92** EXTERNAL DEBT AND ECONOMIC GROWTH
— Isabel H. Correia
- 8/92** BUSINESS CYCLES FROM 1850 TO 1950: NEW FACTS ABOUT OLD DATA
— Isabel H. Correia, João L. Neves, Sérgio Rebelo
- 9/92** LABOUR HOARDING AND THE BUSINESS CYCLE
— Craig Burnside, Martin Eichenbaum, Sérgio Rebelo
- 10/92** ANALYSIS OF FOREIGN DIRECT INVESTMENT FLOWS IN PORTUGAL USING PANEL DATA
— Luísa Farinha
- 11/92** INFLATION IN FIXED EXCHANGE RATE REGIMES:
THE RECENT PORTUGUESE EXPERIENCE
— Sérgio Rebelo
- 12/92** TERM STRUCTURE OF INTEREST RATES IN PORTUGAL
— Armindo Escalda
- 13/92** AUCTIONING INCENTIVE CONTRACTS: THE COMMON COST CASE
— Fernando Branco
- 14/92** INDEXED DEBT AND PRODUCTION EFFICIENCY
— António S. Mello, John Parsons

- 15/92** "TESTING" FOR MEAN AND VARIANCE BREAKS WITH DEPENDENT DATA
— José A. F. Machado
- 16/92** COINTEGRATION AND DYNAMIC SPECIFICATION
— Carlos Robalo Marques
- 17/92** FIRM GROWTH DURING INFANCY
— José Mata
- 18/92** THE DISTRIBUTION OF HOUSEHOLD INCOME AND EXPENDITURE IN PORTUGAL: 1980
and 1990
— Miguel Gouveia, José Tavares
- 19/92** THE DESIGN OF MULTIDIMENSIONAL AUCTIONS
— Fernando Branco
- 20/92** MARGINAL INCOME TAX RATES AND ECONOMIC GROWTH IN DEVELOPING
COUNTRIES
— Sérgio Rebelo, William Easterly
- 21/92** THE EFFECT OF DEMAND AND TECHNOLOGICAL CONDITIONS ON THE LIFE
EXPECTANCY OF NEW FIRMS
— José Mata, Pedro Portugal
- 22/92** TRANSITIONAL DYNAMICS AND ECONOMIC GROWTH IN THE NEOCLASSICAL MODEL
— Robert G. King, Sérgio Rebelo
- 23/92** AN INTEGRATED MODEL OF MULTINATIONAL FLEXIBILITY AND FINANCIAL HEDGING
— António S. Mello, Alexander J. Triantis
- 24/92** CHOOSING AN AGGREGATE FOR MONETARY POLICY: A COINTEGRATION APPROACH
— Carlos Robalo Marques, Margarida Catalão Lopes
- 25/92** INVESTMENT: CREDIT CONSTRAINTS, REGULATED INTEREST RATES AND
EXPECTATIONS OF FINANCIAL LIBERALIZATION THE PORTUGUESE EXPERIENCE
— Kolemán Strumpf
- 1/93** SUNK COSTS AND THE DYNAMICS OF ENTRY
— José Mata
- 2/93** POLICY, TECHNOLOGY ADOPTION AND GROWTH
— William Easterly, Robert King, Ross Levine, Sérgio Rebelo
- 3/93** OPTIMAL AUCTIONS OF A DIVISIBLE GOOD
— Fernando Branco
- 4/93** EXCHANGE RATE EXPECTATIONS IN INTERNATIONAL OLIGOPOLY
— Luís Cabral, António S. Mello
- 5/93** A MODEL OF BRANCHING WITH AN APPLICATION TO PORTUGUESE BANKING
— Luís Cabral, W. Robert Majure

