IDENTIFICATION AND ESTIMATION OF A LABOUR MARKET MODEL FOR THE TRADEABLES SECTOR: THE GREEK CASE

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Abstract. This paper derives a theoretical labour market model for the tradeables sector of a small open economy. Using Greek manufacturing data and applying multivariate cointegrating techniques, two cointegrating vectors are estimated based on the a priori restrictions provided by the theoretical model; a labour demand and a real exchange rate equation, respectively. The short-run estimates of the model suggest that labour decisions not only depend upon past disequilibria in the labour market, but also on the discrepancy between the real exchange rate and its implied long-run equilibrium relationship, that is, the magnitude of the real exchange rate misalignment.

Keywords: Labour market, tradeable goods, cointegration, identifying restrictions, Greece.
JEL classification: C32, C51, C52, E24, O52.

1. Introduction

Based on a two-level Constant Elasticity of Substitution (CES) production function, this paper introduces a theoretical labour market model for the tradeables sector (proxied by the manufacturing sector) of a small open economy. Using quarterly data for Greece, the model is estimated by the Johansen (1988, 1995) multivariate cointegrating framework. The advantage of introducing prior economic information in Johansen's cointegrating approach is discussed in Wickens (1996), who points out that researchers often fail to give an economic interpretation to their estimated cointegrating vectors when they ignore economic theory.

Existing labour market models (see e.g. Layard *et al*., 1991) have mainly focused on the interrelationships among labour variables within the context of a Cobb-Douglas production function. Recently, using a theoretical two-level CES production function (see Bruno and Sachs, 1985; Alogoskoufis, 1990), Milas (1997) estimated a labour market model of the Greek economy. In the current paper, we extend the work in Milas (1997), by explicitly introducing in the theoretical model a long-run real exchange rate equation, as a measure of price competitiveness. The importance of this new feature, is that it allows for the effect of open economy issues upon employment and output levels in the tradeables sector. Further, we use quarterly data as opposed to annual data in Milas (1997), which allows the introduction of richer dynamics into the empirical analysis.

Our findings support the existence of two cointegrating vectors which are identified using the a priori economic information provided by the theoretical model. The first cointegrating vector can be interpreted as a long-run labour demand equation, which depends upon output and real wages. The second vector can be thought of as a long-run real exchange rate equation, depending on real wages and international oil prices. The short-run dynamics of the model suggest that labour decisions in the tradeable sector not only depend upon past disequilibria in the labour market, but also on the discrepancy between the real exchange rate and its implied long-run equilibrium relationship.

The organisation of the paper is as follows. Section 2 introduces the theoretical labour market model for the tradeables sector. Section 3 is devoted to the key empirical issues: the properties of the data, the cointegration method and results, the implied long-run equilibrium relationships, and the short-run dynamics of the model. Section 4 offers some concluding remarks.

2. The theoretical model

Starting from a two-level CES production function in the tradeables (T) sector, which is separable into capital (k_T), labour (l_T), and imported oil (o_T), and assuming perfect competition, Bruno and Sachs (1985) and Alogoskoufis (1990) have derived the following log-linear equations for gross output (q_T), oil (o_T), and employment (l_T), respectively:

$$q_T = \pi_1 v_T + (1-\pi_1) o_T, \tag{1}$$

$$o_T = q_T - \rho(p_O - p_T), \tag{2}$$

$$l_T = v_T - \sigma(w - p_T) + \frac{\sigma}{\rho}(q_T - v_T), \tag{3}$$

where v_T is value added in the tradeables sector, ρ is the elasticity of substitution between v_T and o_T, σ is the elasticity of substitution between k_T and l_T, $p_O - p_T$ is the relative price of imported oil, $w - p_T$ refers to real product wages, and π_1 is the share of value added in gross output ($0 < \pi_1 < 1$). All variables are in logs. Substituting (2) and (1) in (3) gives the long-run labour demand equation in the traded goods sector:

$$l_T = v_T - \sigma(w - p_T) - \sigma\left(\frac{1-\pi_1}{\pi_1}\right)(p_O - p_T). \tag{4}$$

According to (4), labour demand in the tradeable sector (l_T) is a function of output (v_T), tradeable wages ($w - p_T$) and the relative price of imported oil ($p_O - p_T$).

