International Structural Time Series Evidence on the Cyclical Behaviour of Prices

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I. INTRODUCTION

While the procyclicality of prices was accepted as a stylised fact for a long time, recent econometric work has led to the general conclusion that prices became countercyclical in the post-war period, particularly since 1973. KYDLAND and PRESCOTT (1990) found strong negative correlation between U.S. output and prices over the period 1954–89. WOLF (1990) concluded that the general price level has not been consistently procyclical in the post-war period and that since 1973 it has become procyclical, a conclusion that is shared by KING and WATSON (1996). COOLEY and OHANIAN (1991) examined the price-output relationship over the period 1822–1987 and concluded that U.S. prices were countercyclical in the post-World War II period. SMITH (1992) also found broadly similar results for ten countries over extended sample periods. Likewise, BACKUS and KEHOE (1992, p. 882) found supportive evidence for ten countries, concluding that «price fluctuations have changed from procyclical to countercyclical», describing the change as an «international phenomenon» (p. 883).

The evidence for countercyclicality found in these studies is explained, within the framework of the standard aggregate demand and supply (AD-AS) model, in terms of the dominance of supply shocks in the most recent period (post-war or post-1973). The countercyclicality of prices in the post-war period and particularly since 1973 is, therefore, attributed to the dominance of supply shocks such as the rise in oil prices, tax changes and the shift towards supply-side policies.

If this is the case then a question arises here: why is it that more recent studies have not been supportive of the hypothesis of countercyclicality of prices? For example, ANDERSEN and HANSEN (1996) studied price behaviour in fifteen OECD countries using post-war data and concluded that «there is no clear-cut stylised fact concerning the behaviour of prices over the cycle» (p. 383). A similar conclusion is reached by SPENCER (1996) who examined quarterly U.S. data over the period 1954:1–1994:2 using three price measures and three output measures. Although his results indicate weaker coun-

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tercyclicality in the pre-1973 period, he concludes that «the price level has certainly not been consistently procyclical but neither has it been consistently countercyclical» (p. 99). SERLETIS (1996) has also found a «mixed bag» when he re-examined the BACKUS and KEHOE (1992) data.

Generally, these studies have utilised one or more of three filters to detrend the observed output and price series prior to the calculation of the correlation coefficient between them: (i) the HODRICK-PRESCOTT (HP) filter, (ii) the linear trend filter and (iii) the first difference filter. There are at least two problems with these studies, the first of which pertains to these filters.

The problem with the linear and first difference filters is that they may result in a misspecification of the trend, producing spurious results (MOCAN and TOPYAN, 1993). The most widely used HP filter, which is simply a moving average transformation of the data, has been criticised by HARVEY and JAEGER (1993) KING and REBELO (1993), COGLEY and NASON (1995) and BOONE and HALL (1996). HARVEY and JAEGER (1993) criticise the HP filter on the grounds that it leads to spurious cyclical behaviour, a point that they illustrate with empirical examples. It may also, they argue, distort unrestricted estimates of the cyclical component, resulting in misleading conclusions regarding the relationship between short-term movements in macroeconomic time series. KING and REBELO (1993) also provide evidence on how HP filtering alters measures of persistence, variability and co-movement. They further argue that the HP filter removes important time series components that have traditionally been regarded as representing business cycle phenomena. They conclude (p. 230) that the component of the time series that is isolated by the HP cyclical filter is likely to capture only a subset of the time series variation that most economists associate with cyclical fluctuations. Therefore, the argument goes, the HP filter is not appropriate for devising stylised facts or evaluating dynamic economic models. Likewise, COGLEY and NASON (1995) demonstrate that the HP filter affects the second order movements of the data in a complex way, distorting the stylised facts based upon them. Finally, BOONE and HALL (1996) also argue that the HP filter is a very special case which can be encompassed by more general representations of the time series properties of the data.

