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## **Does the minimum wage affect inflation?**

### **1. Introduction**

The observed growth in the inflation rate in both developed and developing economies raises questions as to those factors likely to accelerate it. The overall increase in the prices of goods and services may have a circular effect on wage increases. As the prices of goods and services increase, higher wages will be required to compensate. The high inflation rate and minimum wage increases observed in many economies highlights the importance of this topic.

Minimum wages can be an element of a policy to overcome poverty and reduce inequality (ILO, 2006). However, the effectiveness of minimum wages in reducing poverty has been debated for many decades. While minimum wages obviously increase the nominal wages of low-wage workers, whether they also raise their real wages and overall wellbeing is debatable. This is because minimum wage increases may lead to workers being dismissed and/or prices being raised.

Minimum wage increases can impact prices through several channels. First, they lead to higher production costs, which firms may attempt to recoup by raising prices. Second, workers earning slightly above the minimum wage will attempt to maintain the earnings structure, thereby exerting upward pressure on wages. This spillover effect further increases production costs, which may in turn translate into higher prices. Third, minimum wage increases will lead to an increase in overall income, provided the increased wages of those still employed exceeds the complete loss of income of those dismissed. Higher incomes generally increase demand for goods and services, which can drive up prices. Fourth, higher incomes increase the creditworthiness of low-wage workers, which can increase aggregate demand even further. Fifth, other labor market institutions (e.g. severance pay for collective redundancies) are connected to the minimum wage. This further increases total labor costs.

Companies have a few options for dealing with higher labor costs. They can pass them on by raising prices. They can dismiss workers and/or reduce their non-

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financial benefits. Finally, they can absorb the increase, at the cost of reduced margins and profits, by leaving staff levels, non-financial benefits, and prices untouched (Lemos, 2006). The overall effect of the minimum wage on prices will largely depend on the degree of market competition. Disemployment effects are expected under perfect competition. Under monopsony, by contrast, firms may even increase employment. This has been confirmed by Card and Krugger (1995). Since modern labor markets are far from competitive, the majority view in the literature is that the employment and profit effects are small; most firms adjust to higher labor costs by raising prices (see Harasztosi and Lindner, 2019).

An enormous amount of research has been devoted to the impact of the minimum wage on labor market outcomes. The effects on employment, however, are mixed, primarily because of the heterogeneity of the workforce. Neumark and Shirley (2021), and Wolfson and Belman (2019) have most recently summarized the evidence from the US. Studies have also confirmed this finding in other countries (see e.g.: Campolieti, 2020, with a meta-analysis for Canada; and Dube, 2019, for a summary of the international evidence). While less research has been conducted on the effects of the minimum wage on prices, there is once more no consensus in the literature. Some studies conclude that minimum wage growth does not increase inflation (see Campos-Vazquez and Esquivel, 2020; MacDonald and Nilsson, 2016). Other studies, however, confirm statistically significant positive effects of minimum wage increases on prices (see Leung, 2020 or Harasztosi and Lindner, 2019).

The reason for the inconsistency of the results on the impact of the minimum wage on prices may be that the pass-through differs depending on many factors: the price elasticity of the demand for the product(s) and service(s) in question; the degree of local competition; the employment structure; long versus short run; and the phase of the business cycle. For example, if the production of certain goods is labor intensive, the workers producing them earn the minimum wage, their consumers are poor, and the goods are necessities comprising a large proportion of their consumption bundle, then minimum wage increases might hurt rather than aid the poor. Moreover, if minimum wage increases cause inflation, then they will hurt the poor even more, as they disproportionately suffer from it (Lemos, 2006).

The higher the degree of competition between firms on the local labor market, the lower the probability that firms will increase prices. Price increases are more probable in service sectors but less probable in sectors facing a high level of competition from foreign imports using cheaper labor. The results may also depend on the period under analysis: in the long run, higher production costs (including higher minimum wages) can be offset by higher productivity. Similarly, in periods of high economic growth, firms will adjust to minimum wage increases by raising prices rather than dismissing staff while they will do the opposite during slowdowns. Therefore the effects of minimum wage increases on prices can also differ across the business cycle. Moreover, since low-wage workers are not equally distributed across regions, minimum wage increases might disproportionately hurt regions with a higher share of low-wage workers.

