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Markups and oil prices in Canada ☆

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ABSTRACT

The markup (the ratio of price to marginal cost) in Canada has risen steadily since the early 1990s suggesting a widening gap between the actual and the efficient level of output and a declining share of labor income in GDP. It exhibits non-stationary movements over the sample period 1982Q1 to 2009Q4, allowing us to identify a permanent markup shock. We provide evidence that oil price movements are important for understanding the behavior of the markup, and separately identify both oil price shocks and permanent non-oil markup shocks. Our key findings are: (1) oil price shocks and non-oil markup shocks account for 50 to 80 percent of the variation in the markup, with the former dominating at shorter horizons; (2) the role of oil price shocks is prominent in accounting for the upward trend in the markup since the mid-1990s; (3) the direct effects of oil prices on the markup in the mining sector (which includes the oil-producing sector) have contributed the most to the upward trend in the aggregate markup; and (4) other explanations such as market structure shifts, trend inflation movements and the falling relative price of investment do not appear to account for the behavior of the markup.

1. Introduction

The markup (the ratio of price to marginal cost) has risen steadily in Canada since the early 1990s. This evidence points to two evolving issues for the Canadian economy. First, since the markup represents the difference between the actual and the efficient (higher) level of output, it suggests a widening gap between the two. Second, since the measured markup is the inverse of the labor share of income, the distribution of income appears to be shifting away from labor towards capital. So far the underlying reasons behind the rising markup have not been sufficiently investigated for the Canadian economy.[2] We conduct an empirical analysis of measured markups to shed some light on this issue.

We begin by constructing several measures of the markup using quarterly Canadian business sector data for the 1982Q1 to 2009Q4 period. We show that all the measures have risen significantly since the early 1990s. Traditionally, the markup is thought to exhibit stationary movements. However, there is strong evidence for the non-stationarity of the markup based on three types of unit root tests. Specifically, the augmented Dickey–Fuller and the Phillips–Perron tests do not reject the null of unit root, and the Kwiatkowski–Phillips–Schmidt–Shin test rejects the null of stationarity.[3]

The literature points to several factors that can, in theory, contribute to permanent changes in the markup. First, shifts in market structure caused by changes in the price elasticity of demand, market concentration, and entry–exit of firms. While such shifts in market structure can induce stationary markup variation over the business cycle (see, for example, Jaimovich and Floetotto (2008)), they can also induce non-stationarity in the markup, as shown in Kim (2010). Second, higher inflation can induce greater competition and thus lead to a lower markup (see, for example, Benabou (1992)). Banerjee and Russell (2001) find evidence that higher inflation is related with a lower markup in the long run based on an analysis for G7 economies and Australia. Recently, Karabarbounis and Neiman (2012) point out that a global decline in the labor share of income is driven in part by a fall in the relative price of investment. Since the labor share of income is the inverse of the markup, changes in the relative price of investment are a potential factor that explains the movement of the markup. We will, however, argue that oil price movements are relatively more important in understanding the behavior of the markup in Canada.

Data show that the markup and oil prices have become highly related and moved together since 1994. Since Canada is a net exporter of crude oil, there are both direct and indirect effects of oil price movements on

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[2] In previous empirical research on markups in the Canadian context, Morrisson (1994) examines the cyclicality of markups in Canadian manufacturing. More recently, Leung (2008) studies how import competition growth has affected the markup growth in Canada, and Boulhol (2008) examines the issue of convergence in the price–cost margins in thirteen OECD countries, including Canada, at the aggregated manufacturing level between 1970 and 2000.

[3] Our findings of non-stationary markups over the 1982Q1–2009Q4 period are also consistent with the evidence presented in Banerjee and Russell (2001) for the 1962Q1–1997Q1 period.

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the markup. When oil prices rise in the international market, the producers of crude oil in Canada earn more as long as there is no change in cost conditions in this sector. This leads to a rise in the markup in the oil-producing sector which can in turn raise the aggregate markup (the *direct effect*). At the same time, a rise in oil prices raises production costs for sectors that use crude oil and petroleum products. Since oil is not immediately substitutable with other materials, the rise in oil prices induces an increase in the share of intermediate inputs (including oil), which in turn results in a rise in the value-added based markup even when there is no change in the desired markup at the firm level (the *indirect effect*). Thus changes in oil prices create a wedge between the price of value-added output and primary input costs.[4]

The evidence of non-stationarity of the markup implies the presence of a permanent markup shock that induces variations in the markup in the long run. To identify this shock, we adopt the empirical methodology developed by Kim (2010) who studies the effects of a permanent markup shock in the U.S. using the structural vector autoregression (SVAR) framework. As shown in Kim (2010), the key identifying restriction is that only a markup shock can affect the level of the markup in the long run. Furthermore, we use other restrictions to identify the effects of shocks to technology and monetary policy at the same time, which implement the long-run restriction proposed by Galí (1999), and the recursiveness assumption of Christiano et al. (1999). Estimation results show that the real wage, output and per-capita hours decline after a permanent positive markup shock. Moreover, inflation rises immediately, but the effect of the markup shock on inflation dissipates quickly.