- 6/93** HOW DOES NEW FIRM SURVIVAL VARY ACROSS INDUSTRIES AND TIME?
— José Mata, Pedro Portugal
- 7/93** DO NOISE TRADERS “CREATE THEIR OWN SPACE”?
— Ravi Bhushan, David P. Brown, António S. Mello
- 8/93** MARKET POWER MEASUREMENT – AN APPLICATION TO THE PORTUGUESE CREDIT MARKET
— Margarida Catalão Lopes
- 9/93** CURRENCY SUBSTITUTABILITY AS A SOURCE OF INFLATIONARY DISCIPLINE
— Pedro Teles
- 10/93** BUDGET IMPLICATIONS OF MONETARY COORDINATION IN THE EUROPEAN COMMUNITY
— Pedro Teles
- 11/93** THE DETERMINANTS OF FIRM START-UP SIZE
— José Mata
- 12/93** FIRM START-UP SIZE: A CONDITIONAL QUANTILE APPROACH
— José Mata, José A. F. Machado
- 13/93** FISCAL POLICY AND ECONOMIC GROWTH: AN EMPIRICAL INVESTIGATION
— William Easterly, Sérgio Rebelo
- 14/93** BETA ESTIMATION IN THE PORTUGUESE THIN STOCK MARKET
— Armindo Escalda
- 15/93** SHOULD CAPITAL INCOME BE TAXED IN THE STEADY STATE?
— Isabel H. Correia
- 16/93** BUSINESS CYCLES IN A SMALL OPEN ECONOMY
— Isabel H. Correia, João C. Neves, Sérgio Rebelo
- 17/93** OPTIMAL TAXATION AND CAPITAL MOBILITY
— Isabel H. Correia
- 18/93** A COMPOSITE COINCIDENT INDICATOR FOR THE PORTUGUESE ECONOMY
— Francisco Craveiro Dias
- 19/93** PORTUGUESE PRICES BEFORE 1947: INCONSISTENCY BETWEEN THE OBSERVED COST OF LIVING INDEX AND THE GDP PRICE ESTIMATION OF NUNES, MATA AND VALÉRIO (1989)
— Paulo Soares Esteves
- 20/93** EVOLUTION OF PORTUGUESE EXPORT MARKET SHARES (1981-91)
— Cristina Manteu, Ildeberta Abreu
- 1/94** PROCUREMENT FAVORITISM AND TECHNOLOGY ADOPTION
— Fernando Branco

- 2/94** WAGE RIGIDITY AND JOB MISMATCH IN EUROPE: SOME EVIDENCE
— Sílvia Luz, Maximiano Pinheiro
- 3/94** A CORRECTION OF THE CURRENT CONSUMPTION INDICATOR – AN APPLICATION OF THE INTERVENTION ANALYSIS APPROACH
— Renata Mesquita
- 4/94** PORTUGUESE GDP AND ITS DEFLATOR BEFORE 1947: A REVISION OF THE DATA PRODUCED BY NUNES, MATA AND VALÉRIO (1989)
— Carlos Robalo Marques, Paulo Soares Esteves
- 5/94** EXCHANGE RATE RISK IN THE EMS AFTER THE WIDENING OF THE BANDS IN AUGUST 1993
— Joaquim Pires Pina
- 6/94** FINANCIAL CONSTRAINTS AND FIRM POST-ENTRY PERFORMANCE
— Paulo Brito, António S. Mello
- 7/94** STRUCTURAL VAR ESTIMATION WITH EXOGENEITY RESTRICTIONS
— Francisco C. Dias, José A. F. Machado, Maximiano R. Pinheiro
- 8/94** TREASURY BILL AUCTIONS WITH UNINFORMED BIDDERS
— Fernando Branco
- 9/94** AUCTIONS OF SHARES WITH A SECONDARY MARKET AND TENDER OFFERS
— António S. Mello, John E. Parsons
- 10/94** MONEY AS AN INTERMEDIATE GOOD AND THE WELFARE COST OF THE INFLATION TAX
— Isabel Correia, Pedro Teles
- 11/94** THE STABILITY OF PORTUGUESE RISK MEASURES
— Armindo Escalda
- 1/95** THE SURVIVAL OF NEW PLANTS: START-UP CONDITIONS AND POST-ENTRY EVOLUTION
— José Mata, Pedro Portugal, Paulo Guimarães
- 2/95** MULTI-OBJECT AUCTIONS: ON THE USE OF COMBINATIONAL BIDS
— Fernando Branco
- 3/95** AN INDEX OF LEADING INDICATORS FOR THE PORTUGUESE ECONOMY
— Francisco Ferreira Gomes
- 4/95** IS THE FRIEDMAN RULE OPTIMAL WHEN MONEY IS AN INTERMEDIATE GOOD?
— Isabel Correia, Pedro Teles
- 5/95** HOW DO NEW FIRM STARTS VARY ACROSS INDUSTRIES AND OVER TIME?
— José Mata
- 6/95** PROCUREMENT FAVORITISM IN HIGH TECHNOLOGY
— Fernando Branco