This paper examines the effects of minimum wage increases on prices across regional labor markets. The dependencies between the structures of regional labor markets and the minimum wage pass-through effects on prices are analyzed. We contend that the impact of minimum wage changes on prices will differ across regions according to their proportion of minimum wage workers. Since low-wage workers tend to spend most of their income on goods with low price elasticity (food, housing, etc.), we predict the pass-through effect to be higher in regions with: a higher proportion of low-wage workers; a lower degree of competition between firms; and/or a higher share of non-tradeable goods.

Polish data were used to verify these hypotheses. Analyzing the minimum wage pass-through effects on price changes in Poland is instructive for several reasons. Minimum wage policy, which is conducted at the national level, is simple and has a long history; there is only one minimum wage rate for all regions, occupations, and sectors. Minimum wage coverage is extensive. All workers in the private sector are covered by minimum wage legislation. According to Eurostat, Poland has one of the highest proportions of minimum wage workers in Europe. There has been a sustained increase in the national minimum wage in Poland. Lastly, Poland exhibits large and enduring regional differences.

Most of the research on the pass-through effect of the minimum wage on prices concerns the US or other developed countries. There are far fewer studies on less developed countries such as Poland. We believe that the minimum wage mechanism may affect prices in less developed countries differently than it does in more developed countries. We predict the pass-through effect of the minimum wage on prices to be higher in Poland than in more developed countries. Firstly, Poland has one of the highest proportions of minimum wage workers in the EU. A large number of low-wage workers may translate into higher minimum wage pass-through rates, especially in less developed regions. Secondly, as a result of linking the minimum wage in Poland to other labor market institutions, the higher increase in production costs may translate into higher prices.

The minimum wage pass-through effects on prices across 16 NUTS2 regions in 2003-2020 are analyzed using publicly available data from Statistics Poland. We analyze the minimum wage pass-through effects on the consumer price index (CPI), and on goods with low price elasticity (specifically food). We aim to verify whether these effects differ between regions with different employment structures. The New Keynesian Minimum Wage Augmented Phillips Curve approach is adopted to verify the impact of minimum wage increases on inflation. We link the minimum wage augmented Phillips curve used for aggregate US data (Glover, 2019) with the regional Phillips curves approach (Bishop and Greenland, 2021; Hazzel et al., 2021) for US regions. The dynamic panel approach is used with the Arellano-Bond (AB) and Blundell-Bond system estimators (BB) in order to account for the dynamic properties of inflation. To the best of our knowledge, this is the first study of its kind.

The structure of the study is as follows. Section 2 reviews the literature. Section 3 discusses minimum wage policy in Poland. Section 4 describes the data and methodology. Section 5 presents the results. Section 6 concludes.

## 2. Review of the literature

There has been increasingly more research on the effects of minimum wages on prices in recent years but without reaching any consensus. Earlier studies indicate that the minimum wage slightly increases prices. Lemos (2008) provides a comprehensive survey on minimum wage price effects by summarizing and critically comparing almost 30 studies that estimate the effect of the minimum wage on prices. The study concludes that, despite the different methodologies, data periods and data sources, most articles found that a 10% increase in the minimum wage raises food prices by no more than 4% and overall prices by no more than 0.4%. The main takeaway from Lemos' survey on price effects is that the minimum wage increases the wages of the poor without destroying too many jobs or raising prices excessively. The main policy recommendation to be derived from these findings is that the minimum wage can be used to increase the wages of the poor without unduly increasing either unemployment or inflation.

The results of more recent studies are mixed. Some conclude that minimum wage growth does not increase inflation. Campos-Vazquez and Esquivel (2020) analyzed the joint effect of doubling the minimum wage and cutting VAT in Mexican municipalities in 2019. They found that reductions in VAT rates predominated over the effect of the minimum wage increase and caused inflation to decrease. The minimum wage effect was, according to their estimates, either very small or null. MacDonald and Nilsson (2016) found that the size of the minimum wage pass-through effect on prices was much smaller than previously reported and entirely concentrated on the month that the minimum wage is increased.