As for the non-traded goods, we assume that these are primarily services, with production being labour intensive. Thus, we write in log-linear form:

$$v_N = l_N, \tag{5}$$

where v_N and l_N refer to non-tradeable output and employment, respectively.

Assuming profit maximising monopolistic competitive firms in the sector, we get optimal prices as a mark-up on unit labour costs:

$$p_{VN} = w + \mu, \tag{6}$$

where p_{VN} refers to the value added deflator in the non-tradeable sector and μ is the constant mark-up.

The log of domestic prices is given by:

$$p = \tau p_{VT} + (1-\tau) p_{VN}, \tag{7}$$

where τ is the share of tradeables and p_{VT} is the value added deflator in the tradeable sector.

From (6) and the identity

$$p_T \equiv \pi_1 p_{VT} + (1-\pi_1) p_O, \tag{8}$$

we write domestic prices as follows:

$$p = \tau p_T + (1-\tau)w - \tau\left(\frac{1-\pi_1}{\pi_1}\right)(p_O - p_T) + (1-\tau)\mu. \tag{9}$$

Following Edwards (1989), competitiveness is defined as the relative price of tradeables to the price of domestic output, that is, $p_T - p$. Rearranging (9) in terms of $p_T - p$, we get:

$$p_T - p = -(1-\tau)(w - p_T) + \tau\left(\frac{1-\pi_1}{\pi_1}\right)(p_O - p_T) - (1-\tau)\mu. \qquad (10)$$

According to (10), competitiveness ($p_T - p$) is a function of tradeable wages ($w - p_T$) and the relative price of imported oil ($p_O - p_T$).[1] If an estimate of π_1 is available (e.g. from previous studies), then equations (4) and (10) can be simplified to:

$$l_T = v_T - \sigma(w - p_T) - \sigma(p_O - p_T)^* \qquad (11)$$

and

$$p_T - p = -(1-\tau)(w - p_T) + \tau(p_O - p_T)^*, \qquad (12)$$

where

$$(p_O - p_T)^* = \left(\frac{1-\pi_1}{\pi_1}\right)(p_O - p_T)\,. \qquad (13)$$

Equations (11) and (12) constitute a set of long-run structural equations for labour demand and competitiveness. Equation (11) assumes a unit coefficient on output (v_T), and equal effects from tradeable wages ($w - p_T$) and the relative price of imported oil $(p_O - p_T)^*$ on employment (l_T). Equation (12), on the other hand, assumes that the coefficient on tradeable wages ($w - p_T$) is equal to the coefficient on the relative price of imported oil $(p_O - p_T)^*$ minus one. The validity of these restrictions can be tested in the cointegrating space. Furthermore, the theoretical structure of the model allows us to derive estimates of some structural parameters of the economy,

[1] Here, we assume that the mark-up parameter (μ) is constant. A future approach would be to model μ as a function of demand fluctuations, that is, $\mu = -\gamma(y - y_F)$, where y and y_F refer to output and full employment output, respectively, and $\gamma > (< 0)$ if the price elasticity of demand is increasing (decreasing) in the level of activity (Bean, 1994).

namely the elasticity of substitution between capital and labour (i.e. σ), and the share of tradeables in total output (i.e. τ).

3. The empirical model

Our model uses a set of $p = 5$ variables, $z = [l_T, (p_T - p), (w - p_T), v_T, (p_O - p_T)^*]'$, for quarterly seasonally unadjusted Greek manufacturing data over the period 1963q2-1997q2.[2] Labour demand, l_T, refers to manufacturing employment. Value added, v_T, refers to manufacturing output. Tradeable earnings, w, refer to average earnings in manufacturing. Assuming that the Greek manufacturing sector is fully open to international competition and hence is a price taker, we proxy p_T by: $p_T = p_T^* + e$, where p_T^* is the dollar unit value index of industrial countries imports and e is the average drachmae/dollar exchange rate. Competitiveness is proxied by the international price of tradeables relative to domestic prices: $p_T - p = p_T^* + e - p$, where p refers to domestic consumer prices less food and rent.[3] Competitiveness can be interpreted as the real exchange rate. In this case, an increase (decrease) in $p_T - p$ is equivalent to a real depreciation (appreciation) of the domestic currency. The price of oil, p_O, is proxied by international oil prices (for a full description of the series see the Data Appendix). Firms are assumed to take $p_O - p_T$ as given, so that we can impose exogeneity of this variable for the rest of the system. In order to test the validity of the restrictions implied by equations (11) and (12) above, we assume that π_1 is equal to

[2] The choice of seasonally unadjusted data is in line with Ericsson et al. (1994), who show that the use of seasonally adjusted observations may affect not only the short-run dynamics of the system, but also the week exogeneity status of the variables (see also Chapter 15 in Hendry, 1995).
[3] In terms of relative price competitiveness in international markets, consumer prices less food and rent seem to be a more appropriate index compared to the more general index of consumer prices.