- 7/95** **MARKETS, ENTREPRENEURS AND THE SIZE OF NEW FIRMS**
— José Mata
- 1/96** **CONVERGENCE ACROSS EU COUNTRIES: INFLATION AND SAVINGS RATES ON
PHYSICAL AND HUMAN CAPITAL**
— Paulo Soares Esteves
- 2/96** **THE OPTIMAL INFLATION TAX**
— Isabel Correia, Pedro Teles
- 3/96** **FISCAL RULES OF INCOME TRANSFORMATION**
— Isabel H. Correia
- 4/96** **ON THE EFFICIENCY AND EQUITY TRADE-OFF**
— Isabel H. Correia
- 5/96** **DISTRIBUTIONAL EFFECTS OF THE ELIMINATION OF CAPITAL TAXATION**
— Isabel H. Correia
- 6/96** **LOCAL DYNAMICS FOR SPHERICAL OPTIMAL CONTROL PROBLEMS**
— Paulo Brito
- 7/96** **A MONEY DEMAND FUNCTION FOR PORTUGAL**
— João Sousa
- 8/96** **COMPARATIVE EXPORT BEHAVIOUR OF FOREIGN AND DOMESTIC FIRMS IN
PORTUGAL**
— Sónia Cabral
- 9/96** **PUBLIC CAPITAL ACCUMULATION AND PRIVATE SECTOR PERFORMANCE IN THE US**
— Alfredo Marvão Pereira, Rafael Flores de Frutos
- 10/96** **IMPORTED CAPITAL AND DOMESTIC GROWTH: A COMPARISON BETWEEN EAST ASIA
AND LATIN AMERICA**
— Ling-ling Huang, Alfredo Marvão Pereira
- 11/96** **ON THE EFFECTS OF PUBLIC AND PRIVATE R&D**
— Robert B. Archibald, Alfredo Marvão Pereira
- 12/96** **EXPORT GROWTH AND DOMESTIC PERFORMANCE**
— Alfredo Marvão Pereira, Zhenhui Xu
- 13/96** **INFRASTRUCTURES AND PRIVATE SECTOR PERFORMANCE IN SPAIN**
— Alfredo Marvão Pereira, Oriol Roca Sagales
- 14/96** **PUBLIC INVESTMENT AND PRIVATE SECTOR PERFORMANCE: INTERNATIONAL
EVIDENCE**
— Alfredo Marvão Pereira, Norman Morin
- 15/96** **COMPETITION POLICY IN PORTUGAL**
— Pedro P. Barros, José Mata

- 16/96** THE IMPACT OF FOREIGN DIRECT INVESTMENT IN THE PORTUGUESE ECONOMY
Luísa Farinha, José Mata
- 17/96** THE TERM STRUCTURE OF INTEREST RATES: A COMPARISON OF ALTERNATIVE ESTIMATION METHODS WITH AN APPLICATION TO PORTUGAL
— Nuno Cassola, Jorge Barros Luís
- 18/96** SHORT-AND LONG-TERM JOBLESSNESS: A SEMI-PARAMETRIC MODEL WITH TIME -VARYING EFFECTS
— Pedro Portugal, John T. Addison
- 19/96** SOME SPECIFICATION ISSUES IN UNEMPLOYMENT DURATION ANALYSIS
— Pedro Portugal, John T. Addison
- 20/96** SEQUENTIAL AUCTIONS WITH SYNERGIES: AN EXAMPLE
— Fernando Branco
- 21/96** HEDGING WINNER'S CURSE WITH MULTIPLE BIDS: EVIDENCE FROM THE PORTUGUESE TREASURY BILL AUCTION
— Michael B. Gordy
- 22/96** THE BRICKS OF AN EMPIRE 1415-1999: 585 YEARS OF PORTUGUESE EMIGRATION
— Stanley L. Engerman, João César das Neves
- 1/97** LOCAL DYNAMICS FOR PLANAR OPTIMAL CONTROL PROBLEMS: A COMPLETE CHARACTERIZATION
— Paulo Brito
- 2/97** INTERNATIONAL PORTFOLIO CHOICE
— Bernardino Adão, Nuno Ribeiro
- 3/97** UNEMPLOYMENT INSURANCE AND JOBLESSNESS: A DISCRETE DURATION MODEL WITH MULTIPLE DESTINATIONS
— Pedro Portugal, John T. Addison
- 4/97** THE TREASURY BILL MARKET IN PORTUGAL: INSTITUTIONAL ISSUES AND PROFIT MARGINS OF FINANCIAL INSTITUTIONS
— Bernardino Adão, Jorge Barros Luís
- 5/97** ECONOMETRIC MODELLING OF THE SHORT-TERM INTEREST RATE: AN APPLICATION TO PORTUGAL
— Nuno Cassola, João Nicolau, João Sousa
- 6/97** ESTIMATION OF THE NAIRU FOR THE PORTUGUESE ECONOMY
— Carlos Robalo Marques, Susana Botas
- 7/97** EXTRACTION OF INTEREST RATE DIFFERENTIALS IMPLICIT IN OPTIONS: THE CASE OF SPAIN AND ITALY IN THE EUROPEAN MONETARY UNION
— Bernardino Adão, Jorge Barros Luís