Other studies confirm statistically significant positive effects of minimum wage increases on prices. Leung (2020) provided empirical evidence that a 10% increase in the minimum wage raises grocery store prices by 0.6%-0.8%. His findings suggest that the minimum wage not only raises labor costs but also affects product demand, especially in poorer regions. Ashenfelter and Jurajda (2021) found that McDonald's restaurants pass through the higher costs of minimum wage increases by raising the price of their Big Mac hamburger, which has a price elasticity with respect to minimum wages of about 0.14. Harasztosi and Lindner (2019) analyzed the margins along which firms responded to a large and persistent minimum wage increase in Hungary. They found that most firms responded to minimum wage increases by raising wages instead of destroying jobs. As a result, firms employing minimum wage workers experienced a large increase in their total labor cost, which they partly recouped by raising prices and partly absorbed. These results indicate that around 75% of the minimum wage increase was paid by consumers and 25% percent by firm owners. Glover (2019) estimated the minimum wage augmented Phillips curve using aggregated data for the US economy. He found that, consistent with theory, controlling for the real minimum wage reduces the effect of output on inflation and increasing the minimum wage is inflationary.

A substantial heterogeneity in the responses to the minimum wage across sectors can also be confirmed. Harasztosi and Lindner (2019) found that disemployment effects were greater in industries where passing wage costs on to consumers is more

difficult. They show that the revenue effects are smaller (and the disemployment effects larger) in the tradable, manufacturing, and exporting sectors. Hungarian firms operating in these sectors are more likely to face foreign competitors that can pay less than the Hungarian minimum wage. They are therefore at a competitive disadvantage, which may lead to a large fall in output. By contrast, the minimum wage increases revenue more (and the disemployment effects are smaller) in the non-tradable sector. Here, all firms are required to pay the minimum wage, which means that individual firms can raise prices without losing competitive advantage and consequently having to reduce output by a large amount. Hau et al. (2019) found that firm-specific price inflation (under wage pass-through) can be excluded for exporting firms in China. Minimum wage shocks do not affect their firm-specific product prices, as they do not increase their exporting prices in response to minimum wage increases. The literature also confirms different price responses for different kinds of goods. Leung (2020) found significant effects for grocery store inflation but statistically insignificant estimates for drug and merchandise stores. MaCurdy (2015) shows that the minimum wage increases consumer prices more for low-wage than high-wage workers. Fougère et al. (2010) corroborate evidence of the pass-through of minimum wages into prices and find more pass-through into prices in industries with a greater share of workers on the minimum wage.

Substantial heterogeneity in the price response was found also across regions. Leung (2020), focusing only on grocery stores in poor counties where the minimum wage is more binding, found that the estimated pass-through elasticity is larger than in richer counties. He explains this with reference to demand-induced feedback, i.e. spillover effects increase household income in poor counties, which lowers demand elasticities, thereby leading to price rises as stores increase markups. Additionally, higher incomes increase the creditworthiness of low-wage workers. Dettling and Hsu (2021) found that higher minimum wages reduce borrowing costs and have positive spillover effects on disposable income and liquidity. Yamagishi (2021) estimated that in the low-quality rental housing market, a 10% minimum wage increase induces a 2.5%–4.5% rent increase.

Larger pass-through effects in poorer regions were also confirmed by Lemos (2006), who additionally observed lower effects in low inflation periods. Another key factor is the product structure of the local market. The higher the degree of competition between firms, the lower the probability that increased labor costs will be passed on to consumers. Some interesting research conducted by Glover and Mustre-del-Río (2021) shows that the effects of minimum wage increases on prices depend on monetary policy. Their analysis suggests that a minimum wage increase leads to higher inflation if the central bank is relatively unresponsive to current inflation, and to a weaker growth in prices if the central bank responds more aggressively to current inflation.

