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Comparison Of Nominal And Real Rigidities: Fiscal Policy Perspective

Abstract

This paper examines the impact of nominal and real rigidities in the economy on the effects of fiscal policy. The study confirmed the hypothesis that both nominal and real rigidities enhance the impact of fiscal policy on the Polish economy. In the case of nominal price rigidity it was found that the impact of government spending on GDP depends on the conduct of monetary policy. On the other hand, under conditions of wage rigidity, the strength of fiscal multipliers depends on the slope of the labour supply curve. The study also examined two types of real rigidities - lack of access to the credit market, and consumer habits. Analyses show that the above rigidities result primarily in a strong positive relationship between government spending and the level of consumption.

Keywords: fiscal policy, nominal rigidities, real rigidities

1. Introduction

In the short term, fiscal policy affects the economy mainly through its impact on aggregate demand. Changes in aggregate demand, in turn, translate into the formation of GDP as a result of the occurrence of rigidities in the economy.

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The nature of rigidities in the economy therefore decisively affects the impact power of fiscal policy.

The two main categories of rigidity in the economy include nominal and real rigidities. This study examined their impact on the nature of government spending effects. The study verified the hypothesis that the presence of both nominal and real rigidities increases the impact of government spending on the Polish economy.

First, the impact of fiscal policy in the case of nominal rigidities in prices was shown. Then, the effects of fiscal policy on conditions of wage contracts were examined. Subsequently, the impact of fiscal policy in the case of real rigidities was examined. The real rigidities included the presence of households with no access to the credit market, and inertia in consumption, i,e,, consumer habits.

2. Nominal rigidities

Within the nominal rigidities one can identify wage rigidity and price rigidity. They were empirically verified by numerous studies at the microeconomic level. On one hand, the presence of price rigidity was confirmed, inter alia, by the works of Kashyap (1995); Taylor (1999); Bils, Klenow (2004); and Dhyne et al. (2006). On the other hand, the occurrence of wage rigidity was empirically verified by Bewley (1999) and Dickens et al. (2006).

Nominal price rigidities are explained mainly on the basis of menu cost models. There is an emphasis in these models on the transaction costs or a situation in which the increase in profit due to changes in prices would be low, which means that companies do not have sufficient incentives to adjust the price (see Akerlof, Yellen 1985; Mankiw 1985). On the other hand, the presence of nominal wage rigidities is explained mainly on the basis of models of wage contracts (see Phelps, Taylor 1977).

The most popular type of price rigidity is based on the assumption that the constant share of the companies changes the price within a given period of time (see Calvo 1983). Occurrence of this mechanism triggers a positive relationship between inflation and the level of economic activity. Other types of price rigidities include:

- Scheme, in which the duration of price adjustment depends on the macroeconomic situation and, connected with this, pressure to change the price (cf. Golosov, Lucas 2003);
- Pricing scheme in which the duration of maintaining prices at the same level is established deterministically (cf. Taylor 1980; Chari, Kehoe, McGrattan 2000).

Generally, in the case of monopolistic competition, the price of the final product is given by the following formula:

$$P_t = \left(\int_0^1 p_{i,t}^{1-\varepsilon} di \right)^{(1-\varepsilon)^{-1}} \tag{1}$$

where:

P_t – Price of the final product,

$p_{i,t}$ – Price of the intermediate good,

ε – Elasticity of substitution of intermediate goods used in the manufacture of the final product,

$\varepsilon > 1$.

Firms that adjust their prices in a given period will face the same problem of optimization, thus one can obtain:

$$\int_0^1 p_{i,t}^{1-\varepsilon} di = \left(P_t^* \right)^{1-\varepsilon} , \tag{2}$$

where:

P_t^* – Price set by firms.

In the case of Calvo (1983) price adjustments, a fixed percentage of companies do not change prices in a given period. Thus we obtain the following formula:

$$P_t = \left(\alpha \int_0^1 p_{i,t-1}^{1-\varepsilon} di + (1-\alpha) \int_0^1 p_{i,t}^{1-\varepsilon} di \right)^{(1-\varepsilon)^{-1}} , \tag{3}$$

where:

α – Probability that in a given period the company will not change its price level, $\alpha \in (0,1)$.

