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Imperfect Competition, Government Spending and Estimated Markup

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Abstract: This paper is an empirical study that aims at explaining economic fluctuations and behavior mark-up. Inspired by the method of Roeger (1995), we perform a study of four OECD countries (Denmark, Finland, Italy and the United States) for 17 manufacturing industries covering the period 1986-2008. This study provides a comparison between our estimates of mark-up and other observations on mark-up pricing (Oliveira, Scarpetta and Pilat (1996), Roger (1995) and Rotemberg and Woodford (1992)). It also provides an interpretation of the estimated markups that depend on the type of market structure. An application of a VAR model is used to examine the relationship between imperfect competition and the effects fiscal policy on output and mark-up, based on the method of Rotemberg and Woodford (1999).

Keywords: Mark-up, Imperfect competition, Fiscal Policy
JEL Classification: E3; E62

1. Introduction

In recent decades, contemporary economies are often characterized by a lower degree of competition between firms. This competition is assessed by the degree of market power of each firm. Indeed, this power is determined by the ability of the price differential compared to its marginal cost. In perfect competition, firms must choose the amount of production factors that equalize the prices with the marginal cost. Under imperfect competition, such an equalization is invalid. The firms have an incentive to increase their profit by setting a price higher than their marginal cost. Therefore, imperfect competition can lead to adverse effects on growth. However, these effects can be reduced by public intervention through taxation and public spending (Barro (2000) and Tabellini (2005)) [1].

In the respective literature, the mark-up plays an important role in models of public policy. According to Rotemberg and Woodford (1992), an increase in government spending leads to an increase in real wages due to imperfect competition generated by a counter-cyclical mark-up. While Goodfriend and King (1997) showed that price rigidity combined with procyclical marginal cost leads-to a decrease in the average mark-up, other studies e.g., Bils (1987) and Galí et al. (2007) estimated marginal cost under the assumption of overtime, showing that mark-ups are cyclical. However, using the relationship between price and average cost, Domowitz et al. (1986), concluded that there is a positive correlation between mark-ups and demand, with a procyclical rate of mark-up. More recently, Nekarda and Ramey (2010) presented an empirical study for the OECD countries; whose markups are shown to be mostly procyclical.

[1] Barro (2000) and Tabellini (2005) found empirically that public intervention has a negative effect on growth, but if the government invests in infrastructure, for example, it is likely to support growth.

Due to the difficulty of finding an accurate accounting rule to measure this cost, some economists have estimated the marginal cost by econometric methods (Bresnahan (1989)). The first work on the estimation of the mark-up is realized by Hall (1986, 1988). Then, Roeger (1995) improved the original model of Hall, solving the problem of endogeneity. Indeed, the methodologies of Hall and Roeger are most commonly used to estimate the mark-up behavior.
Other studies have tried to estimate marginal costs. Morrison (1990) uses gross data to estimate the cost function. He shows that mark-up varies between 1.2 and 1.4 for 16 manufacturing industries. Hall (1988) presents an alternative approach using a method of instrumental variables. He assumes that these variables are orthogonal to exogenous technical progress, and he relaxes the assumption of endogeneity.

Some authors like Gali (1996), Rotemberg and Woodford (1996) introduce imperfect competition in markets, to study its influence on the emergence of economic fluctuations. Imperfect competition is compatible with increasing returns to scale and allows for the existence of a positive rate of mark-up. They stresse that the variability mark-up and the level of increasing returns can also be a source of local indeterminacy of the steady state by fostering the emergence of endogenous fluctuations (Porter (1995), Seegmuller (2003)).

In its first section the paper presents the empirical study that seeks to explain economic fluctuations and behavior mark-up. Inspired by the method of Roeger (1995), an estimate of the mark-up is performed on four OECD countries (Denmark, Finland, Italy and the United States) for 17 manufacturing industries during the period 1986-2008. This study provides a comparison between our estimates of mark-up and other (Roger (1995), Oliveira, Scarpetta and Pilat (1996) and Rotemberg and Woodford (1992)). It also provides an interpretation of the estimated mark-up depending on the type of market structure. The manufacturing industries are classified according to the degree of competition and the markup cyclicality. In the second section, we examine the relationship between imperfect competition and fiscal policy, based on Rotemberg and Woodford (1999)'s method. Therefore, an empirical study is made in the context of a VAR model with annual data for the same set of countries, but over a wider period (1975-2011).

2. Estimating Mark-Ups

2. 1 Methodology

The Lerner index (B) is an indicator that refers to the gap between prices (P) and marginal costs (MC). It takes values between 0 and 1. Under perfect competition, this index is equal to zero because the firm has no market power. When pries exceed marginal cost, the B index becomes positive ($B \in [0,1]$), it claims a certain degree of competition in price. Therefore, it is necessary to explore the relationship between the Lerner index and the mark-up ratio (μ = P/MC) as follows:

$$B = \frac{P - MC}{P} = 1 - \frac{1}{\mu} \quad (1)$$

The Solow residual (SR) indicates the difference between the growth rate of output and a weighted average of the growth rate of factor inputs. This method is defined in the Hall's (1986) approach:[2]

$$SR = \Delta q - \alpha \Delta l - (1-\alpha)\Delta k = B(\Delta q - \Delta k) + (1-B)\theta \quad (2)$$

Where Δq, Δl and Δk represent respectively, the growth rate of real value added, labor and capital, α is the share of labor in total value added and θ is the rate of technical progress.

Under perfect competition, the SR correspond to the productivity term (B = 0). A necessary condition is that the SR should not be correlated with the growth rate of the output / capital ratio. However, Hall (1986) shows that the assumption of perfect competition is rejected because the hypothesis of no correlation is not always true.

Assuming that the rate of technological progress is a random spread and mark-up rate is constant over time, so we can estimate the mark-up ratio ($\mu = \frac{1}{1-\beta}$) from the following equation:

$$\Delta(q_t - k_t) = \mu \alpha_t \Delta(l_t - k_t) + \theta + u_t \quad (3)$$

Under imperfect competition, Hall (1986) shows that the labor / capital ratio is correlated with productivity term. Consequently, the estimates OLS (ordinary least square) of equation (3) will be biased. Frequently, this bias is corrected by using instrumental variables to replace the labor / capital ratio. But, this method has been criticized by Roeger (1995), who proposes an alternative method to estimate the mark-up. He calculates the difference between the traditional Solow residual (SR) and the dual Solow residual based on the price (SRP).

$$SRP = \alpha \Delta w + (1-\alpha)\Delta r - \Delta p = -B(\Delta p - \Delta r) + (1-B)\theta \quad (4)$$

Where ΔP, Δw and Δr represent respectively, the growth rate of output price, wages and the rental price of capital.

Then, by subtracting the two equations (4-2) to obtain the following equation:

$$\Delta y_t = B \Delta x_t + \varepsilon_t \quad (5)$$

Where: $\Delta y = (\Delta q + \Delta p) - \alpha(\Delta l + \Delta w) - (1-\alpha)(\Delta k + \Delta r)$

$\Delta x = (\Delta q + \Delta p) - (\Delta k + \Delta r)$

The variable Δy represents the Solow residual, and the variable Δx is the growth rate of the nominal output / capital ratio. The advantage of this equation is to estimate the Lerner index with OLS estimation. In addition, to Roeger's (1995) approach we can introduce other intermediate inputs and set the mark-up ratio on gross output (not value added) in order to obtain a clear upward biais in the estimation. Therefore, equation (5) becomes:

[2] For further explanation of equation (2) see Annex I in Hall (1986).

$$\Delta y^{\circ} = (\Delta q^{\circ} + \Delta p^{\circ}) - \alpha^{\circ}(\Delta l + \Delta w) - \beta(\Delta m + \Delta p) - (1 - \alpha^{\circ} - \beta)(\Delta k + \Delta r)$$
$$\Delta x^{\circ} = (\Delta q^{\circ} + \Delta p^{\circ}) - (\Delta k + \Delta r) \quad (6)$$

Where q° and p°denote gross output and price, and m *and* p_m correspond to intermediate inputs and their prices, and α° and β are the respective shares of labor and intermediate costs of gross output.