Most of the research on the pass-through effect of the minimum wage on prices has been conducted on the US and other developed countries. Far fewer studies have been conducted on less developed countries. The only study on Poland was carried out by Roszkowska (2013), who analyzed the relationships between

inflation and various macroeconomic and institutional variables at the aggregate level for 1995–2011. She found that the minimum wage increases producer prices and decreases real wages.

Minimum wage increases at the national level may have different effects on regional labor market outcomes, including prices. This paper analyzes the different pass-through effects of the national minimum wage on regional labor markets. First, the average effect is estimated, then the effects for the various regions are assessed. We predict that the pass-through of the minimum wage on prices to be: higher for goods with low price elasticity (specifically food); higher in regions with a high proportion of low-wage workers; higher for labor intensive products; higher in regions with a lower level of competition between firms; lower in regions with a high proportion of workers employed in producing tradeable goods; higher in regions with a high proportion of workers employed in market services; and higher during recovery periods than during downturns.

### **3. The minimum wage in Poland**

Poland is one of the 21 countries among the 27 EU member states that have a national minimum wage. Minimum wage legislation in Poland was first introduced in 1956. The monthly gross minimum wage is set annually through negotiations within the Social Dialogue Council. This body comprises representatives from the government, employer organizations, and trade unions. In the event that the Council cannot reach a consensus, the minimum wage for the following calendar year is decided solely by the Council of Ministers by no later than September 15. The annual minimum wage increase is guaranteed to at least match the CPI increase for the coming year plus two-thirds of the forecast GDP growth rate (Minimum Wage Act of October 10, 2002, as amended).

Annual minimum wage growth has usually exceeded the statutory minimum (see Table 1). In 2005–2020, the minimum wage in Poland increased from 849 PLN to 2600 PLN. In 2005–2020, the average annual increase in the minimum wage was 7.8%, which was much higher than the average inflation rate (2.0%). In 2006–2007, the minimum wage increased by approximately 5% on average. In 2008 and 2009, the national minimum wage in Poland was augmented by 20.3% and 13.3% respectively in nominal terms. The large increase in 2008 was the result of bilateral agreements between the government and the trade unions. In 2009, the government made concessions to the trade unions, which forced a further large increase. After adjusting for the CPI, the real minimum wage increases for 2008 and 2009 were 16.1% and 9.8%, respectively. The annual minimum wage increase has subsequently been lower than in 2008–2009, but has almost always exceeded the statutory minimum. In 2020, it increased by more than 15% in nominal terms.

**Table 1**  
**Minimum wage, CPI and GDP growth in Poland in 2003–2020**

	(1)	(2)	(3)	(4)	(5)	(6)
	Minimum wage (PLN)	Minimum wage growth y/y (%)	CPI (%)	GDP growth rate (%)	CPI + 2/3 GDP growth	Difference between (2) and (5) in p.p.
2003	800	5.3	0.8	3.5	3.1	2.2
2004	824	3.0	3.5	5.0	6.8	-3.8
2005	849	3.0	2.1	3.5	4.4	-1.4
2006	899	5.9	1.0	6.1	5.1	0.8
2007	936	4.1	2.5	7.1	7.2	-3.1
2008	1126	20.3	4.2	4.2	7.0	13.3
2009	1276	13.3	3.5	2.8	5.4	8.0
2010	1317	3.2	2.6	3.7	5.1	-1.9
2011	1386	5.2	4.3	4.8	7.5	-2.3
2012	1500	8.2	3.7	1.3	4.6	3.7
2013	1600	6.7	0.9	1.1	1.6	5.0
2014	1680	5.0	0.0	3.4	2.3	2.7
2015	1750	4.2	-0.9	4.2	1.9	2.3
2016	1850	5.7	-0.6	3.1	1.5	4.2
2017	2000	8.1	2.0	4.8	5.2	2.9
2018	2100	5.0	1.6	5.4	5.2	-0.2
2019	2250	7.1	2.3	4.7	5.4	1.7
2020	2600	15.6	3.4	-2.5	1.7	13.8

Source: Eurostat and Statistics Poland, own calculations.

