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Abstract

Many empirical studies have examined the cyclical nature of the markup ratio. Until recently, few have attempted to ascertain the changes in the markup over a longer time horizon. These changes are of no less interest in view of the posited effects of increasing import competition and lower inflation on the markup. This paper offers evidence on the evolution of the markups for the Canadian business sector and 33 disaggregate industries over the 1961–2004 period. It is found that the business sector markup has declined since the mid-1980s, and that import competition has made a statistically significant but small contribution to this decline.

JEL classification: E31, F41, L11

Bank classification: Econometric and statistical methods

Résumé

De nombreuses études empiriques ont examiné la nature cyclique du taux de marge. Jusqu'à récemment, peu de chercheurs ont tenté de déterminer comment les marges variaient en longue période. Or, cette question n'est pas sans intérêt étant donné les effets présumés de la concurrence croissante des importations et de la baisse de l'inflation sur les marges. L'auteur présente des données sur l'évolution des marges au Canada entre 1961 et 2004, dans l'ensemble du secteur des entreprises et 33 branches d'activité différentes. Il constate que les marges régressent depuis le milieu des années 1980 dans le secteur des entreprises et qu'une part statistiquement significative mais modeste de ce recul est imputable à la concurrence des importations.

Classification JEL : E31, F41, L11

Classification de la Banque : Méthodes économétriques et statistiques

1. Introduction

Variations in the markup of price over marginal cost play a vital role in a number of macroeconomic models. The prediction that counter-cyclical markups enhance the impact of demand shocks in New Keynesian models¹ has motivated numerous empirical studies looking at the cyclical nature of the markup.² Less widely studied, but no less important, is the evolution of the markup over longer time horizons. At least two strands of economic literature have made predictions about long-run changes in markups. First, trade theory suggests that increasing import competition should lead to lower markups. There is abundant evidence from developing countries in this respect,³ but as pointed out by Bouhol (2006), evidence from developed countries is lacking. Second, in the consumer search model of Benabou (1992a), lower inflation can lead to lower markups, but the result is sensitive to the size of search costs. Empirical evidence on this relationship is also mixed. For example, Banerjee and Russell (2001) find a negative relationship in G7 economies, and Chirinko and Fazzari (2000) find a positive relationship among U.S. manufacturing firms.

This paper provides estimates of Canadian markups over the 1961-2003 period for the business sector as a whole and for 33 industries. Estimates for the business sector show how the Canadian markup has evolved and industry-level estimates give insight into why it has changed. Markups are estimated using Roeger's (1995) approach and the state-space approach of Ellis (2006). Roeger's approach has the advantage of being based mostly on nominal data so that the issue of unreliable price deflators in certain industries is avoided. A key disadvantage of using Roeger's approach is that it is derived assuming a constant markup, but rolling regressions can be used to examine whether the markups have changed over time. On the other hand, Ellis' estimation of factor demand equation explicitly allows for a time-varying markup, but makes use of price indices. After verifying that the time variations in the markup estimates are consistent across methodologies, regression analysis

¹For example, see Rotemberg and Woodford (1999).

²For example, see Bils (1987), Domowitz et al. (1988), Rotemberg and Woodford (1991), Morrison (1994), Haskel et al. (1995), Beccarelli (1996), Oliviera Martins et al. (1996) and Marchetti (2002)

³For example, see Levinsohn (1993), Harrison (1994), Krishna and Mitra (1998) and Pavcnik (2002).

is then carried out to examine whether the change in markups is related to increasing import competition since the late 1980s and lower inflation rates brought about by the introduction of inflation targeting.

Other papers have estimated markups for Canada, but these have generally been proxies. For example, Bowman (2003) uses the inverse of labour's share of GDP and Banerjee and Russell (2001) use price over unit labour and import costs. The measures presented in this paper is a price over marginal cost markup derived from a firm's profit maximization problem assuming constant returns to scale.⁴

It is found that after rising steadily a total of 8.1 per cent over the 1961 to 1985 period, markups in the Canadian business sector fell by 10 per cent over the next eight years. This can be compared with Ellis' (2006) findings of both a 17 per cent decline in the markup for the U.K. total economy since 1977⁵ and a 10 per cent decline in the U.S. non-farm business sector markup between 1985 and 2000. The timing of the decline suggests that import competition or inflation reduction may be important, but regression analysis at the level of the business sector does not yield statistically significant results. However, substantial heterogeneity in the evolution of markups across industries is found. Panel regressions, that make use of this variation, show that the effect of import competition is negative but small, while the effect of inflation remains insignificant.

The rest of the paper is organized as follows. Section 2 discusses how markups have been measured in the literature and why this paper employs the methodologies it does. It also discusses the theoretical links between markups, inflation and import competition, and some of the empirical evidence. Section 3 presents the data used in the estimation of the markup. Section 4 provides the results from the empirical analysis. Estimates of the average level of markups using Roeger's methodology are first presented. The time variation in the markups using Roeger's methodology is then checked with the time variation from the state-space approach. Finally, the empirical relationship between markups, inflation and import

⁴Morrison (1994) also estimates price over marginal cost markups for Canadian manufacturing industries, but focuses solely on determining their cyclical nature.

⁵The decline for the U.K. private sector was less at 5 per cent.

competition is explored. Section 5 offers some concluding remarks.

2. Related Literature

2.1 The Measurement of Markups

Hall's (1988) paper on markups in U.S. industries initiated much of the research on the measurement of markups. Hall estimated markups by examining the fluctuations in output relative to the fluctuations in inputs. Consider the production function $Y_t = A_t F(L_t, K_t)$, where Y_t is output, A_t is an index of technological progress, and F is homogenous of degree γ in labour (L_t) and capital (K_t).⁶ The standard Solow residual commonly used in growth accounting (Δz_t^P) is:

$$\Delta z_t^P = \Delta y_t - \alpha_t^V \Delta l_t - (1 - \alpha_t^V) \Delta k_t, \quad (1)$$

while the Solow residual that allows for imperfect competition is:

$$\Delta a_t^P = \Delta y_t - \mu \alpha_t^V \Delta l_t - (1 - \mu \alpha_t^V) \Delta k_t, \quad (2)$$

where Δa_t^P , Δy_t , Δl_t , and Δk_t are the log differences of the technology index, output, labour and capital, respectively, α_t^V is labour's share of nominal output, and μ is the ratio of price over marginal cost. Technology growth is output growth that cannot be accounted for by a weighted growth in inputs. The difference between the Solow residual in (2) and the standard Solow residual in (1) are the weights on the inputs. In the standard Solow residual, the weight on labour is simply α_t^V , while in (2) α_t^V is scaled by μ . Equation (2) can be rearranged to obtain the equation used to estimate the markup ratio and the returns to scale.