2.2 Data Sources

The construction of data is described by Martins Oliveira, and Scarpetta Pilat (1996). The database has been developed to construct series for the period 1988-2008: gross output, employment, wages, gross capital stock and intermediate inputs are provided by the STAN database of the OECD (2009).

The method of calculating the cost of capital is determined in Annex 1. The database does not include price series for the rental price of capital. However, we used the method of Hall and Jorgensen (1967) in order to resolve the problem of lack in data at the sectorial level.

This study is to estimate the mark-up (equation 6) in the 17 manufacturing sectors for four OECD countries (Denmark, Finland, Italy and the United States) .

2.3 The Behavior Mark-Up

Our empirical study is based on the work of Oliveira Martins, Scarpetta and Pilat (1996) applied to annual data for 14 OECD countries during the period 1970-1992. However, our study analyzed the behavior mark-up ratio during a more recent and extended period marked by economic upheaval. We analyze the cyclical behavior of mark-up according to market structure in order to assess the degree of competition over time.

Table 1 presents the results of estimates of mark-up ratio for each country during the period 1988-2008. The highest mark-ups are observed in Italy (1.17), while they are lower for the United States (1.14), Finland (1.13) and Denmark (1.09). Therefore, the estimation results imply the existence of imperfect competitive markets due to the presence of externalities and increasing returns to scale in some sector.

However, the sectorial results show that the values of the estimated mark-ups are in the range [1.06; 1.32], 1.06 in Denmark, in the transport equipment industry and, 1.32 in Italy in the production of wood, products of wood and cork. Indeed, these results show that some value of mark-ups exceeds 1.20, for example in sector of electrical machinery and apparatus, and sector of the pulp and paper (United States and Italy). The estimated mark-ups are relatively low in some industries such as transport equipment (1.06 in Denmark), or motor vehicles and trailers and semi-trailers (1.04 in the U.S.).

It should be noticed that the period under study was characterized by economic tensions in some OECD countries such as the creation of the Economic and Monetary Union (EMU) and structural policies of market liberalization. These factors may adversely affect the market by promoting the

appearance of large firms that dominate the market. Consequently, there was an increase in degree monopoly, which results in a higher rate range. In addition, we find some points of difference between our study with other previous works such as Oliveira, Scarpetta and Pilat (1996) for the period 1980-1992. Indeed, our results show that with the exception of Italy the mark-ups are lower in all countries over the period 1980-1992.

At sectorial level, the comparison of our estimates of mark-ups in the U.S. with those of Oliveira, Scarpetta and Pilat (1996), show that the higher mark-ups are remarked especially in sectors of pulp, paper, paper products, printing and publishing, chemicals and chemical products, and other non-metallic mineral products. Indeed, our estimates of mark-ups are the majority between 1.14 and 1.20. These values are generally lower than the estimates observed in other studies. The cause of the decline in value of mark-ups is the economic development in some markets area.

Our results differ from those of Roeger (1995), because of the introduction of intermediate inputs in the estimated equation which produces lower values. Indeed, in some sectors, intermediate goods are an important part in the overall production. Consequently, the estimated mark-ups differ from one model to another (Bresnahan (1989) and Schmalensee (1989)) according to the method of measurement used. However, a high rate mark-up ratio cannot be taken as some evidence of the presence of the profits generated by market power. For example, in technologically innovative sectors, temporary monopoly rents for a fixed term may be causing a high rate markup.

2.4 The Market Structure

In monopolistic competition, we determined the degree of market power by two factors: the scale and the product differentiation (Dixit and Stiglitz (1977)). According to Sutton (1995), the market power depends on specific structural variables, such as firm size and R&D intensity and capital. In other words, these variables are used to distinguish between different market structures.

In this study, the 17 sectors are grouped according to the type of market structure (fragmented or segmented). In fragmented sectors, firms are medium in size and their number increases with the size of the market. In segmented sectors, firms are large and the concentration becomes relatively stable when the market size increases. The type of competition in each sector is determined by two variables, the R & D intensity to identify homogeneous or differentiated nature of the industry. Then, the size of each industry (fragmented or segmented) is determined according to the number of employees incurred.

We present in Table (2), the average mark-ups of the four groups of sectors. The degree of competition varies from one country to another. The segmented sectors are marked by higher mark-ups than in the fragmented sectors. This shows the existence of large-size firms in a dominant position on the market; these firms are price makers to the extent that a decline in demand does not affect sale price. However, the distinction between homogeneous and differentiated sectors helps to explain the different variables affecting mark-ups (Table 2). First, the fragmented sectors are homogeneous with a low degree of competition in all countries, i.e., the mark-ups rates are lowest, but Italy is the exception. The fragmented differentiated sectors are characterized by very high markups compared to the homogeneous fragmented sectors, showing the presence of imperfect competition and innovation rents.

In addition, the level of product differentiation is an important element in interpreting the degree of competition. For example, in segmented differentiated sector, the structure of market is characterized by the existence of a monopolistic or oligopolistic competition.

To conclude, the explanation of mark-ups differs from one country to another, in line with such specific measures as the conditions of entry into a country, openness to international trade, the asymmetry information and investment in new technology. These factors consolidated the market power and contributed to the development of mark-ups.

2.5 The Business Cycle

Some econometric studies have that the mark-up ratios are pro or counter cyclical. The cyclical nature of mark-up is determined as follows:

$$B_t = \bar{B} + \gamma\, CYCL \tag{7}$$

Where $\bar{B}$ denotes the average fixed mark-up ratios over the business cycle, CYCL is a variable for business fluctuation. The coefficient γ represents the cyclical nature of mark-ups. So with the sign of γ we determine the cyclicality of mark-ups. The negative (positive) sign of γ implies a countercyclical (procyclical) markup.
The new expression of equation (6) becomes:

$$\Delta y_t = \bar{B}\Delta x_t + \gamma(CYCL_t \Delta x_t + \Delta CYCL_t) + \varepsilon_t \tag{8}$$

The cyclical variable is measured by the ratio between the actual and trend sectorial production. We estimate equation (8) by varying the parameter γ between sectors and countries. Then we vary γ depending on the market structure.

Indeed, Table (3) explores the cyclicality of mark-up by sector. Under most sectors, the mark-ups are countercyclical, the γ coefficient of the cyclical variable is negative in 60% of the cases (Italy, Denmark and the United States). However, in Finland, the estimated coefficient γ is positive in most sectors, indicating that mark-ups are procyliques. Our results are confirmed by the findings of Bils (1987), Rotemberg and Woodford (1992), Oliveira (1994) and Oliveira, Scarpetta and Pilat (1996). They showed the existence of countercyclical mark-ups in the U.S.