Minimum wage increases were much higher than the growth rate of the average wage in the analyzed period. As a result, the minimum to average wage ratio increased from 34% to 47%. Poland now has one of the highest minimum to average wage ratios in Europe.<sup>1</sup>

The minimum wage in Poland is set at the national level and covers workers in all regions and almost all sectors and occupations. Because of regional differences in both individual and firm characteristics, average wages vary among regions. As a result, the minimum to average wage ratio varies widely, ranging from 26% to 41% in 2005, and from 40% to 55% in 2020. The minimum to average wage ratio only reached 40% in two regions in 2005. This ratio was at least 40% in every Polish NUTS2 region in 2020, and even exceeded 50% in 11 out of 16 of them

<sup>1</sup> [https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Minimum\\_wage\\_statistics#Minimum\\_wage\\_levels\\_in\\_relation\\_to\\_median\\_gross\\_earnings](https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Minimum_wage_statistics#Minimum_wage_levels_in_relation_to_median_gross_earnings)

(see Table 2). The eastern and south-eastern regions have the highest minimum to average wage ratios. These are the least developed regions of the country, and have a high proportion of low productive and low paid workers.

**Table 2**  
**Average wages and the relative minimum wages for Poland in 2003 and in 2020**

	Average wages (PLN)			Minimum to average wage ratio (%)		
	2003	2020	% change	2003	2020	change in p.p.
POLAND	2 315	5 523	139	34.6	47.1	12.5
Dolnoslaskie	2 234	5 694	155	35.8	45.7	9.9
Kujawsko-pomorskie	2 001	4 832	141	40.0	53.8	13.8
Lubelskie	1 996	4 915	146	40.1	52.9	12.8
Lubuskie	1 990	4 832	143	40.2	53.8	13.6
Lodzkie	2 024	5 148	154	39.5	50.5	11.0
Malopolskie	2 110	5 536	162	37.9	47.0	9.1
Mazowieckie	3 005	6 582	119	26.6	39.5	12.9
Opolskie	2 087	5 079	143	38.3	51.2	12.9
Podkarpackie	1 950	4 708	141	41.0	55.2	14.2
Podlaskie	2 035	4 930	142	39.3	52.7	13.4
Pomorskie	2 257	5 484	143	35.4	47.4	12.0
Slaskie	2 380	5 451	129	33.6	47.7	14.1
Swietokrzyskie	2 024	4 800	137	39.5	54.2	14.7
Warmińsko-mazurskie	2 003	4 709	135	39.9	55.2	15.3
Wielkopolskie	2 129	4 986	134	37.6	52.1	14.5
Zachodniopomorskie	2 135	5 099	139	37.5	51.0	13.5

Source: Eurostat and the Statistics Poland.

Changes in minimum wage in Poland affect the level of other benefits. Higher minimum wage transmits to higher allowances for work at night (which is set at 20% of hourly minimum wage), higher severance pay for collective redundancies (these cannot exceed 15 times the minimum statutory remuneration as at the day on which the employment relationship is terminated). Minimum wage increases also affect the minimum compensation for unequal treatment in employment, and for terminating a contract due to mobbing. They also affect the benefits for standby time and downtime.

Additionally, the minimum wage is the basis for calculating sickness, maternity, care, compensation, and rehabilitation benefits. An increase in the minimum wage means an increase in the base level of these benefits. Lastly, for own-account workers starting a business who pay social security contributions on preferential terms, the



basis for calculating contributions is the declared amount, but cannot be less than 30% of the minimum wage.<sup>2</sup> All of the above increase the costs of doing business.