Taking into account equation (2), the equation determining the price level of the final product can be converted to the form:

$$\left(P_t \right)^{1-\varepsilon} = \alpha \int_0^1 p_{i,t-1}^{1-\varepsilon} di + (1-\alpha) \left(P_t^* \right)^{1-\varepsilon} . \tag{4}$$

The result is:

$$P_t = \left(\alpha P_{t-1}^{1-\varepsilon}(1-\alpha)\left(P_t^*\right)^{1-\varepsilon}\right)^{(1-\varepsilon)^{-1}} .$$ (5)

In the case of nominal price rigidities the nature of the monetary policy is important. If the growth rate of the money supply is constant, that is given by the equation:

$$\frac{M_{t+1}}{M_t} = \phi ,$$ (6)

where:

M_t – Money supply,

then the shock of increasing government spending leads to an increase in GDP and employment. In the case of such a monetary policy, an expansionary fiscal policy causes a reduction in the level of consumption. The decline in private consumption is due to the fact that the increase in government spending produces a negative wealth effect (for more on this subject, see Krajewski 2011). The increase in government expenditure, through the impact of the negative wealth effect on labour supply and production, will also reduce the rate of wages and inflation.

At the same time, as a result of increased government spending aggregate demand is also growing, because the increase in government spending is higher than the reduction of private consumption. This change in demand, in turn, adds to the upward pressure on prices. The increase in aggregate demand, however, is lower than the increase in aggregate supply resulting from increased labour supply, and thus inflation is reduced. At the same time, due to the presence of nominal rigidities, only some companies will adjust their price level. Other firms choose output adjustments. They reduce the production at a given price level, which leads to a decrease in the demand for labour and consequently to a reduction in nominal wages (see Linnemann, Schabert 2003).

Other conclusions are obtained if the monetary authorities set the interest rate according to the Taylor (1993) rule. The basic version of the Taylor rule takes the following form:

$$R_t = r^n + r_y \tilde{y}_t + r_\pi (\pi_t - \pi^*) ,$$ (7)

where:

R_t - Nominal interest rate,

r^n - Natural interest rate,

$\tilde{y}_t$ – Output gap,

π_t – Inflation,

π^* - Target level of inflation,

$r_y, r_\pi > 0$.

Thus, the central bank raises interest rates when inflation is above the target level or the actual output exceeds the potential level. Equation (7) is the basic version of the Taylor rule. A description of Taylor rule extensions is presented in the works of Baranowski (2008) and (2011).

Assuming the occurrence of the Taylor rule as in the above case, an increase in government spending will result in a rise in the the level of employment and output. The impact of an expansionary fiscal policy on inflation and the prices of factors of production may, in this case however, be different than in the case of steady growth of the money supply. In a situation where the central bank sets the interest rate in response to higher aggregate demand, the supply of money increases and companies begin to raise prices. Because of nominal rigidities, not all companies can immediately change the price level. Instead, some companies adjust the level of output.

As a result, due to the presence of nominal rigidities, an increase in government spending increases the production grows much faster than would result from the wealth effect alone. Higher production resulting from an increase in the demand for labour adds to an upward pressure on the rate of wages. For low values of the parameter concerning the output gap in the Taylor rule, the increase in labour demand more strongly affects the wage rate than the increase in labour supply. Consequently wages increase. This is due to the fact that at low values of this parameter, in response to the growth of GDP the real interest rate increases slightly and does not significantly affect the level of aggregate demand (cf. Linnemann and Schabert 2003).

Thus, if there are nominal price rigidities the increase in government spending leads to an increase in GDP. However, the level of fiscal multipliers depends on monetary policy. According to the Taylor rule, the impact of fiscal policy on GDP is stronger than in the case of a constant growth rate of the money supply. Moreover, if the Taylor rule is applied an increase in government spending will lead to higher inflation, while if the money supply does not depend on interest rates an output gap expansionary fiscal policy will decrease inflation.

The lack of perfect wage flexibility is the second type of nominal rigidity. The effects of fiscal policy in the presence of nominal wage rigidities are examined by Cardia (1995). She assumes that every year some employees sign contracts for nominal wages. In this case, the level of wage contract is given by the following formula:

$$W_t^{CONTR} = \sum_{n=0}^{\infty} (\beta)^n (1-\beta) E\left(W_{t+n} + \lambda L_{t+n}^{IND}\right) , \qquad (8)$$

where:

W_t^{CONTR} - Wage contract,

W_t – Nominal wage,

β – Probability that the wage contract will last,

L_t^{IND} – Measure of disequilibrium on the labour market,

$\lambda > 0$.

Thus, we obtain:

$$T_W = \frac{1}{(1-\beta)} , \qquad (9)$$

$$S_N = (1-\beta)(\beta)^N , \qquad (10)$$

where:

T_W - Average duration of the wage contract,

S_N - Share of contracts that last for at least N periods.