60.2% (see Milas, 1997). Therefore, using (13), $(p_O - p_T)^*$ is constructed as $(p_O - p_T)^* = 0.66\ (p_O - p_T)$.

Using the notation described in Johansen (1988, 1995), we write a p dimensional Vector Error Correction Model (VECM) as follows:

$$\Delta z_t = \Gamma_1 \Delta z_{t-1} + ... + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-1} + \mu + \Psi D_t + \varepsilon_t, t = 1,...,T \qquad (14)$$

where D is the first difference operator, z_t is the set of $I(1)$ variables discussed above, $\varepsilon_t \sim niid(0, \Sigma)$, μ is a drift parameter, D_t is a vector of non-stochastic variables, and P is a (p x p) matrix of the form $\Pi = \alpha\beta'$ where a and b are both (p x r) matrices of full rank, with β containing the r cointegrating relationships and α carrying the corresponding loadings in each of the r vectors. Assuming exogeneity of $(p_O - p_T)^*$ enables us to reduce the number of variables to be modelled from five to four. However, we allow $(p_O - p_T)^*$ to enter the cointegrating space, which implies that input prices have a long-run impact on the system. The D_t vector includes (i) three centred seasonal dummies and (ii) a dummy variable, *DEVAL*, which takes the value 1 in 1983q1 and 1985q4; 0 otherwise. The variable *DEVAL* captures the step devaluations of the domestic currency by 15.5% in January 1983 and 15% in October 1985, respectively.[4]

Preliminary analysis of the statistical properties of the data using the Augmented Dickey-Fuller (ADF) tests suggested that all series are $I(1)$ in levels and $I(0)$ in first differences.[5] Table 1 reports the diagnostic tests for the levels of the four equations and the system in (14), using a lag length of $k = 5$.[6] Cointegration results are shown in

[4] Both devaluations were underpinned by tight stabilisation economic programmes as discussed for example in Alogoskoufis (1995).

[5] A detailed Appendix on the ADF tests is available from the authors on request.

[6] The lag length is selected by starting with six lags on every variable, and sequentially testing from the highest order using an F-test. The same number of lags is obtained by the Akaike Information Criterion (AIC). All estimations are obtained using PcFiml 9.0 (see Hendry and Doornik, 1997).

Table 2, which reports the λ_i eigenvalues, the λ-*max* and the *trace* statistics, and the 5% critical values. The critical values for these tests are from Osterwald-Lenum (1992).[7] The λ-*max* statistic rejects no cointegration in favour of $r = 1$ cointegrating relationship, whereas the *trace* statistic supports the existence of $r = 2$ cointegrating vectors. In what follows, we assume two cointegrating vectors as suggested by our priors based on the theoretical model described in the previous section. Table 3 reports the normalised unrestricted β eigenvectors and the corresponding α coefficients.

Table 1: Diagnostic statistics

Statistic	l_T	$(p_T - p)$	$(w - p_T)$	v_T
F *ar* (5,101)	0.504 [0.773]	0.662 [0.653]	0.327 [0.896]	1.585 [0.171]
F *arch* (4,98)	0.102 [0.982]	0.049 [0.995]	1.327 [0.266]	0.362 [0.835]
χ^2 *nd* (2)	2.553 [0.279]	2.725 [0.256]	2.197 [0.333]	1.567 [0.457]
F *het* (42,63)	0.873 [0.677]	0.859 [0.697]	0.460 [0.998]	0.760 [0.827]

Notes: F *ar* is the Lagrange Multiplier F-test for residual serial correlation of up to fifth order. F *arch* is the fourth order Autoregressive Conditional Heteroscedasticity F-test. χ^2 *nd* is a Chi-square test for normality. F *het* is an F test for heteroscedasticity. Numbers in parentheses indicate the degrees of freedom of the test statistics. Numbers in square brackets are the probability values of the test statistics.