#### 4. Data and methodology

To verify the pass through effect of the minimum wage on prices, we link the minimum wage augmented Phillips curve (Glover, 2019) with the regional Phillips curves. Glover (2019) relates inflation to output and the real minimum wage using US aggregate data. Consistent with theory, he found that controlling for the real minimum wage reduces the effect of output on inflation and that minimum wage increases are inflationary. We use this approach for regional data in Poland by applying the regional Phillips curves that Bishop and Greenland (2021) and Hazzel et al. (2021) used for US regions. We estimated the parameters of the following New Keynesian Minimum Wage Augmented Phillips Curve on regional data:

$$\pi_{i,t} = \alpha_0 + \alpha_1 \pi_{i,t-1} + \alpha_2 GAP_{i,t} + \alpha_3 GWREL_{i,t} + \beta_k X_{k,i,t} + \varepsilon_{i,t} \quad (1)$$

where:

$\pi_{i,t}$  ( $\pi_{i,t-1}$ ) – is the inflation rate in regional labor market  $i$  at time  $t$  (at time  $t-1$ );  
 $GAP_{i,t}$  – is the measure of the economic stance in regional labor market  $i$  at time  $t$ ;  
 $GWREL_{i,t}$  – is the % change of the minimum to average wage ratio in regional labor market  $i$  at time  $t$ ;

$X_{k,i,t}$  – vector of other inflation determinants.

Similarly as Eser et al. (2020), we use four measures of economic stance: the output gap ( $gy_{i,t} - gy_{i,t}^N$ ); the unemployment gap ( $u_{i,t} - u_{i,t}^N$ ); the unemployment rate ( $u_{i,t}$ ); and the lagged GDP growth rate ( $gy_{i,t-1}$ ). Therefore  $u_{i,t}^N$  and  $gy_{i,t}^N$  approximate the natural unemployment rate and potential GDP growth in regional labor market  $i$  at time  $t$ .

Data on the GDP growth and unemployment rates in regional labor markets in Poland are publicly available. Unfortunately, there are no data on the natural rate of unemployment and the potential GDP growth rate at the regional level. We construct these as 5-year moving averages of the unemployment rate and GDP growth rates respectively. In further analyses, we check which of these variables best describes the economic situation on regional labor markets.

We include both demand and cost factors in line with the underlying theory. In equation (1), the variable  $GAP$  measures the regional demand changes (Leung, 2020). The change in the minimum to average wage ratio ( $GWREL$ ) accounts for those cost factors that may increase producer price pressure. The elasticity of inflation with respect to minimum wage increases is the minimum wage pass-through elasticity. This is our parameter of interest. Other variables which may

<sup>2</sup> <https://www.money.pl/gospodarka/kogo-wyzsza-placa-minimalna-najbardziej-uderzy-po-kieszeni-6651275499146112a.html>

affect inflation are included. We use the changes in oil prices (*gbrent*) as the measure of external factors which may impact the inflation rate on regional labor markets, and time dummies to account for other macroeconomic common shocks.

The annual data for the 16 NUTS2 level regions in Poland in 2003–2020 are used.<sup>3</sup> All these data were provided by the Local Data Bank, Statistics Poland. The inflation rate is measured by the CPI. The GDP growth rate is measured in constant prices. The unemployment rate refers to the LFS data. The minimum to average wage ratios for a given year are calculated by dividing the minimum wage by the average regional wages. Oil prices are measured as Europe Brent Spot Price FOB in USD per barrel.<sup>4</sup> All the variables used in the model vary considerably both temporally and across regions (see Table 3).

**Table 3**  
**Descriptive statistics of the variables used in the study**

Variable		Mean	Std. dev.	Minimum	Maximum	Observations
Inflation rate	overall	2.05	1.60	-1.70	4.90	N = 288
total	between		0.13	1.84	2.23	n = 16
	within		1.60	-1.75	4.75	T = 18
Inflation rate	overall	2.91	2.50	-2.60	7.10	N = 288
food	between		0.14	2.59	3.13	n = 16
	within		2.50	-2.33	7.07	T = 18
Unemployment	overall	9.89	5.32	1.80	26.00	N = 288
rate	between		1.20	8.03	11.59	n = 16
	within		5.19	1.78	24.76	T = 18
Unemployment	overall	-0.01	1.09	-3.52	2.84	N = 288
gap	between		0.04	-0.10	0.08	n = 16
	within		1.09	-3.55	2.84	T = 18
GDP growth	overall	3.70	2.05	-1.40	9.90	N = 256
rate	between		0.66	2.72	5.04	n = 16
	within		1.94	-0.55	9.62	T = 16
Output gap	overall	0.036	1.76	-4.20	5.92	N = 240
	between		0.09	-0.14	0.19	n = 16
	within		1.76	-4.17	6.00	T = 15
Growth of	overall	1.83	3.72	-5.47	10.46	N = 288
minimum	between		0.26	1.34	2.42	n = 16
	within		3.71	-5.42	10.96	T = 18
wage ratio						

<sup>3</sup> More recent data were not available. Data on regional GDP in Poland are published with considerable delay, the latest concern 2019.