The wage contract depends on the development of current and future wages and on the development of the current and future disequilibrium on the labour market. The current level of nominal wage is a weighted sum of all wage contracts in force, that is:

$$W_t = \sum_{n=0}^{\infty} (\beta)^n (1-\beta) W_{t-n}^{CONTR} . \qquad (11)$$

Thus:

$$W_t = \beta W_{t-1} + (1-\beta) W_t^{CONTR} , \qquad (12)$$

$$W_t^{CONTR} = \frac{1}{\beta} W_{t-1}^{CONTR} - \frac{1-\beta}{\beta}\left(W_{t-1} + \lambda L_{t-1}^{IND}\right). \qquad (13)$$

In this case the impact of a permanent increase in government spending on the economy depends on the wage elasticity of the labour supply. If the labour supply depends on the wage rate, then, as a result of a permanent increase in government spending, production grows. Then, the decline in household assets leads to a decline in consumption and leisure time, and to the increase in the labour supply. Along with the increase in the labour supply the marginal product of capital increases, which leads to an increase in investment. The less responsive wage contracts are to the situation in the labour market, the stronger is the short-term impact of government spending on output. In the case where the labour supply is rigid, an increase in government spending causes a corresponding reduction in private consumption, and therefore in the long-term output remains at an unchanged level.[1]

It should be stressed however, that in the presence of wage contracts, the increase in government spending even with a rigid labour supply has a short-term impact on production.[2] In the period of adjustment, before wage contracts adjust to a new equilibrium level, an increase in government spending causes a reduction in the real wage rate and, consequently, an increase in the demand for labour and output.

It follows from the foregoing that the power of government spending in Poland is dependent on:

- the occurrence of rigidity of prices and wages;
- monetary policy;
- the slope of the labour supply curve.

The presence of nominal rigidities in prices and wages in the Polish economy and the absence of a rigid labour supply has been shown by the empirical results of dynamic stochastic general equilibrium models (see, e.g., Krajewski 2013).[3] The analyses of Poland's conduct of monetary policy indicates that it is pursued according to the Taylor rule (see, e.g., Baranowski 2011). These factors increase the impact of government spending on the Polish economy (cf. Table 1).

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[1] It should also be noted that in the case of a rigid labour supply, employment and production are not affected by tax changes. As empirical studies have shown, such a situation does not occur in the Polish economy, and changes in taxation affect the level of employment (see Krajewski, Mackiewicz 2006; Góra et al. 2008; Krajewski 2012).

[2] While in the absence of wage contracts adjustment of the households' behaviour is immediate and production remains unchanged in the short term as well.

[3] It is worth noting that the first dynamic stochastic general equilibrium models, such as the models of Kydland, Prescott (1982) and Hansen (1985) (for more details about this model see Kuchta, Piłat 2010) did not assume the presence of nominal rigidities. Nominal rigidities were introduced to the dynamic stochastic general equilibrium models in the 1990s. (cf. Mankiw, Romer 1991).

As a result, nominal rigidities, both concerning prices and wages, significantly reinforce the effects of government spending in the Polish economy.

Table 1. The presence of nominal rigidities in the Polish economy and the impact of fiscal policy on GDP

Type of rigidity	The impact of government spending on GDP	Presence in Poland
Nominal price rigidity according to the Taylor rule	Strong positive	Yes
Nominal price rigidity in case of constant growth rate of the money supply	Weak positive	No
Nominal wage rigidity with flexible labour supply	Strong positive	Yes
Nominal wage rigidity with rigid labour supply	Weak positive	No

Source: Author's own compilation.

3. Real rigidities

The presence of real rigidities may also affect the impact of fiscal policy on the economy. In terms of fiscal policy, the two most important types of real rigidities are: households without access to credit markets, and consumer habits.

If households have access to perfect financial markets, the current income does not limit the consumption of households that make consumption decisions based on optimization with the constraint in the form of intertemporal budget constraints. It follows, however, from empirical studies that the current income has a significant impact on the current consumption of households (see Johnson, Parker and Souleles 2004). This is due to the fact that some households do not make decisions based on intertemporal budget constraints, because of the lack of access to credit markets. Such consumers are referred to as rule of thumb consumers.

Households with access to the credit market take into account not only the current utility, but also the future discounted utility of credit. Because only these households invest and benefit from the credit market, they therefore have all the capital stock and bonds.

Consumers that do not have access to the credit market take into account only the current period. In addition, households that do not have access to the credit market consume their entire income in each period. In their case the budget constraint becomes:

$$C_t^{ROT} = w_t L_t^{ROT} \ , \tag{14}$$

where:

C_t^{ROT} - Consumption of households which do not have access to the credit market (rule of thumb consumers),

L_t^{ROT} - Labour supply of households which do not have access to the credit market.