The second problem is that the conclusions of these studies are reached on the basis of the magnitude, sign and significance of the correlation coefficients between the two filtered series without any consideration of the diagnostics of the underlying model. This problem is particularly serious for studies using long sample periods (e.g. SERLETIS, 1996) since the underlying model is unlikely to pass the diagnostic test for normality and perhaps heteroscedasticity.

The objective of this paper is to re-examine the international evidence on the cyclical behaviour of prices using long time series that in some cases extend between the 1800s and the early 1990s. This study is different from the previous ones in at least three aspects: (i) it uses consumer prices when most of the previous studies used the GNP/GDP deflator, (ii) it specifies the price-output relationship as a structural time series model, and (iii) it evaluates the results by taking into account the diagnostics of the underlying model rather than relying solely on simple correlation coefficients. We start, however, by evaluating existing evidence to see if it really supports the «international phenomenon» alluded to by BACKUS and KEHOE (1992).

II. AN EVALUATION OF THE EXISTING EVIDENCE

The existing empirical evidence discussed in this section is found in six recent multi-country studies using annual and quarterly time series. These studies include BACKUS and KEHOE (1992), SMITH (1992), CHADHA and PRASAD (1994), ANDERSEN and HANSEN (1996), BOONE and HALL (1996) and SERLETIS (1996). A summary of the results of these studies is presented in Table 1, showing the filters used and the correlation coefficients between the filtered price and output series over various historical periods. A brief summary of the findings of each study is presented below.

Table 1: Correlation Between Filtered Prices and Output (Selected Evidence)

Country	Study[a]	Filter[b]	Pre-War	Inter-War	Post-War	Whole [c]
Australia	B-K (1992)	HP	0.60	0.59	–0.47	
	SERLETIS (1996)	HP				0.28
	SMITH (1992)	HP	0.63	–0.43, 0.17[e]	0.06	
		FD	0.19	–0.62, 0.36	–0.25	
Canada	B-K (1992)	HP	0.41	0.77	0.12	
	C-P (1994)	DT			–0.57	
		DT, ST[d]			–0.27	
		HP			–0.17	
		FD			–0.26	
	SERLETIS (1996)	HP				0.16
	SMITH (1992)	HP	0.41	–0.22, 0.81	0.00	
		FD	–0.03	–0.12, 0.83	–0.25	
France	A-H (1996)	HP			0.36, 0.18[f]	
		FD			0.20, –0.04	
	C-P (1994)	DT			0.02	
		DT, ST			–0.28	
		HP			–0.69	
		FD			–0.29	
Germany	A-H (1996)	HP			0.19, –0.13	
		FD			–0.10, –0.28	
	B-K (1992)	HP	–0.01	0.71	0.01	

Country	Study[a]	Filter[b]	Pre-War	Inter-War	Post-War	Whole [c]
	B-H (1996)	STM	0.33	0.77	–0.36	
	C-P (1994)	DT			0.34	
		DT, ST			0.51	
		HP			–0.06	
		FD			0.02	
	SERLETIS (1996)	HP				0.11
	SMITH (1992)	HP	–0.004	0.78	–0.07	
		FD	0.07	0.63	–0.22	
Italy	A-H (1996)	HP			0.33, –0.09	
		FD			0.05, –0.18	
	B-K (1992)	HP	–0.02	0.58	0.24	
	B-H (1996)	STM	–0.26	0.23	–0.80	
	C-P (1994)	DT			–0.78	
		DT, ST			–0.65	
		HP			–0.47	
		FD			–0.30	
	SERLEIS (1996)	HP				–0.14
	SMITH (1992)	HP	0.00	–0.16, –0.71	0.21	
		FD	0.11	0.04, –0.83	0.52	
Japan	B-K (1992)	HP	–0.45	0.03	–0.60	
	B-H (1996)	STM	0.17	–0.13	–0.85	
	C-P (1994)	DT			0.46	
		DT, ST			0.83	
		HP			–0.22	
		FD			0.09	
	SERLETIS (1996)	HP				0.28
	SMITH (1992)	HP	–0.45	0.59, 0.31	–0.61	
		FD	–0.51	0.12, 0.45	–0.26	
Sweden	A-H (1996)	HP			0.01, –0.10	
		FD			–0.05, –0.23	
	B-K (1992)	HP	0.15	0.30	–0.53	
	SERLETIS (1996)	HP				–0.48
	SMITH (1992)	HP	0.14	–0.72, –0.20	–0.46	
		FD	0.04	–0.51, –0.04	–0.58	
U.K.	A-H (1996)	HP			–0.03, –0.11	
		FD			–0.20, –0.19	