Table 2: Eigenvalues, test statistics, and critical values

λ_i	λ-*max*				λ-*trace*			
	H_0	H_1	Stat.	95%	H_0	H_1	Stat.	95%
0.332	$r = 0$	$r = 1$	55.35	27.07	$r = 0$	$r \geq 1$	85.28	47.21
0.129	$r \leq 1$	$r = 2$	18.98	20.97	$r \leq 1$	$r \geq 2$	29.93	29.68
0.053	$r \leq 2$	$r = 3$	7.51	14.07	$r \leq 2$	$r \geq 3$	10.95	15.41
0.025	$r \leq 3$	$r = 4$	3.44	3.76	$r \leq 3$	$r = 4$	3.44	3.76

Notes: *r* denotes the number of cointegration vectors. The critical values of the λ-*max* and λ-*trace* statistics are taken from Osterwald-Lenum (1992).

[7] In a cointegrating vector which involves real output, inclusion of a linear deterministic trend may capture slowly evolving stocks of knowledge as well as human and physical capital (Hendry and Doornik, 1994). In our case, however, the deterministic trend turned out to be insignificant and was therefore excluded from the subsequent analysis.

Table 3: Estimated cointegrating vectors (β) and weights (α)

	β_1	β_2	α_1	α_2
l_T	1.000	-1.928	-0.001	0.091
$(p_T - p)$	-5.590	1.000	0.026	0.004
$(w - p_T)$	-1.777	-0.239	-0.010	-0.020
v_T	-0.613	0.735	0.004	0.004
$(p_O - p_T)^*$	5.821	0.442	-	-

To uniquely identify the two cointegrating relationships, given their possible interpretations as the long-run labour demand and price competitiveness equations (11) and (12) above, we excluded $p_T - p$ from the first vector, and l_T from the second one. Then we tested the validity of four over-identifying restrictions. In particular, we imposed a zero effect from $(p_O - p_T)^*$, and equal but opposite effects from $w - p_T$ and v_T in the first vector. In the second vector, we excluded v_T, and restricted the coefficient on $w - p_T$ to be equal to the coefficient on $(p_O - p_T)^*$ plus one.[8]

It is worth noticing that in the first cointegrating vector, the coefficient on $(p_O - p_T)^*$ does not have the expected negative sign; however, it is not statistically different from zero. At the same time, we decided not to impose a unit coefficient on v_T as this restriction was rejected at the 5% significance level. The Likelihood Ratio (LR) test statistic for testing all four over-identifying restrictions discussed above, is distributed as a $\chi^2(4)$ under the null, giving a value of 7.82 which is insignificant at the 5% level (i.e. the corresponding p-value = 0.098). Imposing the restrictions discussed above, yields the following cointegrating vectors:

$$l_T = 0.421\, v_T - 0.421\, (w - p_T)\,,$$

[8] In the theoretical equation (12), the coefficient on $w - p_T$ is equal to the coefficient on $(p_O - p_T)^*$ minus one. However, to test this restriction within the cointegrating space, it must be formulated such that the coefficient on $w - p_T$ is equal to the coefficient on $(p_O - p_T)^*$ plus one.

and

$$(p_T - p) = -0.371\ (w - p_T) + 0.629\ (p_O - p_T)^*$$

The first vector is interpreted as a long-run labour demand equation, with the coefficient on output estimated at 0.421 and σ also estimated at 0.421. The theoretical model suggested a proportional relationship between employment and output; however, our finding of a lower effect from v_T on l_T implies that labour may be treated as a quasi-fixed factor of production, due to expectations about the permanent or temporary nature of changes in production and requirements specific to a firm (Oi, 1962).

The second cointegrating vector can be interpreted as a price competitiveness equation, with the share of tradeables in total output estimated at $\tau = 62.9\%$. Further, τ measures the effect of oil price increases on the real exchange rate. In particular, since Greece is an oil importer, an increase in the world price of oil has the effect of depreciating the real exchange rate in the long-run, and vice versa. It should be noted that there are other possible determinants of the real exchange rate both in the long and the short run (e.g. the level and composition of government expenditure, import tariffs, and the extent of capital controls in the economy, among others; see Edwards, 1989). However, the formulation of a complete real exchange rate determination model is beyond the scope of this paper.