$$\Delta (y_t - k_t) = \mu \alpha_t^V \Delta (l_t - k_t) + \Delta a_t^P + \varepsilon_t. \quad (3)$$

Hall (1988) pointed out that (3) should not be estimated using ordinary least squares (OLS) because the unobserved technology term is correlated with the regressors, thus some form of

⁶Domowitz et al. (1988) show that Hall's (1988) approach for measuring the markup is biased if intermediate inputs are not taken into account. Here, they are omitted in the theoretical section for simplicity, but are taken into account in the empirical work.

instrumental variables (IV) estimation should be used. The intuition for (3) is that under constant returns to scale and perfect competition total output and total input grow at the same rate in the absence of changes in technology. Thus fluctuations in the explanatory variable, the weighted labour-capital ratio, caused by exogenous factors unrelated to technology (a shock to aggregate demand, for example) should be matched one to one by changes in the dependent variable, capital productivity. As noted by Caballero and Lyons (1990), in practice, it is not easy to find instruments, exogenous factors, that are sufficiently correlated with the regressor.⁷

Roeger (1995) proposed an extension to Hall's approach that eliminated the need to use IV estimation. He showed that if constant returns to scale is assumed, the difference between the standard production-based (primal) Solow residual shown in (1) and the standard price-based dual Solow residual (Δz_t^D) is a function of the markup ratio, but not the technology parameter.

$$\begin{aligned}\Delta z_t^P - \Delta z_t^D &= (\Delta y_t + \Delta p_t) - \alpha_t^V (\Delta l_t + \Delta w_t) - (1 - \alpha_t^V) (\Delta k_t + \Delta r_t) \\ &= B [(\Delta y_t + \Delta p_t) - (\Delta k_t + \Delta r_t)] + \varepsilon_t,\end{aligned}\tag{4}$$

where B is the Lerner index of market power, p is the price of output, w is the wage rate, and r is the user cost of capital. The Lerner index of markup power is related to the markup in the following way.

$$B = \frac{P - MC}{P} = 1 - \frac{1}{\mu} \quad \text{or} \quad \mu = \frac{1}{1 - B}.\tag{5}$$

The intuition for (4) is that by taking the difference between the two productivity residuals the unobserved technology term common to both is eliminated, and the markup is identified

⁷A number of researchers have used variations of Hall's methodology to estimate markups. Domowitz et al. (1988) and Norrbin (1993) incorporate intermediate inputs into Hall's framework. Basu and Fernald (1997) adapt Hall's approach to account from deviations from constant returns to scale. Basu, Fernald and Shapiro (2001) consider capacity utilization as well. Others like Morrison (1994) expand on Hall in different dimensions. Instead of estimating simply the production relationship implied by the solution to the firm's profit maximizing problem, Morrison estimates a number of equations associated with a dynamic profit maximizing factor demand model with imperfect competition, non-constant returns to scale and capacity utilization. Among the equations estimated are demand equations for variable inputs, the inverse demand function, and Euler equations capturing investment behaviour. Given the large number of endogenous variables in such systems, the problem of finding instruments is even more daunting and generally a time trend is introduced into the flexible functional forms to account for technology.

by the different way the two residuals handle deviation from perfect competition.⁸

There are two advantages to estimating equation (4) compared to equation (3). Most importantly, the technology term is not present in (4), so OLS estimation is more justifiable. Second, only nominal variables appear in the regression, so problems obtaining reliable price indices are largely avoided. The drawback of Roeger's methodology in comparison to Hall's is that constant returns to scale and a constant markup must be assumed to obtain (4).⁹ However, Basu and Fernald (2002) argue that decreasing returns to scale is not intuitive at the firm-level as it implies firms price output below their marginal costs, and they show that the degree of decreasing returns disappear at higher levels of aggregation.¹⁰ Consistent with Basu and Fernald (2002), Paquet and Robidoux (2001) find that constant returns to scale holds approximately for the aggregate Canadian economy. Given that decreasing returns to scale is not theoretically appealing at higher levels of aggregation and that the degree of returns to scale have generally been found to be roughly constant at the industry level, the first disadvantage of Roeger's methodology is likely minor.

Roeger's assumption of a constant markup may be more problematic in the context of this paper which focuses on the time variation in the markup. While rolling regressions can be used to obtain an estimate for the markup around a certain year, it would be preferable to find a methodology that does not make the assumption of a constant markup. The state-space approach of Ellis (2006) avoids making this assumption.

Ellis (2006) estimates factor demand equations from a firm's profit maximization problem, treating technology and the markup as unobserved components to be estimated each time period.¹¹ Assuming constant returns to scale, a CES production function and a constant

⁸Oliviera Martins et al. (1996) show that Roeger's estimating equation can also be derived by differentiating with respect to time the definition of the price-average cost markup and then setting the change in the markup to be zero.

⁹Bouhol (2005) also argues that markups estimated using Roeger's methodology are upward bias, and presents a reformulation of (4) that corrects this bias. In the context of this paper, it is found that the difference in the markup estimates produced by the two methodologies are minimal, so only Roeger's estimates are shown.

¹⁰Basu and Fernald (2002) and Norrbin (1993) find roughly constant returns to scale (slight decreasing returns) in U.S. industries. Furthermore, using a Hall-type approach, Marchetti (2002) finds that constant returns to scale cannot be rejected for most Italian manufacturing industries.

¹¹The approach of Ellis (2006) is similar to Morrison (1994) in that a system of equations from a firm's

elasticity demand curve, the following factor demand equation for labour can be derived:

$$y_t - l_t = (1 - \sigma)a_t + \sigma(w_t - p_t) + \sigma \ln \mu_t + \sigma \ln(1 - \alpha) + e_{1t}, \quad (6)$$

where σ is the elasticity of substitution and α is the distribution parameter. In principle, other factor demand equations besides the one for labour could be used as well. Ellis (2006) estimates both a labour and capital demand equation. However, Perrier (2005) notes that the capital demand equation may not give satisfactory results because of difficulties in constructing a user cost of capital and determining the utilization rate of capital, if capital is not fully flexible. The state space model is completed by assuming that the technology term and the markup follows a certain statistical process such as:

$$\begin{aligned} \ln \mu_t &= \ln \mu_{t-1} + \lambda_{1t}, \\ a_t &= a_{t-1} + \phi + \lambda_{2t}, \end{aligned} \quad (7)$$

where ϕ is the average growth rate of technology. The Kalman filter can then be used to obtain estimates of the unobserved components, the markup and technology, at each time period relative to the value given in an initial period.