Country	Study[a]	Filter[b]	Pre-War	Inter-War	Post-War	Whole[c]
	B-K (1992)	HP	0.26	0.20	–0.50	
	B-H (1996)	STM	0.04	0.17	–0.80	
	C-P (1994)	DT			–0.77	
		DT, ST			–0.44	
		HP			–0.53	
		FD			–0.23	
	SERLETIS (1996)	HP				–0.15
	SMITH (1992)	HP	0.23	–0.32, 0.76	–0.32	
		FD	0.11	–0.29, 0.37	–0.41	
U.S.	A-H (1996)	HP			0.27, 0.00	
		FD			–0.07, –0.31	
	B-K (1992)	HP	0.22	–0.72	–0.30	
	B-H (1996)	STM	0.15	–0.48	–0.87	
	C-P (1994)	DT			–0.71	
		DT, ST			–0.25	
		HP			–0.14	
		FD			–0.03	
	SERLETIS (1996)	HP				0.09
	SMITH(1992)	HP			–0.68	
		FD			–0.54	

[a]B-K = BACKUS and KEHOE, B-H = BOONE and HALL, C-P = CHADHA and PRASAD, A-H = ANDERSEN and HANSEN. All studies used annual data except A-H and C-P (quarterly). [b]HP = HODRICK- , STM = Stochastic trend model, DT = Deterministic linear trend, FD = first difference, ST = Segmented trend. [c]The whole period. [d]DT is applied to prices while ST is applied to output. [e]The first and second numbers refer to the pre- and post-Depression periods (about 1910–29 and 1930–45 respectively). The interwar period falls within these two periods. [f]The first and second numbers refer to producer and consumer prices respectively.

BACKUS and KEHOE (1992), who studied ten countries, found correlation between filtered output and prices to be predominantly positive in the pre-war and inter-war periods. They also found this negative correlation to be stronger in the period after 1969. Moreover, they ruled out measurement errors in the pre-war period as the reason for this change in the behaviour of prices.

The study by BOONE and HALL (1996) employed the same data set for five of the countries studied by BACKUS and KEHOE (Germany, Italy, Japan, the U.K. and the U.S.) but a different detrending method based on the stochastic trend model (as opposed to the HP filter). While their results are quantitatively different from those of BACKUS and KEHOE, their general conclusion is that there is strong evidence for countercyclicality in the post-war period and some evidence for procyclicality in the pre-war and inter-war period.

SERLETIS (1996) also analysed the same data set using the HP filter but he calculated the correlation coefficients over the whole sample period which for some countries extended between 1850 and 1986. He found a «mixed bag»: prices are acyclical for Canada, Germany, Italy, Norway, the U.K. and the U.S.; weakly countercyclical for Denmark and Sweden; and procyclical for Australia. The finding of mostly acyclical prices can be readily attributed to the use of the whole sample period which involves several structural breaks and changes in the relationship as well as the distortion introduced by the war years.

SMITH (1992) used annual data and two filters (the HP and first difference filters) but his sub-sample periods were different from those of BACKUS and KEHOE (1992). Specifically, he measured correlation over the pre- and post-Depression periods by including the war years. He found prices to be procyclical prior to World War II with the exception of the period from 1910 until the onset of the Depression (during which prices were countercyclical). He also found prices to be countercyclical for the post-Depression period except a period of procyclical prices in the 1950s and 1960s.