Then, table (4) has the γ coefficient estimates based on the structure of market. The market is composed of four sector groups (fragmented; homogeneous or differentiated, segmented; homogeneous or differentiated). Indeed, that the sensitivity of mark-ups cycle differs from one group to another. But always the cyclicality character dominates the various estimates. Therefore, the estimated mark-ups are higher in segmented than in fragmented sectors. The countercyclical nature of mark-ups is a strong competitive pressure when the economy is in a period of expansion. The importance of our estimates is to provide explanations of macroeconomic theory during the study period (1988-2008). Indeed, Oliveira (1994) showed that countercyclical mark-up presents a means for examining the procyclical real wages and their effects on the economy, when real wages increase with aggregate output and employment during periods of expansion. In particular, this

study shows that there are factors other than technology shocks in explaining macroeconomic fluctuations (Rotemberg and Woodford, 1991).

2.6 The Results

The main results of the estimates of mark-ups ratios in four OECD countries are the following:
- Most of the estimated mark-ups rates are significantly higher than 1. This implies the existence of a market with imperfect competition in all sectors.

- The level of mark-up depends on the market structure. The estimated mark-ups are higher in segmented differentiated sectors than in fragmented homogeneous sectors.

- Some economic policies by some countries as barriers to entry or taxation affect market structure and affect the level of mark-ups.
- The results on the cyclicality of mark-ups show that mark-ups are countercyclical in all countries except for Finland.
- The estimated mark-ups in our study are very close to those found in other studies (see for instance Rotemberg and Woodford, 1992, and Oliveira, Scarpetta and Pilat, 1996).

In summary, under imperfect competition, it is important to analyze the components of a mark-up. On the one hand, the estimated mark-up is not a technique surely adapted to determine the degree of competition. It is considered as a simple measure of corporate behavior on prices in a given area. However, it is necessary to take into account other variables to determine the degree of monopoly. On the other hand, empirical data on mark-up in the manufacturing industry may be affected by constraints such as the measurement error due to information asymmetry.

3. Fiscal Policy and Estimated Mark-Up

The interaction between imperfect competition and economic policy has occupied an important place in the theory. Some authors such as Hall (2009) showed that fiscal policy can increase the degree of monopoly in the market. This is characterized by high mark-ups due to the multiplier effect of short-term profits or increasing returns to scale in the long term. Any time, empirical studies examining the nature of the relationship between the degree of competition and the effects of fiscal shocks are limited because of a lack of time series for mark-ups.

Additionally, it is important to mention some paper empirical study. Indeed, Monacelli and Perotti (2008) used a VAR model with quarterly data to explain the interaction between the mark-ups and government spending in the United States. Their results show a rate of mark-up countercyclical with fiscal shocks. Any time, Afonso and Costa (2010) followed the same approach as Monacelli and Perotti (2008) but on a wider sample (OECD), showing that the majority of mark-ups are procyclical with productivity shocks and light behavior countercyclical impact of public spending. This section based on the approach of Rotemberg and Woodford (1999) and, Afonso and Costa (2010). We produce results with annual data for a group of four OECD countries, over the period 1975-2011: Denmark, Finland, Italy and the United States. Then, we studied the interaction between fiscal policy and different macroeconomic variables using a VAR modeling.

3.1 Data Sources

Macroeconomic data are obtained from the AMECO database of the European Commission (2012). We examine a set of four OECD countries (Denmark, Finland, Italy, and the United States) during the period 1975-2011. Indeed, the choice of the sample period and the countries is justified by some elements. First, the availability of data does not allow to choose only four OECD countries. Second, the study period has known various economic and political factors that have changed the OECD events.

The data are as follows (annex 2): Y_t represents real GDP per capita (between 15 and 64 years), K_t is the real capital stock per capita, L_t is the total hours worked, and s_t represents the adjusted wage share in total income.

P_t is the GDP deflator, it is calculated as the ratio between nominal GDP and real GDP. We divide the price deflator by (1+τ_t), where τ_t means the ratio of indirect taxes less subsidies and nominal GDP. W_t is the ratio of adjusted hourly nominal wage rate obtained by $\frac{s_t P_t Y_t}{L_t}$.

The study of the effect of fiscal policy on mark-up requires the addition of certain series: the final consumption expenditure of government, gross fixed capital formation, tax revenues, the amount of taxes direct and indirect, and social security contributions.

Data on average mark-ups μ_t^* are drawn from the results found in the first section. We assume that the mark-ups are constant in long-term μ_t^* (Table 1).

The α_t (1-s_t) is given by Hoddrick-Prescott (HP) (λ =100). The Φ_t series is obtained by application of the HP filter (the right side of equation (A.3: annex 2)).
We obtain the series of mark-up as follows:

$$\mu_t = \frac{1-\alpha_t}{s_t} \frac{\mu^*}{\mu^* - (\mu^* - 1)x_t}$$

$x_t = \frac{HP(K_t^{\alpha} L_t^{1-\alpha})}{K_t^{\alpha} L_t^{1-\alpha}}$ is a measure of cyclical fluctuations in inputs.

3.2 VAR Modeling

We estimate a VAR model with five variables for the period 1975-2011. The variables in the model are: government spending, G, real output, Y, the real taxes T, the rate of mark-up μ_t and the level of productivity, A (PTF). All variables are in logarithms except for the rate of mark-up in level.

An econometric study with time series requires two steps. First, the application of unit root tests to identify stationarity and order of integration of the series. Then we will choose the order of the VAR model to estimate. Second, the estimation of the VAR model and the identification of structural shocks from the impulse response functions.

The VAR (P) can be written as follows:

$$X_t = c + \sum_{i=1}^{p} V_i X_{t-i} + \varepsilon_t \quad (9)$$

Where X_t denotes the vector of 5 endogenous variables, $X_t = \{\Delta \log A_t , \Delta \log G_t , \Delta \log T_t , \Delta \log Y_t , \mu_t\}$, V_i is the matrix of autoregressive coefficients, and ε_t is the error vector, $\varepsilon_t = \{\varepsilon_t{}^A, \varepsilon_t{}^G, \varepsilon_t{}^T, \varepsilon_t{}^Y, \varepsilon_t{}^\mu\}$. The number of lags of the endogenous variables, p, is determined by the information criteria.

The order of variables in the VAR model is from the most exogenous to the least exogenous one. We make TFP in first position because a productivity shock can have an immediate impact on all other variables. Any time, the response of productivity due to other variables, cannot be simultaneous to all structural disturbances. The same reasoning is true of government spending that does not directly react to any disturbances caused by taxation, GDP or mark-up (delay in government decision making). In case of a fiscal shock (taxation is the third variable), the impact is not immediate public spending or technology of production, but the effect on the GDP and mark-up.

The Determination of Structural Shocks[3]

The interest results are the impact of fiscal shocks on macroeconomic variables in the model. Figure 2 shows that for Denmark, where a shock of public expenditure, the mark-up is marked by alternating positive and negative effects, and an expansionary early in the second period with a peak followed by a recession (recess in the third period). The maximum mark-up increase was recorded at 0.03%.

In Italy, a positive shock on public expenditure is reflected in the mark-up, by alternating positive and negative effects manifested by increases phases (periods: [1, 2], [3, 4], [5, 6]) and lower (periods [2, 3], [4, 5]). The impact of fiscal innovation leads to sharp drop in the pace of mark-ups in the short term. Indeed, the impact of the shock on the mark-up also reflects the degree of competition on the market and the number of firms attracted to the sector concerned. But the effect of this shock reflects moderate fluctuations over the medium term and stable over the long term. However, in the United States, there is a slight expansion in the short term [1, 3] and stabilized over time. In Finland, the effect of a positive shock to government spending is insignificant.