Table 4 reports the growth equations for Δl_T, $\Delta(p_T - p)$, $\Delta(w - p_T)$, and Δv_T using Full Information Maximum Likelihood (FIML) estimates. Most insignificant variables have been dropped based on the χ^2 version of the LR-test of over-identifying restrictions. Under the null hypothesis of valid over-identifying restrictions, the test gives $\chi^2(45) = 19.19$ which is insignificant (p-value = 0.99).

Table 4: FIML estimates of the error correction model

Variable	Dl_T		$D(p_T - p)$		$D(w - p_T)$		$D\ v_T$	
	Coeff.	S. E.	Coeff.	S. E.	Coeff.	S. E.	Coeff.	S. E.
$\Delta\ l_{T\ \ t}$			-0.158	0.101				
$\Delta\ l_{T\ \ t\text{-}1}$	-0.465	0.084					0.182	0.104
$\Delta\ l_{T\ \ t\text{-}2}$	-0.410	0.092			0.130	0.092		
$\Delta\ l_{T\ \ t\text{-}3}$	-0.157	0.089					0.215	0.108
$\Delta\ l_{T\ \ t\text{-}4}$	0.139	0.076						
$\Delta(p_T - p)_{\ t\text{-}1}$			0.316	0.095	-0.293	0.127		
$\Delta(p_T - p)_{\ t\text{-}2}$			0.136	0.069	-0.142	0.086	0.168	0.086
$\Delta(p_T - p)_{\ t\text{-}3}$			-0.158	0.075				
$\Delta(p_T - p)_{\ t\text{-}4}$			-0.138	0.091	0.205	0.118		
$\Delta(w - p_T)_{\ t}$								
$\Delta(w - p_T)_{\ t\text{-}1}$	0.091	0.050	0.305	0.075	-0.260	0.095		
$\Delta(w - p_T)_{\ t\text{-}3}$			-0.165	0.069	0.081	0.070		
$\Delta(w - p_T)_{\ t\text{-}4}$			-0.200	0.071	0.266	0.093		
$\Delta\ v_{T\ \ t\text{-}1}$	0.197	0.056	0.228	0.047	-0.113	0.068	-0.184	0.070
$\Delta\ v_{T\ \ t\text{-}2}$	0.100	0.058			-0.075	0.060	-0.289	0.076
$\Delta\ v_{T\ \ t\text{-}3}$	0.195	0.057			-0.099	0.061	-0.102	0.071
$\Delta\ v_{T\ \ t\text{-}4}$	0.134	0.054			-0.065	0.055	0.510	0.073
$\Delta(p_O - p_T)^*_{\ t}$			0.168	0.023	-0.084	0.030		
$\Delta(p_O - p_T)^*_{\ t\text{-}1}$	0.030	0.023	0.074	0.026	-0.127	0.034		
$\Delta(p_O - p_T)^*_{\ t\text{-}2}$							-0.097	0.033
$\Delta(p_O - p_T)^*_{\ t\text{-}3}$			0.047	0.022				
$\Delta(p_O - p_T)^*_{\ t\text{-}4}$	0.052	0.020			-0.038	0.027		
$CV1_{\ t\text{-}1}$	-0.127	0.034						
$CV2_{\ t\text{-}1}$	0.057	0.022	-0.059	0.020			0.042	0.030
DVAL			0.111	0.018	-0.172	0.023		
Diagnostic Tests								
σ	0.023		0.024		0.032		0.033	
F *ar* (5,104)	1.971 [0.089]		1.361 [0.245]		0.983 [0.432]		2.894 [0.017]	
F *arch* (4,101)	0.157 [0.959]		0.037 [0.997]		1.274 [0.285]		0.032 [0.998]	
χ^2 *nd* (2)	3.823 [0.148]		5.636 [0.060]		4.615 [0.100]		5.990 [0.050]	
F *het* (47,61)	0.783 [0.807]		1.006 [0.486]		0.364 [1.000]		0.683 [0.913]	

Notes:

All regressions also include a constant and centred seasonal dummies. σ is the standard error of the regression.

The diagnostic tests are defined in the notes of Table 1, and the numbers in square brackets denote probability values.

CV1 = $l_T - 0.421v_T + 0.421(w - p_T)$, and CV2 = $(p_T - p) + 0.371(w - p_T) - 0.629(p_O - p_T)^*$.