Households with access to the credit market (optimizing consumers) face the following budget constraint:

$$C_t^{OPT} + I_t + \frac{B_{t+1}}{(1+R_t)} = (1+r)K_t + w_t L_t^{OPT} + B_t, \tag{15}$$

where:

C_t^{OPT} – Consumption of households with access to the credit market,

L_t^{OPT} - Labour supply of households with access to the credit market,

I_t – Investments,

K_t – Capital,

r – Return on capital,

B_t – Bonds.

The effects of fiscal policy in the case of the occurrence of both households which behave according to intertemporal budget constraints and households which base their decisions on current income, are demonstrated by the model of Galí, López-Salido and Vallés (2007). This model shows that the impact of government spending on the economy is significantly affected by the share of households without access to the credit market. Along with an increase in the share of such households the strength of the positive impact of government spending on production increases.

The analysed type of real rigidities also affects the response of private consumption to increases of government spending. When the households which don't have access to the credit market constitute the majority of the population,

then based on the model we obtain a positive correlation between government spending and private consumption, i.e., the dependence consistent with the empirical data.

Consumer habits are the second type of real rigidities examined in this paper. The assumption about consumer habits submitted by Abel (1990) means that households have certain habits which cause their consumption behaviours to be characterized by inertia. Thus, the utility of the consumption depends not only on the level of current consumption, but also on its level in the previous period. The assumption that the consumption decisions of households are dependent on their previous behaviour regarding the level of consumption has been empirically confirmed by, among others, the work of Chintagunta, Kyriazidou and Perktold (2001).

When households purchase particular goods on the basis of persistent habits, then companies, while setting the price, must take into account that the future demand will depend on the current sales volume. Higher consumption of a given good at present means that the household will also be willing to buy more of that good in the future.

While analysing consumer habits it is convenient to assume that households consume a variety of goods provided by the companies operating under monopolistic competition, and then aggregate these goods in accordance with the Dixit and Stiglitz (1977) index. This index, in its general form, is as follows:

$$C_t^j = \left(\int_0^1 c_{i,t}^{j\ \frac{\varphi-1}{\varphi}} \, di \right)^{\frac{\varphi}{\varphi-1}} , \tag{16}$$

where:

C_t^j - Index of consumption of the *j*-th household,

$c_{i,t}^j$ – The *i*-th good in the basket of goods,

φ – Elasticity of substitution of consumer goods that make up the basket of goods consumed by a household,

$\varphi > 1$.

In the case of consumption habits the following formula is obtained for the index of consumption:

$$C_t^j = \left(\int_0^1 \left(c_{i,t}^j - \mu v_{i,t-1} \right)^{\frac{\varphi-1}{\varphi}} di \right)^{\frac{\varphi}{\varphi-1}}, \tag{17}$$

where:

μ – Parameter which determines the importance of consumption habits in decision-making by households,

$v_{i,t}$ – Measure determining the consumption habits for the whole economy,

$\mu, \in (0,1)$.

In the model showing the impact of fiscal policy on the presence of consumption habits developed by Ravn, Schmitt-Grohe and Uribe (2006), the measure which specifies consumption habits is given by:

$$v_{i,t} = \chi(v_{i,t-1} - c_{i,t}) + c_{i,t}, \tag{18}$$

where:

$c_{i,t}$ - The average level of consumption of good i for the whole economy,

$\chi \in (0,1)$.

The average level of consumption for the whole economy is given by the formula:

$$c_{i,t} = \int_0^1 c_{i,t}^j dj. \tag{19}$$

The level of consumption by a household depends on the previous average levels of consumption of this good in the economy, which a household takes as predetermined.

As a result we have:

$$c_{i,t}^j = \left(p_{i,t}^{-\varphi} \left(\int_0^1 p_{i,t}^{1-\varphi} di \right)^{(\varphi-1)^{-1}} \right) C_t^j + \mu v_{i,t-1}, \tag{20}$$

When aggregating individual households' consumption, we find that the aggregate consumer demand for good i is given by the formula:

$$c_{i,t} = p_{i,t}^{-\varphi} P_t^\varphi C_t + \mu v_{i,t-1}. \tag{21}$$

The analysed model assumes that the objective of fiscal policy is to maximize the government spending index defined by the equation:

$$G_t = \left(\int_0^1 \left(g_{i,t} - \mu v_{i,t-1}^g \right)^{\frac{\varphi-1}{\varphi}} di \right)^{\frac{\varphi}{\varphi-1}} , \qquad (22)$$

where:

G_t - Government spending index,

$g_{i,t}$ – Government spending on the purchase of an good i,

$v_{i,t}^g$ – Measure determining the consumption habits of public consumption.