A positive impact on public expenditure is reflected in the production of a positive medium-term before stabilizing effect until the end of the period. These effects are similar for the three countries (Denmark, Italy and Finland). With the exception of Finland, we observe alternating negative and positive effects, negative effects during the first two periods, then a positive impact between periods 2 and 5

[3] See annex 3.

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Figure 1: The impulse response functions: Italy

Response to Cholesky One S.D. Innovations ± 2 S.E.

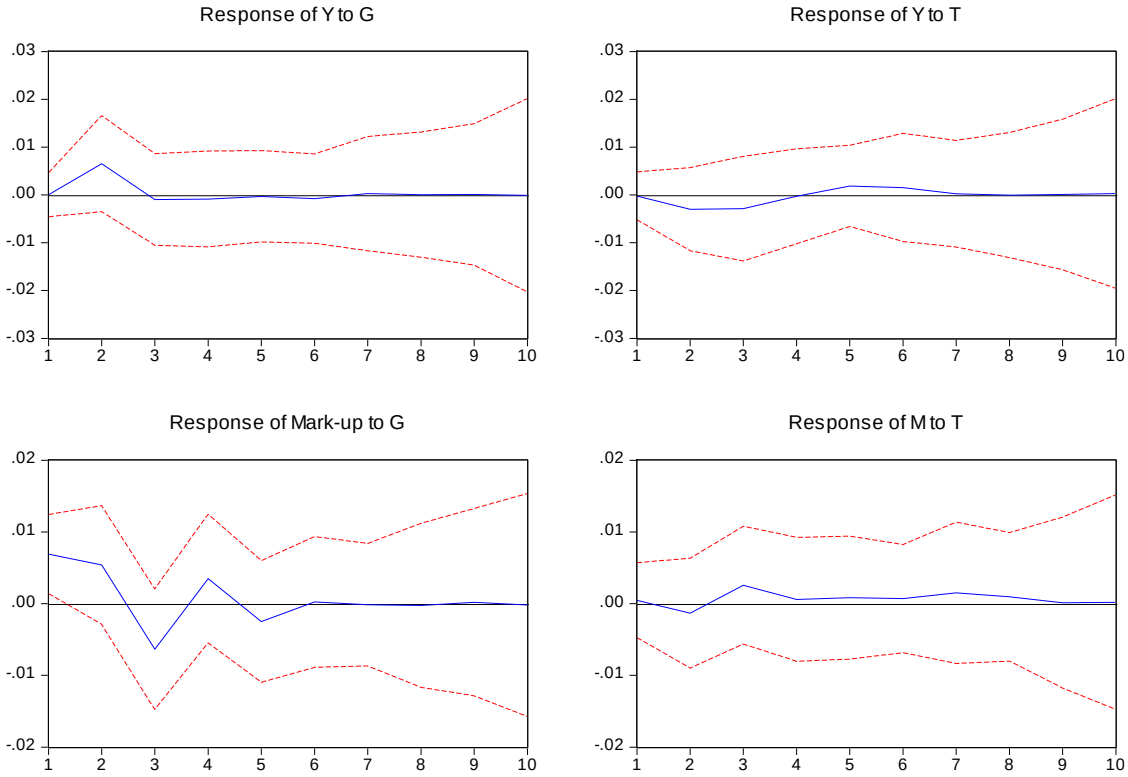

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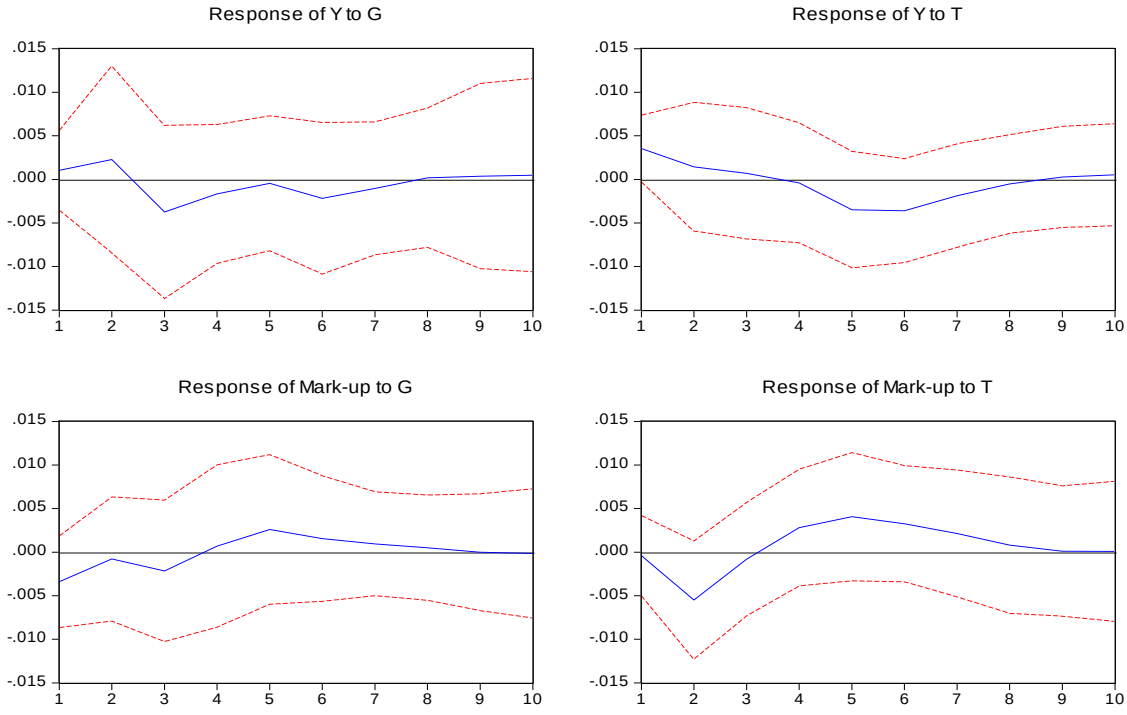
Figure 2: The impulse response functions: Denmark

Response to Cholesky One S.D. Innovations ± 2 S.E.



The impact of a fiscal shock on the mark-up rate in Denmark is negative and more significant than those public spending with lower that exceeds 0.05 % (second period). This phenomenon was not observed in Italy, where the tax shock is accompanied by a transient decrease in production and mark-ups, then followed by temporary increases. This increase is explained by the multiplier effect profits of short-term or by increasing returns to scale (Hall (2009)). The maximum recessionary impact observed only in Italy (-0.003 %). Indeed, responses mark-ups to tax shock were positive from the third period. Any time, this trend is not confirmed in Finland, since the responses are almost neutral (annex 3). The effects of the shock are very low and often close to zero. In the United States, the fiscal shock resulted in a maximal decrease does not exceed the bar 0.002 %.

The results reported in the graphs above indicate that the response functions of production and mark-ups appear satisfactory and consistent with economic theory, all reactions with the expected pace.

We used the techniques of time series analysis. We based on a structural VAR model to analyze the effects of public spending, as well as taxes on the degree of competition and economic growth in four countries studied. We have shown, in a system with five variables, it is possible to study the reactions of the markup and production to the various shocks of government spending; including changes in the conduct of public policy depends on the rate of taxation.
In conclusion, the VAR model is an important tool for determining economic fluctuations. However, the unavailability of sufficient long time series and temporal precision statistics, as well as the limits of the structural VAR technique, prevent to provide a reliable estimate. The use of panel data could help provide more information.

3.3 The Panel VAR Model

In this section, we use recent developments in econometrics associated with panel data. These data comprise repeated formed on a set of individuals (4 countries) at different dates (1975-2008) observations. We retain the same temporal dimension studied previously. We add a modeling panel that will analyze the evolution of variables for all countries and not those of each country.