The two studies by CHADHA and PRASAD (1994) and by ANDERSEN and HANSEN (1996) employed post-war quarterly data. Using four different filters, CHADHA and PRASAD obtained results which generally supported the countercyclicality hypothesis. ANDERSEN and HANSEN, on the other hand, found no simple pattern holding across countries although some tendency towards procyclical prices could be observed. The results obtained by ANDERSEN and HANSEN cast doubt on the plausibility of explaining the change in the behaviour of prices in terms of the dominance of supply or demand shocks. They found countercyclical prices even for the early seventies, a period which is usually considered to be dominated by supply shocks. If anything, they concluded, prices have a tendency to be procyclical.

Obviously, the results of these studies are greatly diverse. In order to derive some sort of conclusion from these results we adopt the following criteria following SERLETIS (1996). Strong correlation is indicated by a correlation coefficient of 0.5 and over, weak correlation by a correlation coefficient between 0.2 and 0.5 and lack of correlation by a correlation coefficient of less than 0.2.[1] If we exclude the results of SERLETIS, Table 1 reports a total of 152 correlation coefficients. Table 2 reports a classification of these results into five different categories according to the criteria mentioned earlier: strongly positive, weakly positive, strongly negative, weakly negative and no correlation. The table shows that most of the evidence indicates no correlation in the pre-war period, but there are eight cases of weakly positive correlation. In the inter-war period, the largest number of cases show strongly positive correlation (12 out of 42). In the post-war period there is a large number of cases showing no correlation (28) and 18 cases of strongly positive correlation. Thus, it is possible to state the following on the basis of the available international evidence using the above mentioned criteria: prices were acyclical in the

1. Prices are in these cases described as being strongly cyclical, weakly cyclical and acyclical. Positive (negative) correlation would naturally imply procyclical (countercyclical) prices.

pre-war period, procyclical in the inter-war period and acyclical/countercyclical in the post-war period. The safest thing to say, however, is that the evidence is indeed mixed. The countercyclicality of prices in the post-war period is not an «international phenomenon», and there seems to be no stylised fact as such. Before an explanation is presented for this conclusion, we will present our empirical evidence which is based on structural time series modelling.

Table 2: A Summary of Existing Evidence

Correlation	Pre-war	Inter-war	Post-war
Strongly Positive	1	12	3
Weakly Positive	8	7	8
Strongly Negative	2	6	18
Weakly Negative	3	7	24
Uncorrelated	15	9	28
Total	29	42	81

III. METHODOLOGY

The structural time series approach of HARVEY (1989) is used to model prices in terms of unobserved trend, cyclical and random components. HARVEY and JAEGER (1993) argue that this approach provides the most useful framework within which to present stylised facts on time series because the underlying model is explicitly based on the stochastic properties of the data. This approach also allows investigators to deal explicitly with seasonal and random components which may distort the extracted cyclical component. This point is reinforced by KING and REBELO (1993) who argue that growth, cycles and seasonal variation are to be studied within a unified framework. This methodology is different from that adopted by the studies surveyed in the previous section. These studies are based on correlations between detrended series obtained most predominantly by applying the HP filter. The only exception is the study of BOONE and HALL (1996) who used a decomposition of the time series based on the stochastic trend model which is similar to the model used in this paper. One major difference remains, however. While the BOONE and HALL results are based on correlations between the extracted cyclical components, our results are based on a model which explains the price series in terms of its components and the components of output. We believe that the method used in this study is superior to HP filtering because it allows for statistical inference while HP filtering does not.

The model used in this study may be written as

$$p_t = \mu_t + \phi_t + \varepsilon_t \tag{1}$$

where p_t is the logarithm of the observed price series, μ_t is its trend, ϕ_t is the cyclical component and ε_t is the random component. The trend and cyclical components are assumed to be uncorrelated while ε_t is assumed to be white noise.