The adoption of this index of government spending means that households form habits not only based on private consumption, but also on public consumption. The model for determining the consumption habits of public consumption is the following:

$$v_{i,t}^g = \chi(v_{i,t-1}^g - g_{i,t}) + g_{i,t} . \qquad (23)$$

Consumption habits have a significant influence on the direction of the impact of government spending on private consumption. If there are no consumer habits, an increase in government spending leads to a decline in private consumption, which results from the emergence of a negative wealth effect. However, where consumption habits exist, in addition to the wealth effect there is also a strong substitution effect. As a result of the growth in the rate of real wages, households substitute leisure for consumption. According to the simulation conducted by Ravn, Schmitt-Grohe, and Uribe, the income effect in this case is weaker than the substitution effect. Consequently, an increase in government spending also results in increased private consumption.[4]

It follows from the above analyses that the real rigidities affect primarily the nature of the impact of government spending on private consumption. The results of stochastic general equilibrium models (see Krajewski 2013) indicate that consumer habits are present in the Polish economy. In addition, the credit market in Poland in comparison with most countries of the European Union is relatively underdeveloped, which may translate into a large share of households without access to the credit market. As can be seen from the analyses, these

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[4] Moreover, consumption habits influence the relationship between government spending and wages. According to the simulation carried out by the above-mentioned authors, with respect to consumer habits the government spending impact is stronger on demand for labour than its impact on labour supply. As a result, an increase in government spending leads to an increase in real wages.

factors affect the occurrence of a strong positive relationship between the level of government spending and the development of private consumption (see Table 2).

Table 2. The presence of real rigidities in the Polish economy and the impact of fiscal policy on consumption

Type of rigidity	Direction of the relationship between government spending and consumption	Presence in Poland
Share of households with no access to the credit markets	Positive	Yes
The presence of consumption habits	Positive	Yes

Source: Author's own compilation.

4. Conclusions

The presence of rigidities has a key influence on the functioning of an economy. This study examined the effects of nominal and real rigidities on the impact of fiscal policy on an economy.

In the case of nominal price rigidity, the impact of government spending on GDP is dependent on the conduct of monetary policy. Fiscal multipliers are higher when the central bank changes the interest rate, and lower for a fixed rate of growth of the money supply. In the case of wage rigidity fiscal multipliers are dependent on the slope of the labour supply curve. The greater the impact of wages on labour supply, the stronger the impact of fiscal policy.

Taking into account the conduct of monetary policy in Poland and wage elasticity of labour, based on the analyses the hypothesis was confirmed that nominal rigidities significantly enhance the impact of fiscal policy on the Polish economy.

Based on the analyses, the hypothesis was also confirmed that real rigidities increase the impact of government spending on GDP. In this study, two types of real rigidities were examined - lack of access to the credit market and the presence of consumer habits. The larger the shares of households that do not have access to the credit market, the greater the impact of fiscal policy on GDP. Furthermore, both the lack of access to the credit market and the existence of consumer habits lead to a positive relationship between the government spending and private consumption.

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Streszczenie

ANALIZA PORÓWNAWCZA ODDZIAŁYWANIA SZTYWNOŚCI NOMINALNYCH I REALNYCH NA EFEKTYWNOŚĆ POLITYKI FISKALNEJ

W pracy zbadano wpływ występowania sztywności nominalnych i realnych w gospodarce na charakter oddziaływania polityki fiskalnej. Potwierdzono hipotezę, że zarówno sztywności nominalne, jak i realne zwiększają siłę wpływu polityki fiskalnej na gospodarkę polską. W przypadku sztywności nominalnej cen uzyskano, że siła oddziaływania wydatków rządowych na PKB uzależniona jest od prowadzonej polityki pieniężnej. Natomiast w warunkach sztywności płac wysokość mnożników fiskalnych zależy od nachylenia krzywej podaży pracy. W pracy zbadano również dwa rodzaje sztywności realnych – brak dostępu do rynku kredytowego i występowanie przyzwyczajeń konsumpcyjnych. Z przeprowadzonych analiz wynika, że ww. sztywności skutkują przede wszystkim silną dodatnią zależnością pomiędzy wydatkami rządowymi a poziomem konsumpcji.

Słowa kluczowe*: polityka fiskalna, sztywności nominalne, sztywności realne*