The study panel data has two dimensions: first one concerns the heterogeneity of the countries between them, indicated by N the number of countries; the second one concerns the change in macroeconomic variables over time, indicated by T the number of observations in each country.

Applying a modeling VAR panel exposes several advantages. The use of a large number of observations in this study increases the accuracy of estimates and will yield fluctuations consistent with theory. In addition, the individual dimension increases the number of data, adding information on different countries and thus leads a multi-country analysis. Second, it allows controlling individual heterogeneity of OECD countries, and identifying effects that cannot be detected by a simple series of temporal data. Among the major works on the VAR model with panel data, we cite the work of Gilchrist and Himmelberg (1995) and Love and Zicchino (2002), which analyzed the relationship between investment and capital productivity.

In this work, the use of panel data should allow us to solve the problem of heterogeneity of response functions of key variables such as the responses of real output and mark-up rate to a shock in public spending.

Consider the following system: $X_{it} = \{\Delta \log A_{it}, \Delta \log G_{it}, \Delta \log T_{it}, \Delta \log Y_{it}, \mu_{it}\}$, the indices i = 1,...,*N* et t=1,...,*T* reflecting individual and time dimension of the sample (N is the total number of individuals of the panel, T the total number of observations).

Equation (11) becomes as follows:

$$X_{it} = c_0 + \sum_{j=1}^{p} V_j X_{it-j} + \varepsilon_{it} \quad (10)$$

The results of unit root tests are presented in the Appendix. All variables in the VAR model are introduced in first differences, except the rate of margin level. Then, we estimate the VAR model in first differences. We apply the test of delays to determine the order of the model.

The Determination of Structural Shocks

We try to push our analysis further by seeking to identify the transmission channels of fiscal policy in the OECD by a panel VAR model.

Figure 3 shows the response functions as well as bands of error of 5 % generated by Monte Carlo simulation. These response functions show the maximum variation with time of each variable following a shock. Thus, this graph shows the impact of the variable in the variable row i column j, with orders for the Cholesky decomposition.

We estimate that the responses of output (Y) and mark-ups face on impact of public spending (G) we remark after is significant. These results are confirmed by Figure 3 (row 1, column 1), the simulation of an impact on public spending would lead to a positive effect on output in the short term [1, 2] followed by a recession during periods [2, 4]. In the long term, the effect is neutral. For against, the effect of a fiscal shock (T) is more significant, there is alternating positive and negative effects before dissipating completely (row 1, column 2). Thus, this result shows that the impact of public intervention is always short term.

Regarding the markup, a slight increase is observed caused by a shock on government spending (line 2, column 1) with a peak of 0.03%, then a recession that will persist in the medium term as we studied in previous estimates. In addition, we have noticed a priori positive relationship with taxes. The shock appears in the second period, since the impact on taxes first causes a small decrease in mark-ups before starting up until the fifth period. Several reasons can be put forward to explain this result, as the strong cyclicality of mark-up caused by purely exogenous factors do not allow the tax to have a significant influence.

Finally, we note that the results of a panel VAR model are more robust than a structural VAR. But often the impact of a shock dissipates quickly in time. Like most empirical studies, we have sought to identify the effects of fiscal shocks on mark-up and production. We felt it appropriate to use the VAR model to determine the different channels of transmission more operational for OECD countries. Part of this result is consistent with findings of earlier research.

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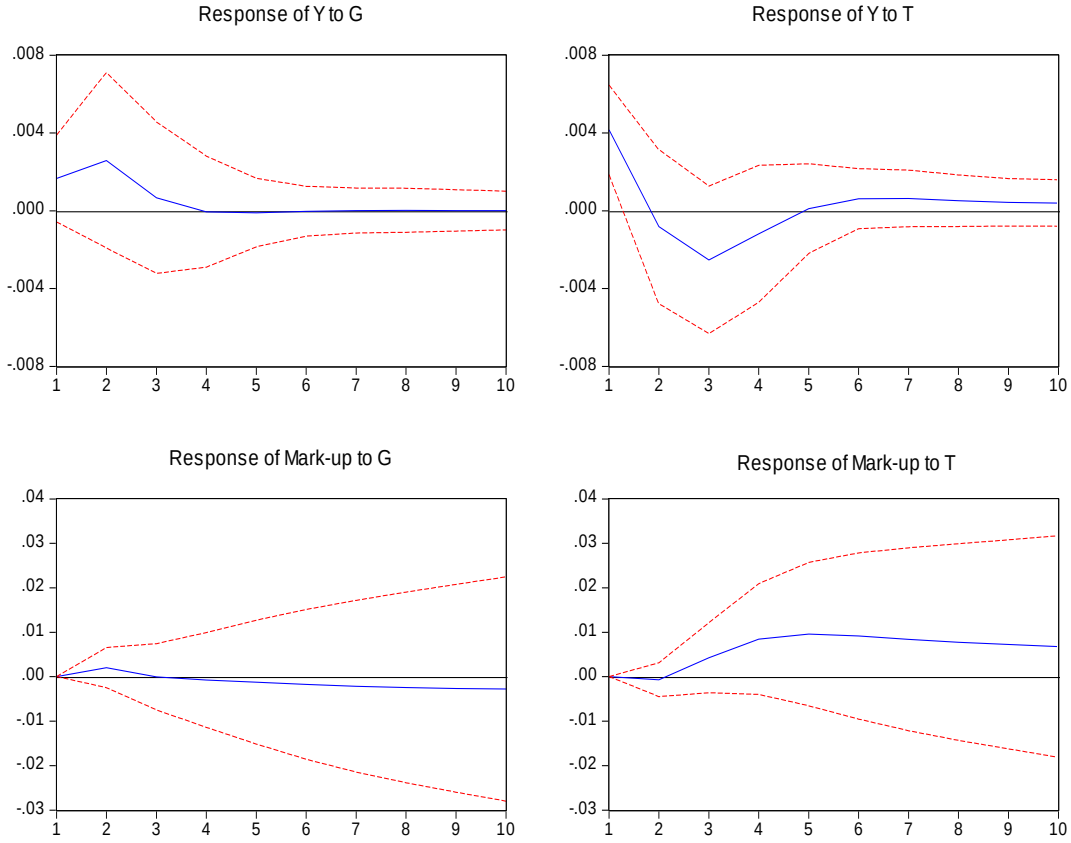
Figure 3: The impulse response functions

Response to Cholesky One S.D. Innovations ± 2 S.E.



4. Conclusions

This paper has focused on the variability of the markup in the presence of market imperfections. This markup is considered as a tool for determining the degree of competition. Indeed, we have presented empirical methodology discussed by Hall (1988) and Roeger (1995) before estimating empirically the effect of public spending on the markup and the level of competition. This work has made it possible for us to explain economic fluctuations and the behavior markup, based on the method of Roeger (1995). Also, we have examined the nature of the relationship between imperfect competition and fiscal policy, based on the method of Rotemberg and Woodford (1999). This study to compare our estimates of the markup with others like Roger (1995), Oliveira, Scarpetta and Pilat (1996) and Rotemberg and Woodford (1992). The main findings of our two econometric studies are as follows: in sectors results, there is a slight deviation from the overall results. The markup is cyclical and involves strengthening the effectiveness of fiscal policy on output and this is particularly relevant when the fiscal multiplier is positive.