In both Roeger (1995) and Ellis (2006), the need to use instrumental variables is avoided, and both methodologies assume constant returns to scale. Although Roeger needs to assume a constant markup, this approach is not more restrictive than the state-space approach in every aspect. The production and cost function in Roeger need only be homogeneous, while in the state-space approach a specific functional form is assumed. Furthermore, Roeger's approach uses mostly nominal data, while the state-space approach depend on appropriate deflators. Given that both methodologies have their strengths and weaknesses, estimates using both methodologies are presented.

profit maximization problem is estimated. Unlike Morrison (1994), a specific functional form, CES, for the production function is assumed. The CES is more restrictive than the flexible functional form estimated in Morrison, but restrictions on the flexible functional forms estimated by Morrison are generally needed as well. The CES assumption simply makes these restrictions more explicit and intuitive.

2.2 Markups, Import Competition and Inflation

It has been suggested that increased competition from imports should be driving down markups. While there is a large literature documenting the decline in the markups of emerging economies when exposed to foreign competition, evidence from developed countries is lacking. For example, Thompson (1999) finds no evidence that increasing import competition reduced market power in Canada during the 1970s. Furthermore, when Bouhol (2006) plots the price-cost margin and foreign penetration rates for the manufacturing sectors of a number of OECD countries, he observes that, aside from Spain and Japan, the price-cost margins do not appear to be affected by the foreign competition. The lone convincing study that shows a positive impact of import competition in a developed country is Bouhol et al. (2006). Using data from U.K. manufacturing firms, Bouhol et al (2006) show that markups declined 5 percentage points (also roughly 5 per cent) in the latter half of the 1990s and that the effect of the increasing share of imports in total demand is strong, a one percentage point increase in the import share bringing about a one percentage point decrease in the markup.

In theory, the long-run effect of inflation on markups is ambiguous. Benabou (1992a) posits that in a model where buyers search across firms for prices, higher inflation leads to more price dispersion but a higher return to search. Greater price dispersion alone tends to increase the average price paid by buyers, but this can be counteracted by an increase in search intensity. Markups rise if the increase in buyer search is small, but can fall if the increase in buyer search is sufficiently large. Gwin and Taylor (2004) argue that whether the relationship between markup and inflation is positive or negative depends importantly on the level of search costs. The empirical evidence on the effect of inflation on the markup is also mixed. Benabou (1992b) finds a negative relationship using data from the U.S. retail trade sector and Kaskarelis (1993) finds a negative relationship using U.K. manufacturing data. More recently, Banerjee and Russell (2001, 2004) find a negative relationship in the aggregate data of G7 economies. On the other hand, Chirinko and Fazzari (2000) find a positive relationship in U.S. industries, while Gwin and Taylor (2004) find a positive relationship in U.S. industries where search costs are high.

3. Data

Statistics Canada's KLEMS database is the primary source used in this paper. The KLEMS data are from the Canadian Productivity Accounts and are used to produce the official multifactor productivity numbers for Canada.¹² The data are annual. The vintage of KLEMS used in this paper spans the period 1961 to 2003 for the aggregate business sector, and 1961 to 2004 for the disaggregate industries. This paper uses the 2-digit level industries for all sectors, except in manufacturing where 3-digit level industries are used. In total, 33 industries are examined, 19 manufacturing industries and 14 other 2-digit industries.¹³ Chain-weighted quantity and price indices for capital, labour, energy, material and services inputs and gross output are available in KLEMS, as are nominal gross output, capital, labour, energy, material and service costs. Capital input is capital services and labour input is quality-adjusted hours.¹⁴

Although capital costs and the price indices of capital are included in KLEMS, they are not used because they are derived by subtracting labour, energy, material and service costs from nominal gross output. If these capital costs indices were used, then by construction, constant returns to scale and zeros markups would be found. Instead, the user cost of capital is constructed using other Statistics Canada data on CANSIM. The user cost is approximated by the following:

$$r_t = p_t^i(i_t - \pi_t + \delta_t) + (p_t^i - p_{t-1}^i)/p_{t-1}^i, \quad (8)$$

where p_t^i is the industry specific price of investment, π_t is growth rate of the aggregate GDP deflator, and δ_t is the industry specific depreciation rate.¹⁵ The variable i_t is the weighted average of the return on equity (HP filtered return on the TSX, capital gains and dividends)

¹²See Statistics Canada (2002) for more details on the source of this data.

¹³Educational services and health care and social assistance are omitted due to the small size of the business sector portion of these industries. Leather and allied products is omitted because of some of the data in this industry is secured.

¹⁴See Statistics Canada (2002) for more detail on the distinction between capital services and capital stock, and how the quality adjustment in hours worked is carried out. The difference between capital services and capital stock is not related to capacity utilization but rather reflects the weighting of the various capital assets by their relative rates of return or user costs.

¹⁵These variables were obtained from Statistics Canada's CANSIM.

and the nominal interest rate on ten-year Government of Canada bonds. The weights are given by the amount of debt relative to equity used by each industry.¹⁶

The measures of import competition for each industry (imports of the industry's main output as a fraction of the total domestic availability of that good) are taken from Dion (1999-2000) and updated to 2002, and the inflation rate is calculated from CPI-all items. Industry-specific inflation can also be derived from KLEMS. In addition to import competition and inflation, a control to capture the cyclical nature of markups is also included. This control is the output gap measure from the Bank of Canada, or an industry-specific measure based on HP-filtered industry output.¹⁷ A notable omission in the list of possible explanatory variables is a measure of domestic competition. Unfortunately, concentration ratios and firm mobility statistics (static and dynamic measures of competition) can only be calculated with firm-level data, which is not readily available over such a long time period.¹⁸

Since the markup is non-stationary by construction, tests were first performed to see if import competition and inflation were unit roots and whether the three were cointegrated. Perhaps because of the lack of a measure of domestic competition, cointegration is not found. Thus the difference of the log markup is regressed on the difference of the log of import competition, the difference of the log of the output gap, and the difference of inflation. All of the regressors mentioned above are endogenous, so IV estimation is used. Instruments include: the change in U.S. CPI inflation, U.S. GDP growth, and U.S. average tariff rate (U.S. customs duties divided by U.S. goods imports), and one lag of each of the just-mentioned variables. Also, included are import competition and the real effective exchange rate, both

¹⁶These are taken from Statistics Canada's Financial and Taxation Statistics of Enterprises available on CANSIM.

¹⁷Potential end of sample problems are somewhat mitigated by the fact that import competition measures are available only up to 2002, so the the output gap estimates in 2003 and 2004 are not used.

¹⁸A possible indicator of domestic competition, the fraction of employment in large firms, was included in some early regressions. However, it was generally not statistically significant and did not have a large effect on the other variables. It was not included in the final results because the measure is available for only a limited number of years (1983-1999, Statistics Canada's *Employment Dynamics*).