The equation for Δl_T reveals that employment in the manufacturing sector depends negatively on the first cointegrating vector (i.e. *CV1*) with an estimated coefficient equal to -0.126, which suggests that approximately 50% of the adjustment takes place within a year.[9] Further, the estimated coefficient on the second cointegrating vector (i.e. *CV2*) is positive and significant. This suggests that when the real exchange rate is above its long-run equilibrium level (i.e. the real exchange rate is undervalued) labour in the manufacturing sector rises; put another way, firms increase their demand for labour following an improvement in competitiveness.

The equation for $\Delta(p_T - p)$ provides some insights on the determinants of the real exchange rate in the short-run, which depreciates following an increase in the world price of oil. In addition, the coefficient on *CV2* has the expected negative sign and suggests that approximately 20% of the discrepancy between the real exchange rate and its long-run equilibrium level (real exchange rate misalignment) is corrected within a year.

The equation for $\Delta(w - p_T)$ depends on its own past values as well as those of the other variables in the system. Neither of the two error correction terms is found to affect wage growth in the manufacturing sector. This result can be explained by the institutional characteristics of the Greek economy, namely the fact that wage decisions take place within the government sector, which sets the main guidelines for wage increases in the manufacturing sector (Katseli, 1990).

The equation for Δv_T reveals that output growth in the manufacturing sector depends positively on employment and the relative price of traded goods (that is, the real

[9] Using annual data, Milas (1997) found an adjustment coefficient of -0.093. In that model, however, the dependent variable was number of employees, whereas here the regressand refers to total hours worked by persons. This difference is due to the fact that firms find it easier to adjust hours worked rather than the number of employees, because of strict labour legislation which limits lay-offs without government authorisation to a maximum of 2% of the firm's monthly workforce.

exchange rate), and negatively on oil prices. Interestingly, we also find a weak positive effect from the discrepancy between the real exchange rate and its long-run equilibrium level on Δv_T. This result suggests that if the real exchange rate is undervalued (i.e. $CV2 > 0$), the economy becomes more competitive. As a result, employment in the tradeable sector rises (see the positive effect from *CV2* in the Δl_T equation) and at the same time, production of tradeable goods expands.

The bottom panel of Table 4 reports the diagnostic tests for all four equations. As can be seen, the equations pass the LM test for residual serial correlation of up to fifth order (although in the case of Δv_T the test is rejected at the two per cent significance level), Engle's LM test for ARCH of up to fourth order, the test for normality, and White's test for heteroscedasticity. The stability of the system is analysed using recursive FIML estimates. The plots of the 1-step residuals ± 2*standard errors (SE) suggest reasonable parameter constancy for all four equations. Stability is also confirmed by the sequences of one-step forecast tests (1↑ step Chow test), break-point F-tests (N↓ step Chow test), and forecast F-tests (N↑ step Chow tests), which are all insignificant at the one per cent level (see Figure 1).

4. Concluding remarks

In this paper we have introduced a theoretical labour market model for the tradeable sector of a small open economy. Using quarterly data for Greece, the model has been estimated following the Johansen (1988, 1995) cointegrating approach, which provides a test for the existence of, say, *r* cointegrating vectors that are chosen on purely statistical terms. In order to translate these vectors to meaningful economic relationships, we need to take into account the a priori information provided by economic theory. The results of our modelling exercise provide some evidence in favour of the two long-run relationships derived from the theoretical model. Indeed, our findings support the existence of two cointegrating vectors. The first one can be interpreted as a long-run labour demand equation, whereas the second one can be thought of as a price competitiveness equation.

Turning to the short-run dynamics of the model, labour decisions in the tradeable sector are found to be affected by past disequilibria in the labour market and, perhaps more interestingly, the discrepancy of the real exchange rate from its implied long-run equilibrium relationship. The latter result has an important policy implication as it shows that temporary misalignments of the real exchange rate will affect employment and output decisions in the tradeables sector. In a future modelling exercise, it would be interesting to extend the analysis by incorporating some factors (such us the decomposition of government expenditure into tradeables and non-tradeables) that may also affect the behaviour of the real exchange rate.

Figure 1. Parameter constancy tests.