However, this work has some limitations. It does not establish a detailed description of the nature of government intervention in the level of taxation, as is the case with are various property sectors in the economy. It is therefore, necessary to identify policy specified for each public sector. These problems concern directions for future research. Second, in the econometric level, the use of a VAR model to change plans (time series or panel data) could help us to explain well the impact of public

spending on the degree of competition. But the unavailability of long series of statistics for the study sample will continue to influence the robustness of the results.

Endnotes

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Table 1. Estimated markup ratios for manufacturing industries Period 1988-2008

Sector	Italy	Denmark	U. S.A	Finland
Food products, beverages and tobacco	1.19	1.06	1.19	1.10
Wood and products of wood and cork	1.32	1.11	1.08	1.11
Pulp, paper and paper products	1.25	1.11	1.2	1.10
Pulp, paper, paper products, printing and publishing	1.24	1.08	1.16	1.10
Printing and publishing	1.14	1.07	1.13	1.11
Coke, refined petroleum products and nuclear fuel	1.16	1.06	1.12	1.11
Chemical, rubber, plastics and fuel products	1.18	1.13	1.17	1.17
Chemicals and chemical products	1.16	1.19	1.21	1.20
Rubber and plastics products	1.2	1.14	1.16	1.18
Other non-metallic mineral products	1.21	1.16	1.13	1.16
Fabricated metal products, except machinery and equipment	1.25	1.12	1.13	1.17
Machinery and equipment, n.e.c.	1.17	1.11	1.12	1.13
Machinery and equipment	1.2	1.09	1.12	1.16
Electrical machinery and apparatus, n.e.c.	1.21	1.07	1.25	1.13
Radio, television and communication equipment	1.14	1.12	1.11	1.2
Motor vehicles, trailers and semi-trailers	1.07	1.11	1.04	1.12
Transport equipment	1.07	1.06	1.08	1.07
Country	1.17	1.09	1.14	1.13

Table2. Average mark-up ratios by the type of market structure (1988-2008)

Country	Fragmented industries	Segmented industries	Fragmented homogeneous industries	Fragmented differentiated industries	Segmented homogeneous industries	Segmented differentiated industries
United States	1.13	1.15	1.12	1.13	1.14	1.16
Finland	1.14	1.15	1.11	1.13	1.13	1.15
Italy	1.17	1.19	1.23	1.13	1.20	1.21
Denmark	1.09	1.10	1.09	1.11	1.09	1.12

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Table 3. The business cycle by sector

Sector	*Italy*	*Denmark*	*U. S.A*	*Finland*
Food products, beverages and tobacco	-0.318 (-2.88)	-0.54 (-3.07)	-0.173 (-2.18)	-0.027 (0.55)
Wood and products of wood and cork	-0.011 (-0.193)	0.015 (0.99)	-0.045 (-0.14)	0.328 (3.43)
Pulp, paper and paper products	-0.607 (-5.88)	0.202 (3.12)	1.08 (2.8 9)	0.24 (1.81)
Pulp, paper, paper products, printing and publishing	0.138 (1.49)	-0.217 (-2.09)	-0.02 (-0.14)	0.09 (0.87)
Printing and publishing	0.183 (2.92)	-0.191 (-4.22)	0.512 (2.26)	0.046 (1.98)
Coke, refined petroleum products and nuclear fuel	-0.199 (-3.02)	0.182 (0.99)	-0.031 (-0.33)	-0.105 (-1.97)
Chemical, rubber, plastics and fuel products	-0.052 (-1.32)	-0.086 (-2.62)	-0.098 (-1.95)	-0.076 (-2.09)
Chemicals and chemical products	-0.17 (-2.81)	-0.056 (-1.81)	-0.038 (-0.56)	0.009 (0.19)
Rubber and plastics products	-0.077 (-2.22)	-0.019 (-0.87)	-0.003 (-0.08)	0.22 (2.54)
Other non-metallic mineral products	-0.79 (-3.06)	0.085 (1.63)	0.095 (0.84)	0.160 (1.92)
Fabricated metal products, except machinery and equipment	-0.013 (-0.21)	-0.164 (-1.63)	-0.033 (-0.39)	0.029 (1.16)
Machinery and equipment, n.e.c.	-0.043 (-0.60)	-0.348 (-6.23)	-0.25 (-3.39)	0.031 (0.89)
Machinery and equipment	-0.102 (-3.11)	-0.192 (-2.74)	0.006 (0.03)	0.083 (1.68)
Electrical machinery and apparatus, n.e.c.	-0.203 (-3.23)	-0.021 (-0.47)	-0.167 (-1.59)	0.046 (2.74)
Radio, television and communication equipment	-0.041 (-0.52)	0.095 (2.09)	-0.68 (-1.94)	0.271 (2.33)
Motor vehicles, trailers and semi-trailers	0.771 (1.88)	-0.016 (-1.23)	0.091 (0.43)	-0.12 (-1.98)
Transport equipment	-0.096 (-1.14)	-0.086 (- 2.58)	0.06 (0.37)	0.26 (2.36)

*The values in parentheses are t-statistics of the estimated coefficients.

Table 4. Business cycle according to market structure

Country	Fragmented industries	Segmented industries	Fragmented homogeneous industries	Fragmented differentiated industries	Segmented homogeneous industries	Segmented differentiated industries
United States	-0.093	-0.034	-0.023	-0.126	-0.019	-0.052
Finland	0.053	-0.006	0.305	0.044	0.001	-0.11
Italy	-0.093	-0.341	-0.198	-0.085	-0.421	-0.01
Denmark	-0.071	-0.008	0.020	0.085	-0.052	0.001

Annex

A.1 The rental price of capital

The rental price of capital was defined as follows:

$$R = [(i - \pi_A) + \delta]\rho_k$$

Where *i* is the long-run nominal interest rate and π_A is the expected inflation rate. The δ denotes the depreciation rate of gross capital stock (5%). ρ_k is the economy-wide deflator for fixed business investment.

A.2 The mark-up ratio

We assume the production function of the following representative firm (Rotemberg and Woodford (1991)):

$$Y_t = A_t\left(K_t^{\alpha_t} L_t^{1-\alpha_t} - \Phi_t\right) \qquad (A.1)$$

$0 < \alpha_t < 1$, and $\Phi_t > 0$

Where Y_t is the output, K_t and L_t represent respectively the capital stock and the labour input. A_t is a (non-observable) measure of TFP. Φ_t indicates the fixed cost, it implies that the economy is imperfect competition (increasing returns to scale).

The real pure profit function of the representative firm is given by:

$$\pi_t = Y_t - TC_t \qquad (A.2)$$

Where TC_t is the total cost of production:

$$TC_t = \frac{W_t L_t + R_t K_t}{P_t} \qquad (A.3)$$

Where R_t is the nominal rental price of capital and P_t is the aggregate price index relevant for producers. Under imperfect competition in product markets, real factor prices are not equal to their marginal products:

$$\frac{W_t}{P_t} = \frac{Pml_t}{\mu_t} \qquad \frac{R_t}{P_t} = \frac{Pmk_t}{\mu_t} \qquad (A.4)$$

Where Pmk_t and Pml_t represent the marginal productivity of capital and the marginal productivity of labor.