The capital intensity of an industry would also be a proxy domestic competition because high capital requirements might indicate high barriers to entry. Real capital over real output can be constructed using data in KLEMS, but it is not included as an explanatory variable because it is highly correlated to capital's nominal share in gross output and by construction highly correlated to the markup.

lagged twice.¹⁹

4. Results

4.1 Markup Estimates

Table 1 presents average markup for each industry over the 1961-2004 period, based on Roeger's methodology. All markups are statistically different from one at the 5 per cent level. Most markups are statistically significant at the 1 per cent level. Markups range from a low of 7 per cent for the construction industry to 138 per cent for utilities. A high markup for utilities would be expected as for much of the period it was dominated by local monopolies. The high markup of 128 per cent for mining, oil and gas could also be due to the high capital costs associated with that industry, which act as an effective barrier to entry. The relatively high markup of 76 per cent for FIRE is also expected as the largest chartered banks control a large fraction of the financial services sector. On the other hand, construction, an industry that is highly fragmented, exhibits the lowest markups at 7 per cent.²⁰ The business sector markup is obtained by aggregating industry-level markups using nominal shares in gross output as weights.²¹ This method of aggregation appears to work well as the manufacturing sector markup is nearly identical to the one based on the aggregation of the 19 manufacturing industries.

Rolling regressions, with a sample size of 9 years, for all industries are carried out and aggregated to obtain a time-varying markup for the business sector. Figure 1 compares these estimates to the ones given by the state-space approach. Consistent with Perrier (2005), the elasticity of substitution for the Canadian business sector is estimated to be 0.568, statistically significantly less than one. However, the constant term in (6), $\sigma \ln(1 - \alpha)$,

¹⁹The U.S. variables are readily available from the Bureau of Labor Statistics, Bureau of Economic Analysis, and *U.S. Statistical Abstract*. The real effective exchange rate is the C-6 trade weighted rate computed at the Bank of Canada.

²⁰These numbers are roughly in line with that found in Oliveira Martins et al. (1996) who also adopt Roeger's (1995) approach. In that paper, estimates of 1.29 for the entire Canadian trade industry and 1.20 for the manufacturing industry during the 1980-1992 period are found. Oliveira Martins et al. use data from the OECD STAN database.

²¹Estimates using Hall's (1988) and Roeger's (1995) methodologies tend to be upward biased when value-added output is used, so the business sector markups are not estimated directly. See Domowitz et al. (1998).

is not statistically significant. This suggests that the level of productivity and the level of the markup are not well-identified in the model. This problem does not affect the changes in the markup and productivity over time as arbitrarily choosing a constant term only shifts the estimated markup and productivity series. As a result, the markup estimates using the state-space approach are scaled to match the average markup for the business sector over the entire sample period as shown in Table 1.²² Overall, both measures exhibit the same broad patterns.²³ The markup rose steadily between 1961 and the mid-1980s. It then fell back to roughly its level in 1961 in less than a decade, and has since remained relatively stable. As a result of the similarities, the rest of the paper focuses on the estimates derived from the state-space approach because they are available over a longer period.

4.2 The Importance of Import Competition and Inflation

Both import competition and inflation appear related to the markup. Figure 2 shows the business sector markup and inflation. Markups are definitely higher in the high inflation years between 1973 and 1982, and the sharp decline in markups follows the shift to lower inflation rates after 1982. The sharp rise in inflation does not seem to have precipitated as sharp a rise in the markup before 1973, but the increase in inflation was not as quick as the decline. There might also be some degree of non-linearity in the relationship as the further reduction in inflation rates in the inflation-targeting era has not brought about a further reduction in markups. Figure 3 shows the business sector markup and import competition.²⁴ Import competition has risen over time, but the rate of increase rose perceptibly in the 1980s onwards. This increase in the pace of import competition growth roughly coincides with the decrease in markups, but overall, markups and import competition appear positively correlated.

²²The state space estimates are obtained by setting the noise to signal ratio, the ratio of variances of the error terms in (6) compared to the variances in (7) to 2. Variation of this ratio from 1 to 10 does not alter the results significantly.

²³This is also the case for many of the industries. Industry by industry comparisons are available on request.

²⁴Dion's (1999-2000) measures of import competition at the industry-level are also aggregated based on nominal gross-output shares.

Table 2 presents the results of the regression analysis. Column (1) shows the results for the regression at the level of the business sector. Neither the output gap nor inflation is statistically significant. As predicted by Figure 3, the sign on import competition is counter-intuitively positive and significant.²⁵ It may be the case that the effects of import competition and inflation are not instantaneous, but their lagged values are not statistically significant either.

Column (2) presents the regression with industry-specific markups and industry-specific measures of import competition. Unlike the results from the regression using aggregate data, the sign on import competition is negative and significant. Aggregation of the data appears to have obscured the expected relationship between the variables. As evidence of the degree of heterogeneity across industries, one needs only look at the diverse markup trends exhibited at the 2-digit industry level (see Figure 4). Inflation, however, is still insignificant. To check if this result is also related to aggregation, industry-specific (producer) price inflation and industry output gap measures are used in the regression shown in column (3). The results are similar to column (2). The coefficient on import competition remains unchanged and inflation is still insignificant. This suggests that, in Canada, the reduction in buyer search following a decline in inflation and price dispersion is enough to keep markups from falling.

Columns (4) and (5) repeat the analysis in (2) and (3), but for the panel of 19 manufacturing industries only. Similarly, columns (6) and (7) present the results for the panel of non-manufacturing industries. When only the manufacturing industries are used, the effect of import competition is estimated to be two to three times stronger than when all industry data are used. In fact, the result for all industries is driven solely by the manufacturing industries as the effect of import competition on non-manufacturing industries is not statistically significant. Inflation is not statistically significant in any of the regressions.

In columns (2) to (5), markups are found to be pro-cyclical. This result should be taken with some degree of skepticism. The estimated markups presented in this paper are derived

²⁵The R^2 's for the first stage regressions range from 0.47 to 0.75, and the instruments are jointly significant at least at the 10 per cent level in all cases. Furthermore, the Sargan test of over-identifying restriction fails to reject the hypothesis that the instruments are exogenous, not correlated to the residuals.

assuming full adjustment of inputs and are meant to capture long-run changes. If some inputs are fixed in the short run, then the production function will likely exhibit decreasing returns in the remaining variable inputs. The estimated level of the markup assuming full adjustment will be upward biased, but unless the degree of fixity has changed drastically it should not affect the long-run changes in the markup. However, the cyclical properties of the markup could be affected, as Murchison and Zhu (2003) show that their measure of a detrended Canadian markup becomes counter-cyclical only after costly factor adjustment is taken into account.