Considering that oil prices are determined in the international market, our discussion above suggests that the identified markup shocks may in part reflect oil price movements. Indeed, results from the Granger causality test and a regression of identified markup shocks on current and lagged changes in oil prices confirm this point. We, therefore, construct an extended VAR model that can separate permanent markup shocks into oil price shocks and non-oil markup shocks. Both variance decomposition and historical decomposition analyses show that oil price shocks account for nearly half of the variation in the markup over a 12 quarter horizon. Beyond this horizon, the non-oil markup shocks become more important, accounting for nearly 47 percent of the variation at the 20 quarter horizon. Taken together, both shocks account for 50 to 80 percent of the variation in the markup. Other shocks, namely, technology and monetary policy are not important for the markup variation at any horizon. The historical decomposition analysis reveals that the role of non-oil markup shocks gets muted in the late 1990s whereas that of oil shocks is prominent in accounting for the upward trend in the markup.

We conduct a sectoral analysis which complements the analysis based on the aggregate data. To this end, we classify Canadian industries into six aggregated sectors: agriculture, forestry and fishing; mining; manufacturing; utilities (electricity, gas and water); construction; and services. The sectoral analysis reveals three interesting findings and, in addition, allows us to check robustness using an alternative measure of the markup, namely, the price–cost margin. First, we find that changes in the value-added based markup largely reflect changes in the gross output based markup. In other words, changes in the share of intermediate inputs in gross output, which can drive a wedge between these two markup measures, are of relatively small magnitude. Second, we are able to assess the direct and indirect effects of oil prices and their implication for both sectoral and aggregate markups.

We find that the direct effect of oil price changes is relatively larger than the indirect effect. In the mining sector (which includes the oil-producing sector), the markup exhibits a strong upward trend driven by the direct effects of oil prices. This upward trend has contributed the most to the upward trend in the aggregate markup. Third, oil prices appear to have a distinct role in driving markups relative to shifts in market structure that influence the degree of competition within the mining sector. As Boulhol (2008) points out, markups can increase when entrants are efficient-high markup firms and exiting firms are inefficient with low markups. However, Ciobanu and Wang (2012) find that the entry rates – whether based on number of firms or employment – did not surpass the exit rate in the Canadian mining sector during the 2000–2008 period. This suggests that the role of market structure shifts is likely to be limited relative to the role of oil prices in driving the markup in the mining sector. Sectoral markups in the remaining five sectors either show a less robust upward trend (for example, manufacturing and construction) or a decline (agriculture, forestry and fishing, utilities, and services). While the role of changes in market structure may perhaps be more relevant in these sectors, their respective markups do not appear to drive the upward trend in the overall aggregate markup observed since the mid-1990s.

The rest of the paper is organized as follows. In Section 2, we construct several measures of the markup and conduct tests on whether the markup is non-stationary in Canada. In Section 3, we describe the empirical methodology and estimate the effects of permanent markup shocks. Section 4 presents evidence for the linkage between markups and oil prices. Section 5 presents the sectoral analysis. Finally, Section 6 concludes.

2. Markup trend in Canada

2.1. Methodology

Since the markup (the inverse of real marginal cost) is unobservable, researchers usually employ assumptions to measure the markup. A common empirical strategy in the macroeconomic literature is to make assumptions about the production technology and a variable input to link the unobserved real marginal cost to observable variables. For example, with a Cobb–Douglas production function and labor as the variable input, the labor income share serves as the proxy for real marginal cost, and hence, the markup. Two strands of empirical research use this approach. First, the literature examining the cyclicality of markup over the business cycles (see, for example, Bils (1987), Rotemberg and Woodford (1991), Rotemberg and Woodford (1999), and Nekarda and Ramey (2010)). Second, the literature on estimating New Keynesian Phillips curves (see, for example, Galí and Gertler (1999), Sbordone (2002), and Galí et al. (2001)).

An alternative approach taken mostly in the industrial organization literature is to use the price–cost margin (PCM) defined as the difference between sales and variable costs over sales. Variable costs usually include expenditures on intermediate inputs and labor. Thus the PCM is measured by the following formula:

$$PCM_t = \frac{GO_t - INT_t - CE_t}{GO_t} \tag{2.1}$$

where GO_t, INT_t and CE_t denote the nominal values of gross output, intermediate inputs and compensation of employees, respectively. Examples of this approach are Domowitz et al. (1986) and, more recently, Boulhol (2008, 2010).

In contrast to these approaches measuring the markup directly, Ellis (2006) applies the state space model to estimate the markup indirectly. Assuming a constant elasticity of substitution (CES) production function, Ellis derives two first-order conditions with respect to labor and capital (factor-demand equations) for a typical firm's profit maximization problem, and then jointly estimates the markup and the elasticity of substitution between labor and capital using U.K. data. He finds that the markup has fallen since the early 1970s, which is quite different from what is found when other approaches are applied to U.K. data.

[4] As is pointed out by Rotemberg and Woodford (1993), under imperfect competition environment the increase in the price of gross output is bigger than the increase in production costs, thus leading to a rise in the markup measured in value-added terms (difference between the price of gross output and intermediate input costs).