Thus, if we replace (A.1), (A.2) and (A.3) into (A.4) yields equation advantage as follows:

$$\pi_t = A_t \left(\frac{\mu_t - 1}{\mu_t} K_t^{\alpha_t} L_t^{1-\alpha_t} - \Phi_t \right) \qquad (A.5)$$

Then we define the average share of labor in total income:

$$s_t = \frac{W_t L_t}{P_t Y_t} \qquad (A.6)$$

Using the above equations, we obtain the equation of mark-up ratio:

$$\mu_t = \frac{1 - \alpha_t}{\alpha_t} \frac{1}{1 - \emptyset_t} \qquad (A.7)$$

where $\emptyset_t$ is a measure of increasing returns given by:

$$\emptyset_t = \frac{\Phi_t}{K_t^{\alpha_t} L_t^{1-\alpha_t}} \qquad (A.8)$$

In the long term, $\pi_t{}^* = 0$, so the equation becomes Φ_t:

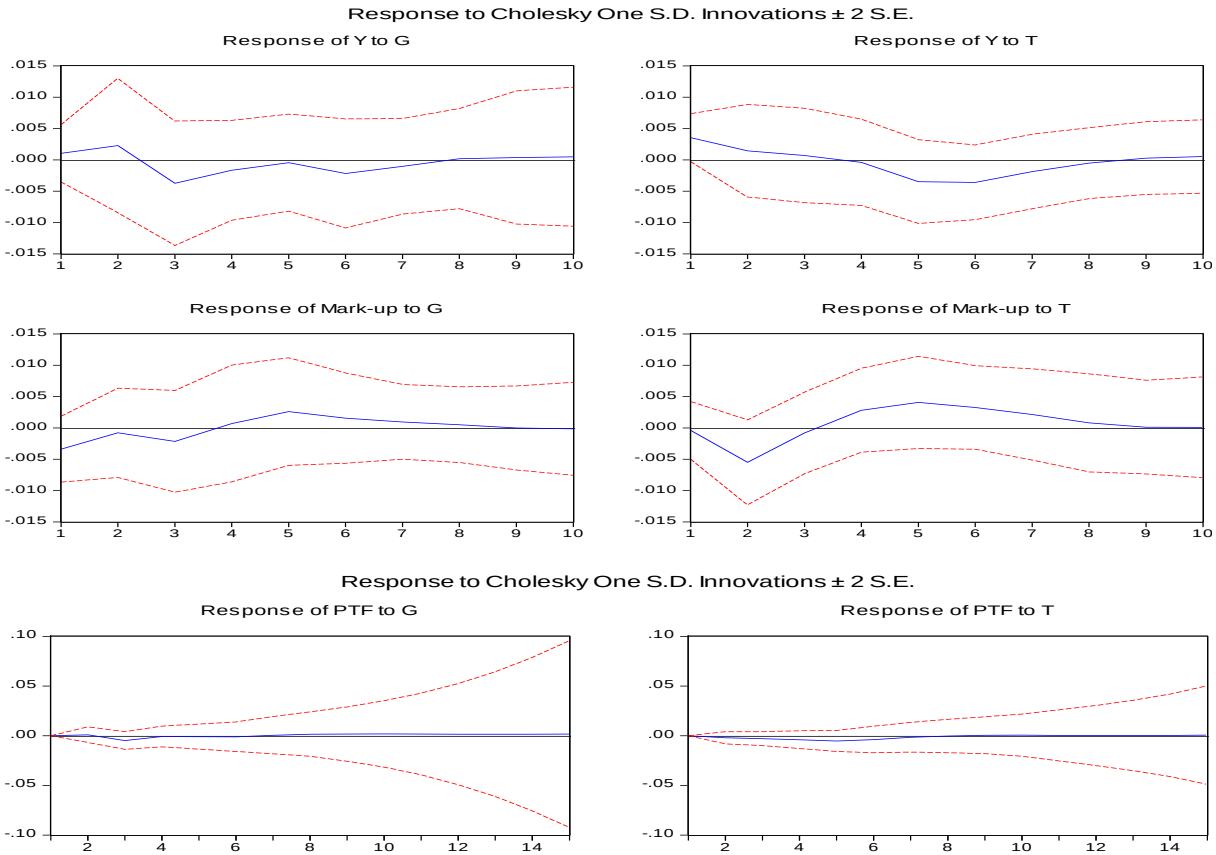
$$\Phi_t = \frac{\mu_t{}^* - 1}{\mu_t{}^*} K_t^{\alpha_t} L_t^{1-\alpha_t} \qquad (A.9)$$

Therefore, using (A.2) and (A.3) we can obtain the share of wages given by:

$$s_t^* = 1 - \alpha_t \qquad (A.10)$$

A.3 Impulse-response functions

Denmark :



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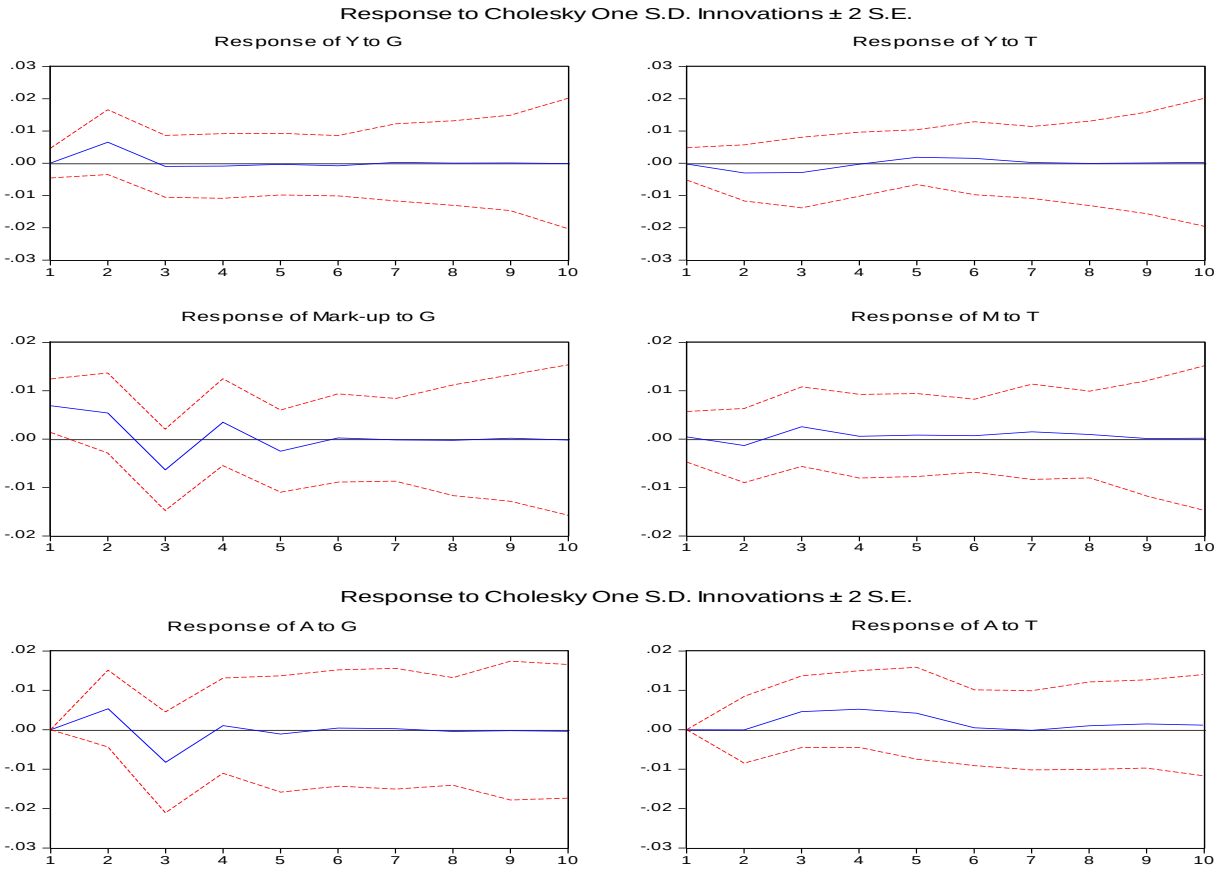
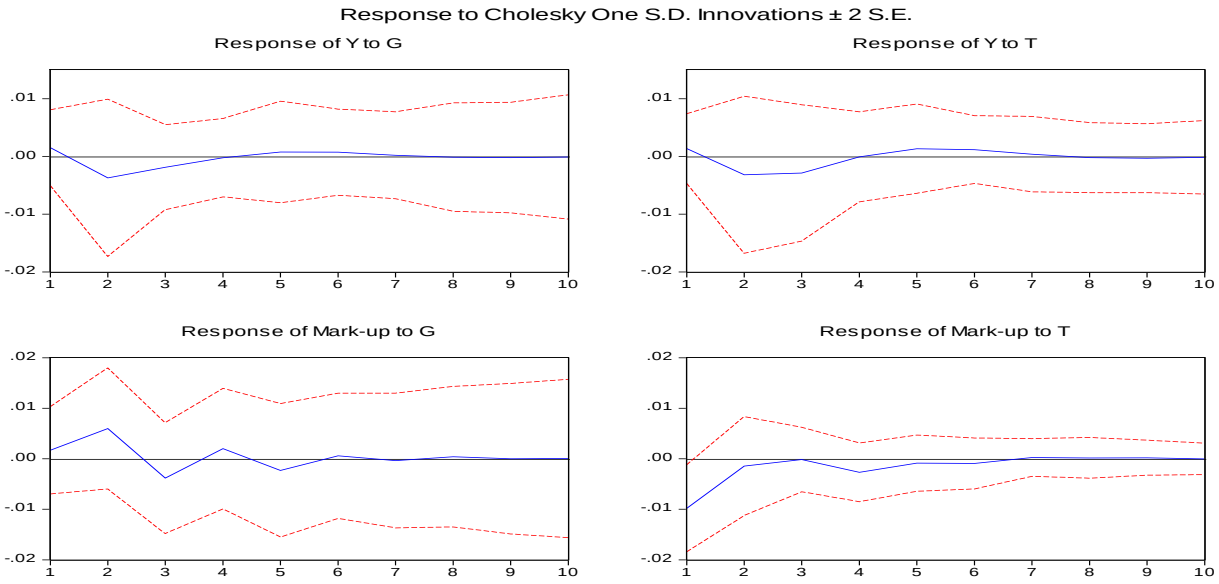
Italy :