- 1/98** A COMPARATIVE STUDY OF THE PORTUGUESE AND SPANISH LABOUR MARKETS
— Olympia Bover, Pilar García-Perea, Pedro Portugal
- 2/98** EARNING FUNCTIONS IN PORTUGAL 1982-1994: EVIDENCE FROM QUANTILE
REGRESSIONS
— José A. F. Machado, José Mata
- 3/98** WHAT HIDES BEHIND AN UNEMPLOYMENT RATE: COMPARING PORTUGUESE
AND US UNEMPLOYMENT
— Olivier Blanchard, Pedro Portugal
- 4/98** UNEMPLOYMENT INSURANCE AND JOBLESSNESS IN PORTUGAL
— Pedro Portugal, John T. Addison
- 5/98** EMU, EXCHANGE RATE VOLATILITY AND BID-ASK SPREADS
— Nuno Cassola, Carlos Santos
- 6/98** CONSUMER EXPENDITURE AND COINTEGRATION
— Carlos Robalo Marques, Pedro Duarte Neves
- 7/98** ON THE TIME-VARYING EFFECTS OF UNEMPLOYMENT INSURANCE ON JOBLESSNESS
— John T. Addison, Pedro Portugal
- 8/98** JOB SEARCH METHODS AND OUTCOMES
— John T. Addison, Pedro Portugal
- 1/99** PRICE STABILITY AND INTERMEDIATE TARGETS FOR MONETARY POLICY
— Vítor Gaspar, Ildeberta Abreu
- 2/99** THE OPTIMAL MIX OF TAXES ON MONEY, CONSUMPTION AND INCOME
— Fiorella De Fiore, Pedro Teles
- 3/99** OPTIMAL EXECUTIVE COMPENSATION: BONUS, GOLDEN PARACHUTES, STOCK
OWNERSHIP AND STOCK OPTIONS
— Chongwoo Choe
- 4/99** SIMULATED LIKELIHOOD ESTIMATION OF NON-LINEAR DIFFUSION PROCESSES
THROUGH NON-PARAMETRIC PROCEDURE WITH AN APPLICATION TO THE
PORTUGUESE INTEREST RATE
— João Nicolau
- 5/99** IBERIAN FINANCIAL INTEGRATION
— Bernardino Adão
- 6/99** CLOSURE AND DIVESTITURE BY FOREIGN ENTRANTS: THE IMPACT OF ENTRY AND
POST-ENTRY STRATEGIES
— José Mata, Pedro Portugal
- 1/00** UNEMPLOYMENT DURATION: COMPETING AND DEFECTIVE RISKS
— John T. Addison, Pedro Portugal

- 2/00** THE ESTIMATION OF RISK PREMIUM IMPLICIT IN OIL PRICES
— Jorge Barros Luís
- 3/00** EVALUATING CORE INFLATION INDICATORS
— Carlos Robalo Marques, Pedro Duarte Neves, Luís Morais Sarmiento
- 4/00** LABOR MARKETS AND KALEIDOSCOPIIC COMPARATIVE ADVANTAGE
— Daniel A. Traça
- 5/00** WHY SHOULD CENTRAL BANKS AVOID THE USE OF THE UNDERLYING INFLATION INDICATOR?
— Carlos Robalo Marques, Pedro Duarte Neves, Afonso Gonçalves da Silva