Finally, the growth in the markup due to import competition is obtained by multiplying the estimated coefficient in column (3) to the observed changes in import competition growth. The predicted growth rates are then applied to the level of the markup at the beginning of the sample.²⁶ The result is shown in Figure 5. While the predicted markup exhibits the same pattern as the actual markup, especially after the mid 1970s, the magnitude of the changes in the predicted markup is smaller than that of the actual. The rise in import competition accounts for roughly one-tenth of the decline in the markup between 1985 and 1993.

4.3 The Importance of Commodity Prices and the Real Exchange Rate

Broad changes in relative prices, may also have affected the markup. For example, lower worldwide demand for commodities or a higher Canadian dollar may have moved the market equilibrium to a more elastic part of the demand curve for Canadian products, resulting in lower markups. To gauge their individual impacts, the change in real commodity prices and the change in the real exchange rate are entered into all regressions.²⁷ Arguably these variables are exogenous and are not instrumented.²⁸ The results are presented in Table 3. The previous results are robust to the introduction of the additional regressors, and as expected,

²⁶The results would not be altered substantially if the coefficient in column (5) were used. Despite the fact the coefficient in (5) is twice as large as in (3), manufacturing's share of gross output ranges between 0.33 and 0.4, so the effect on the business sector markup is similar.

²⁷The real commodity price is measured by the Bank of Canada's commodity price index relative to the GDP deflator. It is available from 1972 onwards.

²⁸Results where the real exchange rate is instrumented are not significantly different from the ones presented. However, the set of instruments listed in the data section were not jointly significant in the case of the real exchange rate.

there is evidence to suggest that a rise in commodity prices and a depreciation of the real exchange rate lead to higher markups. Interestingly, the effect of the real exchange rate is of a comparable magnitude and statistically significant in all the regressions, suggesting its effect is widespread across all industries. Apparently, depreciations that directly stimulate exporting industries, indirectly impact non-exporting industries as well. In contrast, the effect of commodity prices is strongest when aggregate data is used (column (1)), significant at the 10 per cent level for the panel of all industries (columns (2) and (3)), and not significant when the panel is divided into manufacturing and non-manufacturing. The latter result is likely due to the fact that the split into manufacturing and non-manufacturing does not isolate the industries most affected by commodity prices.

Figure 6 and 7 show the predicted markup due to changes in commodity prices and the exchange rate, respectively, calculated using the coefficients in column (3). The fall in commodity prices preceded the decline in the markup, so when the markup began to decline in 1985, roughly half of the decline in commodity prices between 1980 and 1993 had already occurred. As a result, commodity prices account for only 6 per cent of the decline in the markup between 1985 and 1993. The real exchange rate appreciated between 1986 and 1991, but depreciated sharply in subsequent years, so its effect on the markup over that time period is negligible.

5. Conclusion

Recent studies have shown that markups have declined in the United States and the United Kingdom. It has been suggested that lower inflation and import competition may have contributed to this decline. However, empirical evidence on the effects of inflation on the markup is mixed and evidence that increasing import competition negatively affects the markup in developed countries is scant. This paper presents evidence on how markups have changed in the Canadian business sector and in its major industries. The Canadian business sector markup is found to have declined in the mid-1980s and early 1990s, but the evolution of this aggregate markup overall does not appear to be negatively affected by the degree

of import competition. This is confirmed by regression analysis at the level of the business sector. However, substantial heterogeneity exists in the evolution of the markup across industries, and using this variation, a small but negative effect from import competition is found. Import competition accounts for roughly ten per cent of the decline in the aggregate markup. On the other hand, there is little evidence that lower inflation has brought about a decline in the markup. Real commodity prices and the real exchange rate are found to have a positive impact on the markup, but they account for even less of the decline in the markup than import competition.

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Table 1. Average markups: 1961-2004

Major industries		Manufacturing industries	
Agriculture, forestry and fishing	1.472	Food	1.110
Mining, oil and gas	2.284	Beverage and tobacco	1.368
Utilities	2.378	Textiles	1.130
Construction	1.070	Clothing	1.097
Manufacturing	1.147	Wood products	1.166
Wholesale trade	1.264	Paper	1.243
Retail trade	1.209	Printing	1.102
Transportation and warehousing	1.233	Petroleum and coal	1.028
Information and culture	1.562	Chemical	1.249
FIRE	1.760	Plastics and rubber	1.142
Professional, technical and scien.	1.213	Non-metallic mineral	1.256
Administrative and management	1.212	Primary metal	1.141
Arts, entertainment and recreation	1.305	Fabricated metal	1.143
Accommodation and food	1.178	Machinery	1.157
Other services	1.169	Computer and electronics	1.195
		Electrical equipment	1.128
		Transportation equipment	1.103
		Furniture	1.110
		Miscellaneous	1.117
Aggregate (weighted by nominal shares in gross output)	1.346	Manufacturing (weighted by nominal gross output)	1.148

Note: All estimates are statistically different from one at the 5% level

Table 2. Markups, inflation and import competition: 1961-2002

	Aggregate (1)	Panel – all industries (2) (3)		Panel – manufacturing (4) (5)		Panel – non-manufacturing (6) (7)	
$\Delta \ln(\text{import competition})$	0.1423 (0.0582)	-0.0501 (0.0227)	-0.0479 (0.0211)	-0.1423 (0.0505)	-0.1096 (0.0412)	0.0030 (0.0098)	-0.0197 (0.0207)
$\Delta \text{CPI inflation rate}$	-0.0036 (0.0028)	0.0052 (0.0500)	----	0.0452 (0.0788)	----	-0.0827 (0.0587)	----
$\Delta \ln(\text{output gap})$	0.1761 (0.1717)	0.2551 (0.0689)	----	0.4387 (0.1222)	----	0.1078 (0.0724)	----
$\Delta \text{industry inflation rate}$	----	----	0.0019 (0.0209)	----	0.0191 (0.0262)	----	-0.0525 (0.0586)
$\Delta \ln(\text{industry output gap})$	----	----	0.1346 (0.0317)	----	0.1431 (0.0301)	----	0.1441 (0.0922)
Sargan-Hansen p-value	0.938	0.204	0.200	0.560	0.314	0.694	0.579

Note: HAC standard errors in parentheses. The dependent variable is the differenced log markup.