The trend, which represents the long-run movement in a series, is assumed to be stochastic and linear. This component can be represented by the matrix equation

$$\begin{bmatrix} \mu_t \\ \beta_t \end{bmatrix} = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} \mu_{t-1} \\ \beta_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_t \\ \zeta_t \end{bmatrix} \tag{2}$$

where $\eta_t \sim NID(0, \sigma_\eta^2)$ and $\zeta_t \sim NID(0, \sigma_\zeta^2)$.

The cyclical component, which is assumed to be a stationary linear process, may be represented by

$$\begin{bmatrix} \phi_t \\ \phi_t^* \end{bmatrix} = \rho \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} \phi_{t-1} \\ \phi_{t-1}^* \end{bmatrix} + \begin{bmatrix} \omega_t \\ \omega_t^* \end{bmatrix} \tag{3}$$

where ϕ_t^* appears by construction while ω_t and ω_t^* are uncorrelated white noise disturbances with variances σ_ω^2 and $\sigma_{\omega^*}^2$ respectively. The parameters $0 \leq \theta \leq \pi$ and $0 \leq \rho \leq 1$ are the frequency of the cycle and the damping factor on the amplitude respectively.

The model represented by equation (1) may be modified to include explanatory variables. If output, y_t, is the only explanatory variable then the model becomes

$$p_t = \mu_t + \phi_t + \delta y_t + \varepsilon_t \tag{4}$$

It may be argued that since the objective is to measure the cyclical co-movements of prices and output, the explanatory variable on the right hand side of equation (4) must be the cyclical component of output.[2] It can be shown, with a proper re-definition of the trend and random component, that the specification of equation (4) is valid. In order to demonstrate this point, we will re-write equation (4) with a change of notation as

$$p_t = \mu_t^p + \phi_t^p + \delta\phi_t^y + \varepsilon_t^p \tag{5}$$

2. We are grateful to an anonymous referee for bringing our attention to this point.

where μ_t^p, ϕ_t^p and ε_t^p are respectively the trend, cyclical component and random component of prices while ϕ_t^y is the cyclical component of output. The total output series can be decomposed as follows:

$$y_t = \mu_t^y + \phi_t^y + \varepsilon_t^y \tag{6}$$

By combining equations (5) and (6) we obtain

$$p_t = (\mu_t^p - \delta\mu_t^y) + \phi_t^p + \delta y_t + (\varepsilon_t^p - \delta\varepsilon_t^y) \tag{7}$$

Equation (7) shows that the trend of the output series is part of the trend component of equation (4), μ_t. This component captures both the price and output non-stationary trends, while δ measures the association between the cycles (HARVEY, 1989, Chapter 8). Our empirical results are based on the estimation of equation (4) by maximum likelihood via the Kalman filter once the model has been written in state space form. For details, see HARVEY (1989).

IV. DATA AND EMPIRICAL EVIDENCE

The empirical results presented in this section are based on annual data covering various sample periods.[3] The price variable is the consumer price index (all items), while the output variable is GDP at constant market prices. Up to 1987 the series were obtained from LIESNER (1989). For the period 1988–1993 the time series were obtained from the *OECD Economic Outlook.*

We start by presenting the results of estimating the equation (the final state vector) over the whole sample periods to demonstrate the hazards of such an exercise. The results are presented in Table 3, including the estimated state variables (μ, β, ϕ, ϕ^* and δ) and their t statistics. Also reported are measures of goodness of fit (R^2 and R_d^2) and the diagnostics for normality (N), heteroscedasticity (H) and serial correlation (Q).[4] The results show that the cyclical components are insignificant, implying either that cyclical variation is absent or that output is capable of explaining the cyclical variation in prices.