Finland :



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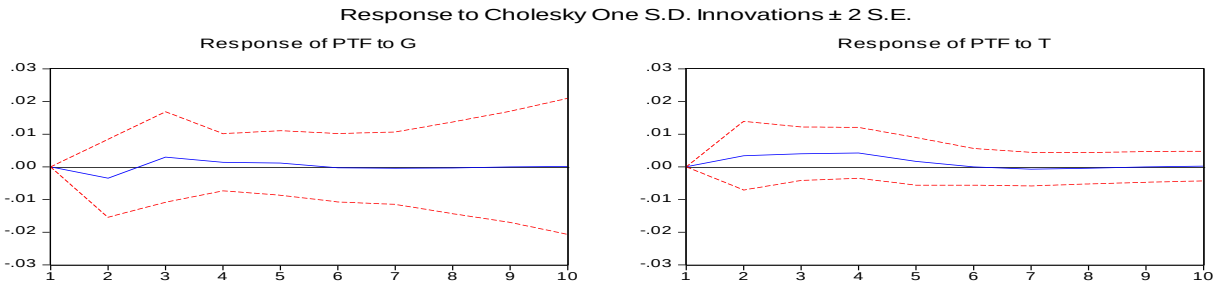
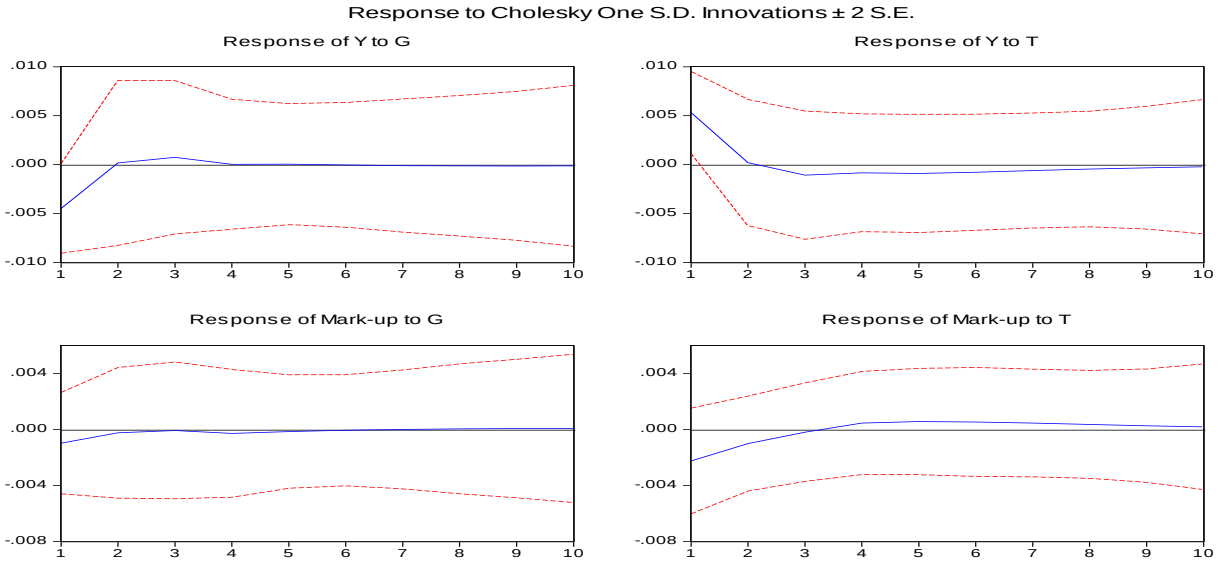
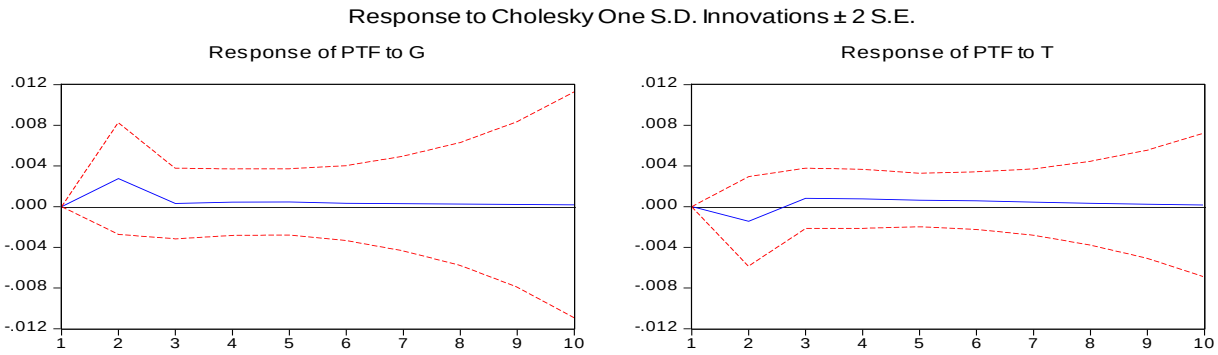


United States:





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A. 4. Panel VAR : Impulse-response functions