Table 3. Markups, commodity prices and the real exchange rate: 1972-2002

	Aggregate (1)	Panel – all industries (2) (3)		Panel – manufacturing (4) (5)		Panel – non-manufacturing (6) (7)	
$\Delta \ln(\text{import competition})$	0.0223 (0.0542)	-0.0232 (0.0143)	-0.0415 (0.0161)	-0.0907 (0.0340)	-0.0754 (0.0252)	0.0025 (0.0112)	-0.0139 (0.0183)
$\Delta \text{CPI inflation rate}$	-0.0041 (0.0025)	0.0052 (0.0500)	----	0.1006 (0.0815)	----	-0.0928 (0.0643)	----
$\Delta \ln(\text{output gap})$	0.2200 (0.1826)	0.1472 (0.0589)	----	0.3670 (0.1112)	----	0.0459 (0.0760)	----
$\Delta \text{industry inflation rate}$	----	----	-0.0356 (0.0341)	----	-0.0093 (0.0376)	----	-0.0408 (0.0660)
$\Delta \ln(\text{industry output gap})$	----	----	0.1040 (0.0278)	----	0.1100 (0.0232)	----	0.0967 (0.0904)
$\Delta \ln(\text{real commodity price})$	0.0640 (0.0235)	0.0172 (0.0089)	0.0219 (0.0118)	-0.0067 (0.0093)	0.0170 (0.0149)	0.0175 (0.0114)	0.0139 (0.0118)
$\Delta \ln(\text{real exchange rate})$	0.0345 (0.0415)	0.0334 (0.0100)	0.0435 (0.0114)	0.0266 (0.0148)	0.0517 (0.0182)	0.0371 (0.0119)	0.0348 (0.0145)
Sargan-Hansen p-value	0.774	0.151	0.177	0.264	0.309	0.573	0.794

Note: HAC standard errors in parentheses. The dependent variable is the differenced log markup.