3. The sample periods for various countries are as follows: Australia: 1891–1993, Canada: 1927–1993, France: 1950–1993, Germany: 1950–1993, Italy: 1886–1992, Japan: 1946–1992, Sweden: 1919–1993, U.K.: 1886–1993 and U.S.: 1890–1993.
4. R_d^2 is a modified coefficient of determination calculated on the basis of the first difference of the dependent variable. A negative value indicates that the model is worse than a random walk plus a drift model. N is the Bowman-Shenton (1975) test statistic which has a $\chi^2(2)$ distribution. H is a heteroscedasticity test statistic calculated as the ratio of the sum of squares of the last h residuals to that of the first h residuals where h is the closest integer to one third the sample size. It is distributed as $F(h, h)$. Q is the Ljung-Box (1978) test statistic which is calculated from the first n correlation coefficients. It is distributed as $\chi^2(n + 1 - k)$ where k is the number of estimated parameters.

The cyclicality or otherwise of prices is indicated by the sign and significance of the coefficient on output, δ. The estimates of this coefficient show that prices are acyclical in all countries except in Italy where they are countercyclical. However, the model fails to pass the diagnostic for normality in all cases, implying the presence of outliers. This does not mean that the model is necessarily misspecified but rather that it should be re-estimated while taking care of the outliers either by using intervention (dummy) variables or by estimating the model over sub-sample periods. This finding shows that the results obtained by SERLETIS (1996) must be treated and interpreted with caution. Only in one case (Sweden) does the model fail to pass the diagnostic for serial correlation, implying that the specification does not adequately capture the underlying dynamics.

Table 3: Maximum Likelihood Estimates of the Final State Vector over the Whole Period[a]

	Australia	Canada	France	Germany	Italy	Japan	Sweden	U.K.	U.S.
μ	5.169*	4 453*	8.035*	5.254*	15.451*	9.169	7.705*	4.640*	4.733*
	(11.42)	(9.41)	(3.02)	(8.96)	(7.03)	(1.64)	(10.59)	(6.68)	(9.35)
β	0.038	0.028	0.028	0.049*	0.030	0.021	0.001	0.032	0.036
	(1.37)	(1.36)	(1.23)	(3.67)	(0.30)	(0.22)	(0.057)	(0.903)	(1.36)
ϕ	0.0104	–0.0072	0.00	0.0048	0.068	0.00	–0.0341	0.0150	–0.0030
	(0.82)	(–0.40)	(0.00)	(1.02)	(1.54)	(0.00)	(–1.05)	(0.33)	(–0.11)
ϕ^*	–0.0326	–0.0111	–0.0142	–0.0158	0.0320	0.00	–0.0196	–0.0213	–0.0105
	(1.61)	(–0.67)	(0.69)	(–1.42)	(1.21)	(0.00)	(–0.57)	(–0.48)	(–0.41)
δ	0.500	0.136	–0.336	–0.037	–0.753*	–0.334	0.132	0.115	0.051
	(0.59)	(1.73)	(–1.03)	(–0.48)	(–4.50)	(–0.77)	(1.36)	(1.00)	(0.87)
R_d^2	0.30	0.57	0.42	0.58	0.41	0.59	0.13	0.40	0.40
N	98.21*	11.60*	13.46*	26.66*	1581.0*	64.91*	201.1*	222.50*	790.7*
H	0.17	0.36	0.16	0.26	0.16	0.02	0.18	0.25	0.13
Q	8.49	11.63	4.26	9.95	9.60	2.61	23.78*	19.55	12.90

[a] The whole period is different from one case to another: Australia 1891–1993, Canada 1927–1993, France 1950–1993, Germany 1950–1993, Italy 1886–1992, Japan 1946–1992, Sweden 1919–1993, U.K. 1886–1993 and U.S. 1890–1993.

* Significant at the 5% level.

To deal with the problem of outliers our choice is to estimate the model over sub-sample periods. This choice has two advantages: (i) it is consistent with other studies, making it possible to compare the results; and (ii) it allows us to drop the war years, thus avoiding the possible distortion that may be created by their inclusion. One disadvantage, however, is the reduced sample size in the sub periods. Because of this problem, the insignificance of δ in this case will not be interpreted as implying acyclicality but rather as not providing evidence for cyclicality. The model is, therefore, estimated (subject to the availability of data) over four sub-periods: (i) the pre-war period, extending from the beginning of the sample to 1913; (ii) the inter-war period (1919–1939); the pre-1973 post-war period (1946–1972) and (iv) the post-1973 post-war period. The post-war period is divided into two sub-periods to capture the effect of the 1973 oil shock.