<sup>4</sup> Data on oil prices are from the U.S. Energy Information Administration: <https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=RBRT&f=A>

Variable		Mean	Std. dev.	Minimum	Maximum	Observations
Growth	overall	69.76	27.76	-47.14	42.63	N = 288
of oil prices	between		0.00	6.37	6.37	n = 16
	within		27.76	-47.14	42.63	T = 18

Source: Statistics Poland, own calculations.

As for methodology, the New Keynesian Minimum Wage Augmented Phillips Curve is applied to every region in order to test the different specifications of the model. Traditional methods cannot be used as they were devised for static panel models. As such, they provide biased estimates of the parameters in dynamic models. The GMM is used as it was designed to model dynamic panel data. However, OLS and FE estimators are used as a benchmark. We begin with the Arellano-Bond (1991) estimator. This forms the moment conditions using lagged-levels of the dependent variable with first-differences of the disturbances. However, Arellano-Bover (1995) and Blundell-Bond (1998) found that lagged levels can be weak instruments if the autoregressive process is too persistent. In these cases, the estimated values of the parameters are downward biased, especially when the number of periods is small. The Blundell-Bond system estimator uses additional moment conditions in which lagged differences of the dependent variable are orthogonal to disturbance levels (Drukker, 2008). This brings to light a serious problem: once the Arellano-Bond estimations are performed, the Arellano-Bond test for the serial correlation reveals problems with second order autocorrelation in almost every specification of the model. The Arellano-Bond and Blundell-Bond system estimators are therefore both used.

Firstly, the overall inflation rate is used as the dependent variable to estimate the pass-through effect of the minimum wage in the entire sample of regions. Secondly, we check whether the pass-through effect differs when food inflation is used as the dependent variable. Then we verify the stability of the minimum wage effects on overall and food inflation both temporally and across regions.

## 5. Results

In the first step, the best specification of the model is chosen. We verify which of the four measures of the economic stance at the regional level (described in the previous section) best explain the variation of the explained variable, and which specification is correct once the overidentification of the model and the autocorrelation of the error terms are taken into account.<sup>5</sup> The specification with the unemployment rate and lagged GDP growth is the only correct one in that it does not reveal any autocorrelation problems or overidentifying restrictions. The coexistence of both measures in the model stems from the fact that GDP

<sup>5</sup> These estimations are not presented due to lack of space. They are, however, available upon request.

growth approximates the phase of the business cycle and the demand pressure on prices, while the unemployment rate reflects additional pressure from regional labor markets; the lower the unemployment rate in a given regional labor market, *ceteris paribus* the greater the upward pressure on wages and prices. The correlation between these two variables is weak (see Table 4).

**Table 4**  
Correlations between the overall inflation rate, food inflation rate, and the explanatory variables

	$\pi_{i,t}$	$\pi_{i,t-1}$	$\pi_{i,t}^{Food}$	$\pi_{i,t-1}^{Food}$	$u_{i,t}$	$gy_{i,t-1}$	$GWREL_{i,t}$	$gbrent_{it}$
$\pi_{i,t}$	1.00							
$\pi_{i,t-1}$	0.61	1.00						
$\pi_{i,t}^{Food}$	0.89	0.34	1.00					
$\pi_{i,t-1}^{Food}$	0.63	0.89	0.41	1.00				
$u_{i,t}$	-0.02	0.38	-0.25	0.22	1.00			
$gy_{i,t-1}$	0.36	0.07	0.41	0.15	-0.12	1.00		
$GWREL_{i,t}$	0.35	0.27	0.27	0.42	-0.22	0.11	1.00	
$gbrent_{it}$	0.37	0.18	0.32	0.23	0.36	0.11	-0.34	1.00

Source: own estimates.