Figure 1. Business Sector Markups

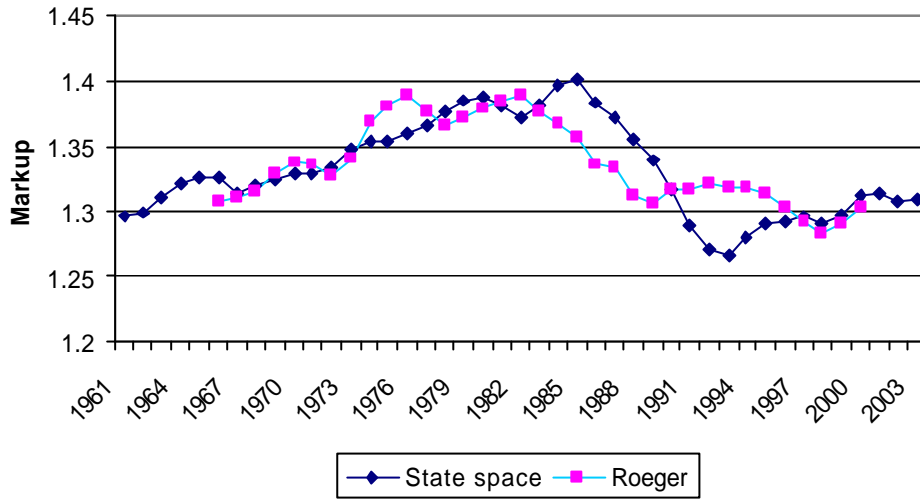


Figure 2. Business Sector Markup and CPI Inflation Rate

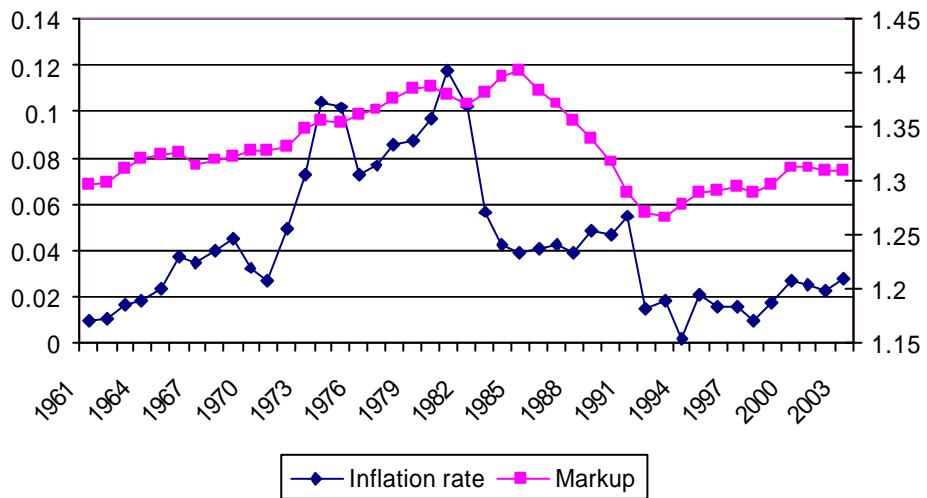


Figure 3. Business Sector Markup and Import Competition

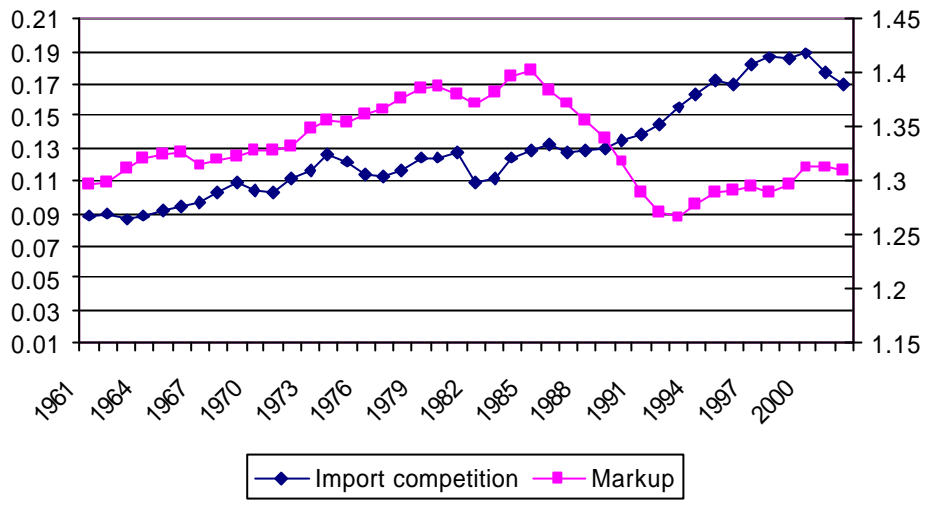


Figure 4. Industry-Level Markups

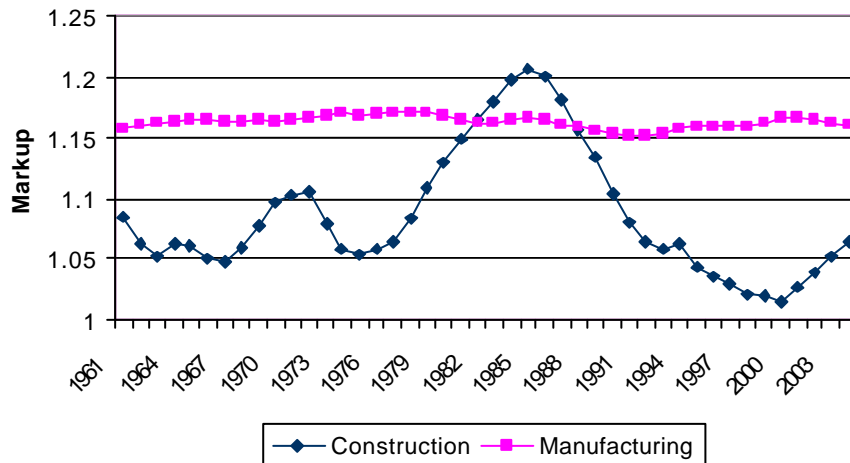
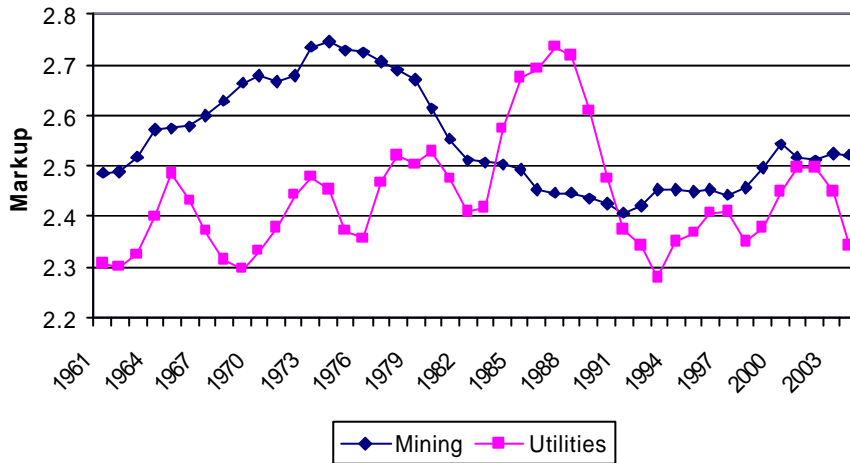
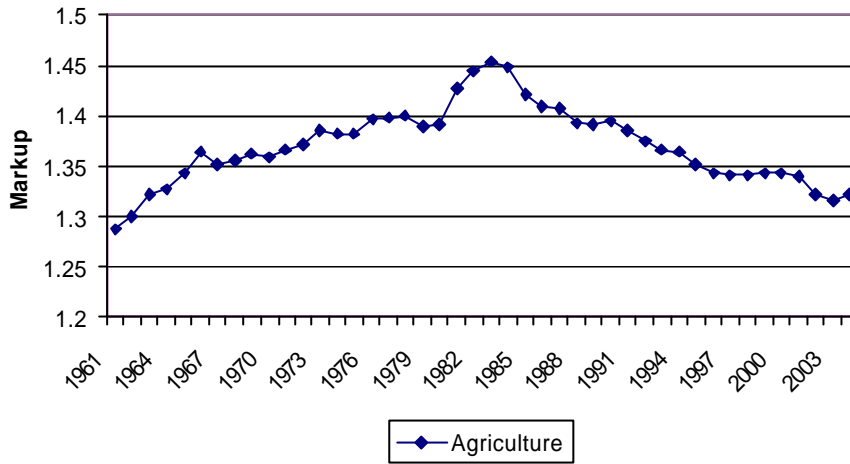


Figure 4. Industry-Level Markups, continued

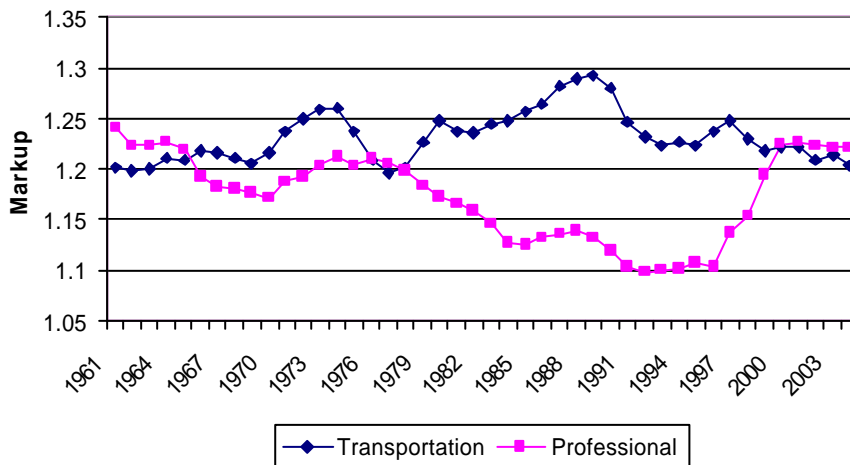
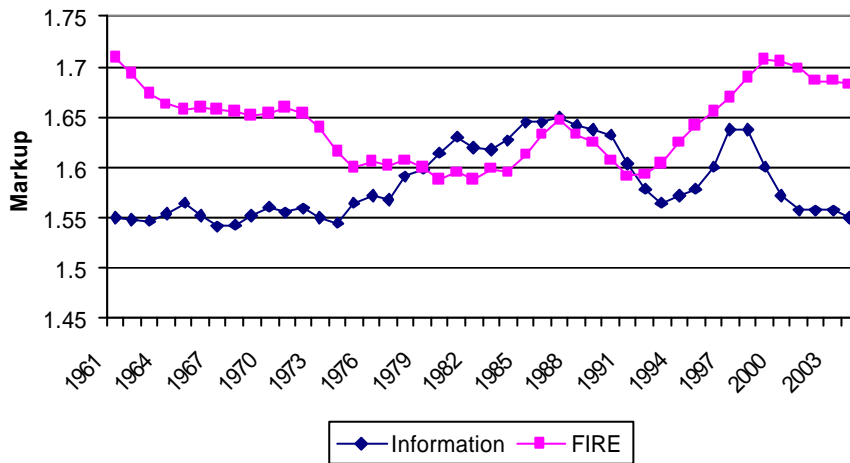
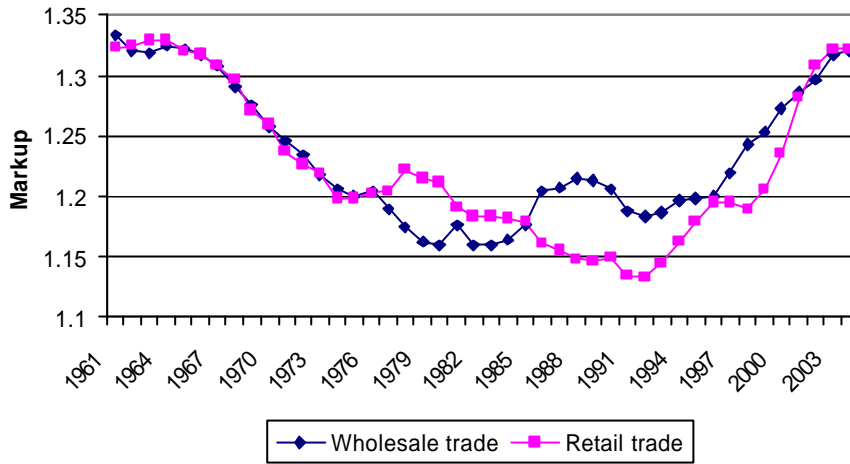