The estimation results are reported in Table 4. To save space, we only report the coefficient on output and its t statistics, as well as the diagnostics. Furthermore, Table 5 summarises the conclusions that can be inferred from these results using the following criteria: (i) a significantly positive coefficient on output indicates procyclicality, (ii) a significantly negative coefficient indicates countercyclicality, and (iii) an insignificant coefficient provides no evidence for cyclicality. The strongest evidence is found for procyclicality of prices in the inter-war period. The evidence for the post-war period is indeed mixed. In the pre-1973 period, prices were countercyclical for Australia and Sweden only. In the post-1973 period prices have been countercyclical only in Canada, Japan and the U.K., with no evidence for procyclicality. This may be considered to be a weak but consistent evidence for countercyclicality in the post-1973 period. This evidence is weaker than what is presented, for example, by BOONE and HALL (1996) to support the «stylised facts» about the cyclical behaviour of prices.

If the cyclical behaviour of prices can be explained in terms of the dominance of supply or demand shocks, then these results would suggest, inter alia, that neither supply nor demand shocks were dominant in the post-war U.S. economy, that supply shocks were dominant in the pre-1973 German economy and that demand shocks were dominant in the post-1973 U.K. economy. This may or may not be true, but it is arguable that the patterns of shocks should be similar to some extent, because most shocks are transmitted via international trade. If this is the case, then differences in the cyclical behaviour of prices must be attributed to some factors other than the type of shock.

We do not believe in the plausibility of the argument attributing a particular behaviour of prices to the dominance of a particular kind of shock. It can be demonstrated, by using the AD-AS model, that both supply and demand shocks can cause either procyclical or countercyclical prices as pointed out by SPENCER (1996). To take SPENCER's argument further, it can be shown that the effect of a shock on the behaviour of prices depends on several factors including the degree of stickiness of prices, whether or not there is a policy response, whether the response takes the form of a supply-side or a demand-side policy, and the timing of both the shock and response.

Table 4: Maximum Likelihood Estimates of the Model over Sub-Periods

	δ	t statistic	R^2	R_d^2	NO	HS	Q
Australia							
1891–1913	0.005	0.03	0.81	0.31	0.98	0.36	12.84
1919–1939	0.550*	3.66	0.90	0.70	3.66	0.18	16.85
1946–1972	–0.795*	–4.28	0.99	0.64	0.50	0.23	5.43
1973–1993	–0.200	–1.07	0.99	0.73	1.08	1.66	12.49
Canada							
1927–1939	0.466*	5.73	0.95	0.78	1.10	0.60	6.25[a]
1946–1972	0.199	1.20	0.99	0.51	2.85	0.09	5.43
1973–1993	–0.252*	–2.05	0.99	0.82	0.27	2.23	8.61
France							
1950–1972	–1.134*	–2.59	0.99	0.60	1.09	0.19	5.42
1973–1993	–0.085	–0.57	0.99	0.93	0.03	0.92	6.74
Germany							
1950–1972	0.043	0.32		0.46	1.96	0.28	8.75
1973–1993	–0.148	–1.87		0.83	1.58	0.46	9.95
Italy							
1886–1913	0.142	0.77	0.90	0.10	25.60*	0.33	11.04
1919–1939	–0.213	–0.74	0.76	0.39	1.18	0.23	7.81
1946–1972	2.913*	3.97	0.95	0.43	5.33	0.11	10.97
1973–1992	0.067	0.33	0.99	0.79	4.53	0.06	6.33
Japan							
1946–1972	0.085	0.14	0.96	0.63	4.74	0.02	0.63
1973–1992	–1.294*	–2.22	0.98	0.64	7.77*	0.26	6.24
Sweden							
1919–1939	0.905*	4.40	0.94	0.45	0.69	0.28	19.13
1946–1972	–0.250*	–2.65	0.99	0.34	1.71	1.21	5.19
1973–1993	–0.221	–1.45	0.98	0.26	0.49	0.62	24.74*
U.K.							
1886–1913	–0.265	–1.67	0.82	0.13	1.21	1.36	5.01
1919–1939	–0.06	–0.27	0.90	0.36	1.50	0.14	14.28
1946–1972	–0.454	–1.95	0.99	0.18	6.68*	0.37	5.94
1973–1993	–0.976*	–3.07	0.99	0.72	1.66	0.39	9.07
U.S.							
1890–1913	0.012	0.15	0.84	0.22	0.36	1.47	6.30
1919–1939	0.483*	7.94	0.93	0.70	14.40*	0.12	12.38
1946–1972	0.004	0.03	0.98	0.21	9.14*	0.05	11.68
1973–1993	–0.019	–0.87	0.99	0.77	1.39	0.19	13.99