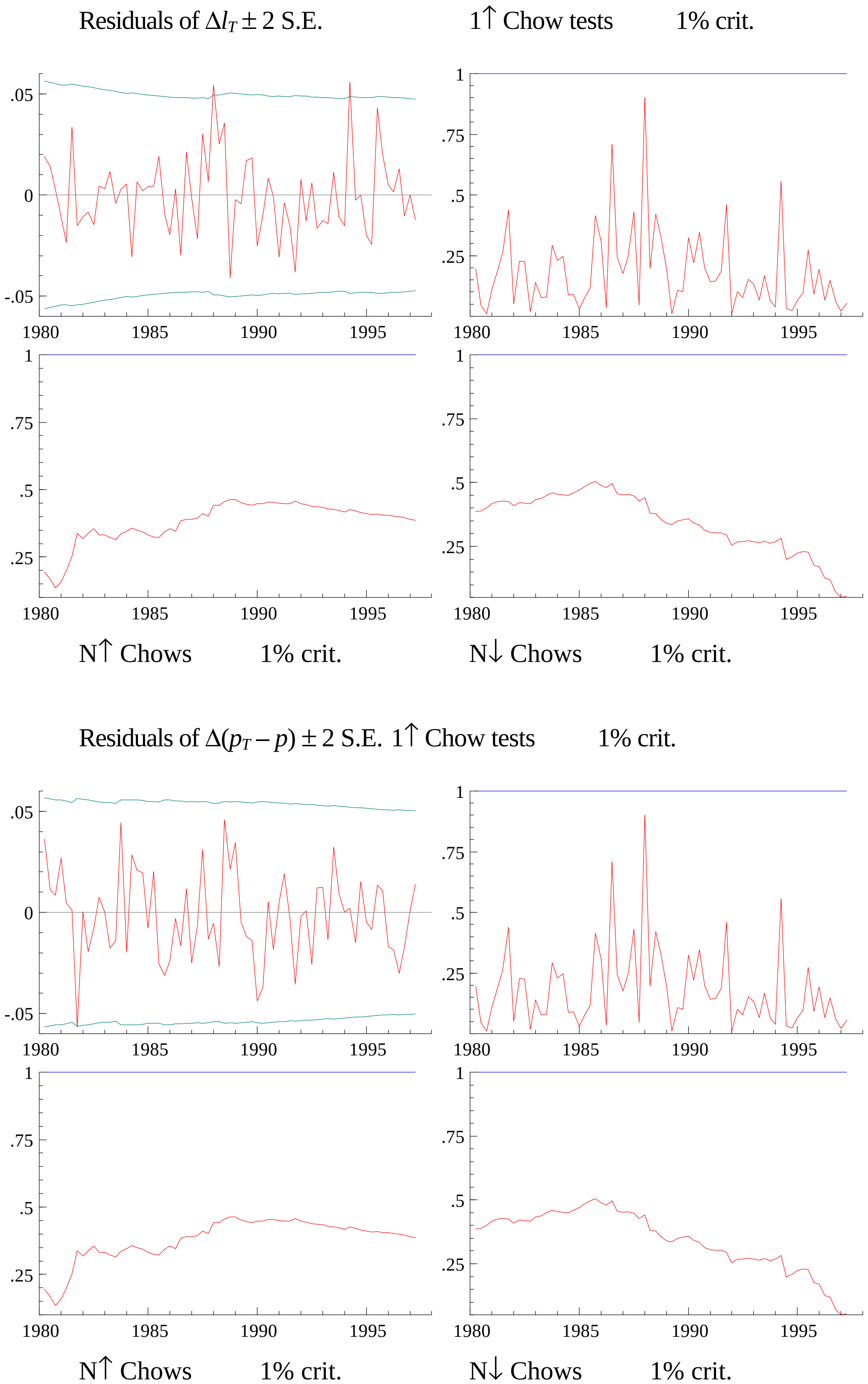
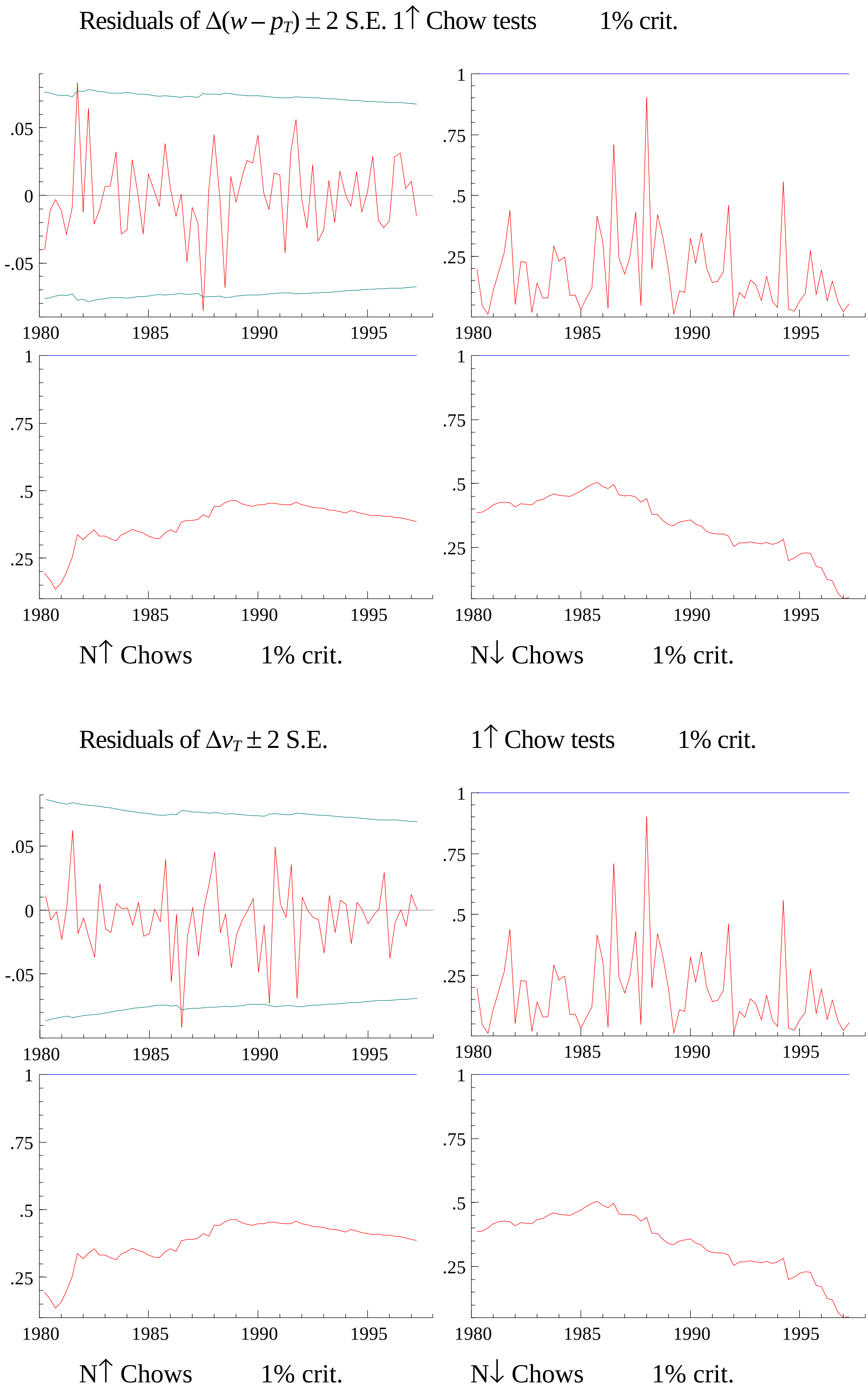


Figure 1 (Continued) Parameter constancy tests.



Data appendix

l_T: Total hours worked by persons in manufacturing (1990=100). Source: Main Economic Indicators, OECD.

v_T: Index of manufacturing production (1990=100). Source: Main Economic Indicators, OECD.

p_T: Price of tradeables (in domestic currency) constructed as $p_T = p_T^* + e$, where p_T^* is the dollar unit value index of industrial countries imports (1990=100), and e is the average drachmae / dollar exchange rate. Source: International Financial Statistics, IMF.

p: Consumer price index (1990=100), which excludes food and rent. Source: Main Economic Indicators, OECD.

w: Index of hourly earnings in manufacturing (1990=100). Source: International Financial Statistics, IMF.

p_O: Oil price in domestic currency, constructed as $p_O = p_O^* + e$, where p_O^* is the average oil price ($ per barrel) and e as above. Source: International Financial Statistics, IMF.

All variables are in logs.

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