Figure 4. Industry-Level Markups, continued

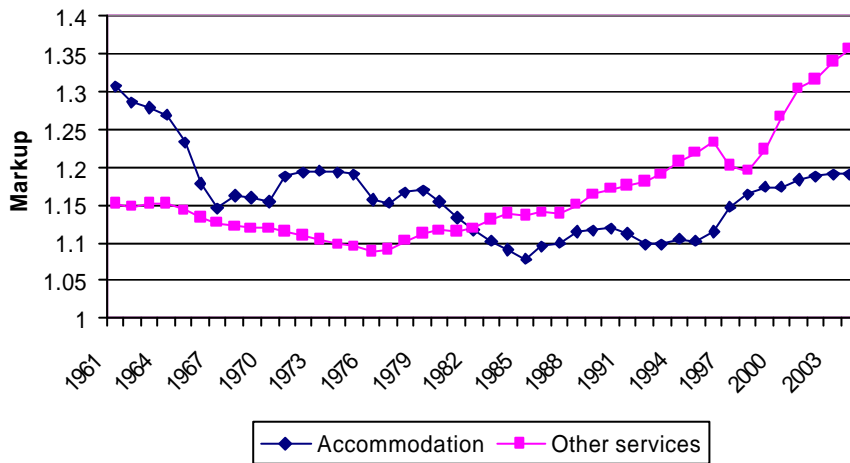
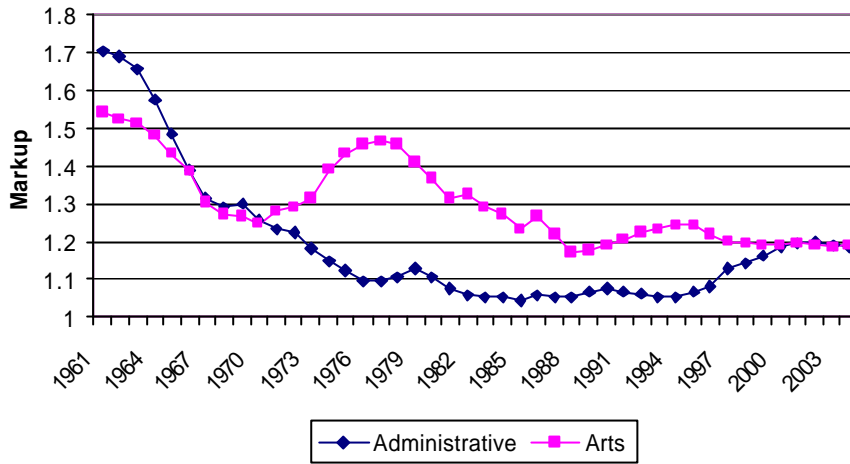


Figure 5. Effect of Rise in Import Competition on Business Sector Markup

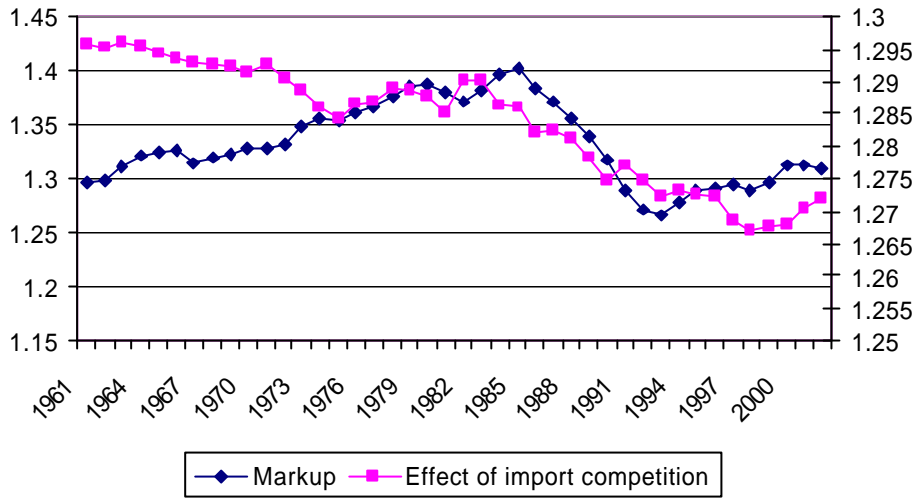


Figure 6. Effect of Fall in Commodity Prices on Business Sector Markup

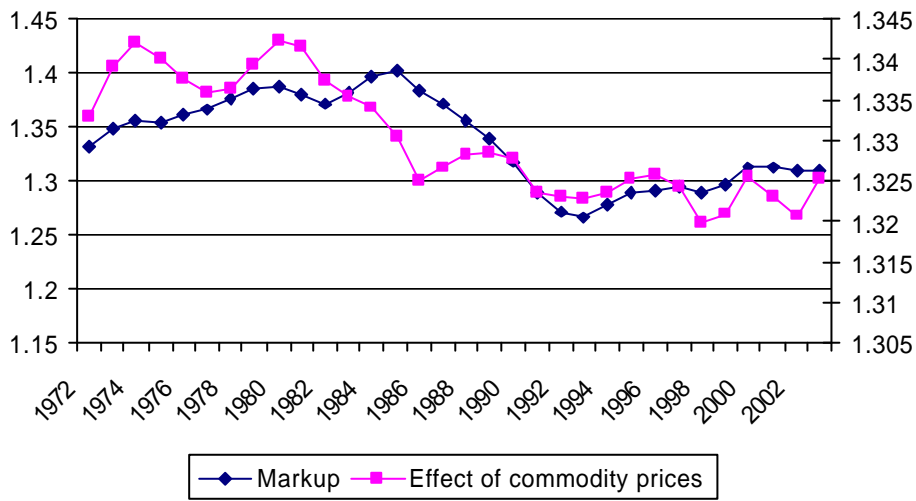


Figure 7. Effect of Changes in Real Exchange Rate on Business Sector Markup