* Significant at the 5% level.

[a] Q is estimated using eight rather than ten lags.

Table 5: A Summary of the Results

Country	Pre-War	Inter-War	Pre-1973	Post-1973
Australia	0	+	–	0
Canada		+	0	–
France			–	0
Germany			0	0
Italy	0	0	+	0
Japan			0	–
Sweden		+	–	0
U.K.	0	0	0	–
U.S.	0	+	0	0

+ procyclical, – countercyclical, 0 no evidence for cyclicality.

V. CONCLUSION

In this paper we re-examined the cyclical behaviour of prices in nine countries using long historical time series. We may, on the basis of the empirical evidence presented in this study, state the following conclusions: (i) there is weak but consistent evidence for countercyclicality of prices in the post 1973 period; (ii) there is weak but consistent evidence for procyclicality in the inter-war period; and (iii) the evidence for the 1950–1972 period is mixed.

These differences cannot be totally attributed to the dominance of a particular type of shock during a given period. Other explanatory factors include differences pertaining to the degree of price stickiness, the type of policy response (if any) and the timing of the response relative to the shock. Thus, even if the patterns of shocks are similar, differences in the cyclical behaviour of prices may appear. Finally, the evidence presented here is not strong enough to support the «international phenomenon» of BACKUS and KEHOE (1992).

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SUMMARY

This paper re-examines the cyclical behaviour of prices in nine countries over long historical periods extending in some cases between the late 1800s and the early 1990s. By evaluating the existing empirical evidence on this issue it is found that the results are sensitive to a number of factors such as the choice of filter and the price variable. The results of structural time series analysis reveal substantial cross-country differences.

ZUSAMMENFASSUNG

Dieses Papier untersucht wiederholt das zyklische Verhalten von Preisen in neun Ländern über lange historische Perioden, die sich in manchen Fällen zwischen dem späten 18. Jahrhundert und den frühen 90iger Jahren erstrecken.

Beim Auswerten der bestehenden empirischen Tatsachen, die dieses Gebiet betreffen, wurde herausgefunden, dass die Ergebnisse von mehreren Faktoren, wie zum Beispiel die Auswahl des Rasters und der Preisvariablen, beeinflusst werden.

Die Ergebnisse der strukturellen Zeitzyklenanalyse zeigen substantielle Unterschiede zwischen den Ländern auf.

RESUME

Ce Papier réexamine le comportement cyclique des prix dans neufs pays pour des périodes historiques qui s'étendent en quelques cas entre la fin du $18^{\text{ème}}$ siècle et le début des années 90 du $19^{\text{ème}}$ siècle.

En evaluant l'evidence pratique empirique du sujet, il a été trouvé que les résultats sont sensitives aux facteurs nombreux comme le filtre et la divergence de prix.

Les résultats de l'analyse structurel de séries périodique révèlent qu'il ya de substantiel différences à travers le pays.