In the second step, we estimate the parameters of the chosen specification in the overall inflation model for the entire sample of regions. We start from the OLS and FE estimators, and then use the Arellano-Bond and Blundell-Bond estimators. Overidentification in the model was avoided by minimizing the number of instruments used. The results are presented in Table 5.

Lagged inflation is positive and significant independently of the method of estimation. The true value of the parameter lies between 0.48 and 0.32. Neither the unemployment rate nor the lagged GDP growth is statistically significant for the entire sample of regions. Our parameter of interest, viz. the elasticity of inflation with respect to minimum wage increases, is significant at the 5-10% significance level. A 1 p.p. increase in the minimum to average wage ratio leads to a 0.04 p.p. increase in the overall inflation rate. The increase in the price of oil is also significant and positive, and leads to higher inflation. Time dummies are significant in all specifications.

**Table 5**  
**The results of the estimation of parameters of model (1) for the whole sample of regions (dependent variable: overall inflation)**

	OLS	FE	AB	BB
$\pi_{i,t-1}$	0.483*** (0.060)	0.323*** (0.068)	0.346*** (0.089)	0.321*** (0.059)
$u_{i,t}$	0.004 (0.010)	-0.012 (0.015)	0.014 (0.031)	0.028 (0.031)
$gy_{i,t-1}$	0.011 (0.011)	0.012 (0.012)	0.013 (0.012)	0.010 (0.013)
$GWREL_{i,t}$	-0.000 (0.021)	0.008 (0.022)	0.046** (0.023)	0.042* (0.023)
$gbrent_{i,t}$	0.014*** (0.003)	-0.029*** (0.009)	0.019*** (0.004)	0.019*** (0.004)
<i>constant</i>	-0.346* (0.184)	1.524*** (0.168)	-0.239 (0.431)	-0.353 (0.477)
N	256	256	240	256
Time dummies	Yes	Yes	Yes	Yes
Adj. R2	0.977	0.978		
FE test		1.64 (0.065)		
TE test		230.16 (0.000)		
Sargan			21.958 (0.080)	24.738 (0.738)
AB(1)			-3.315 (0.001)	-3.460 (0.001)
AB(2)			-1.321 (0.187)	-1.253 (0.210)
Instruments			34	50

AB / BB – Arellano-Bond / Blunell-Bond method with all the variables treated as exogenous. N – number of observations. AB(1) and AB(2) – Arellano-Bond test for serial correlation of first and second order. Sargan – Sargan/Hansen test of overidentifying restrictions.

Source: own estimates.

In the next step, food inflation is the dependent variable. The results (see Table 6) show that the elasticity of inflation with respect to minimum wage increases is significant, positive, and much greater than the elasticity of overall inflation. A 1 p.p. increase in the minimum to average wage ratio leads to a 0.10-0.11 p.p. increase in the food inflation rate. This confirms the findings of other research (see e.g. Ashenfelter and Jurajda, 2021). It is interesting to note that the impact of an increase in the price of oil on food inflation is twice as high as that on overall inflation.

Table 6

The results of the estimation of parameters of model (1) for the whole sample of regions (dependent variable: food inflation)

	OLS	FE	AB	BB
$\pi_{i,t-1}$	0.127** (0.064)	-0.007 (0.067)	0.019 (0.108)	0.039 (0.074)
$u_{i,t}$	0.008 (0.018)	-0.031 (0.026)	-0.027 (0.051)	-0.015 (0.048)
$gy_{i,t-1}$	-0.010 (0.019)	-0.010 (0.021)	-0.018 (0.028)	-0.019 (0.029)
$GWREL_{i,t}$	0.034 (0.037)	0.059 (0.037)	0.113*** (0.043)	0.100** (0.044)
$gbrent_{i,t}$	0.031*** (0.006)	0.034** (0.015)	0.045*** (0.010)	0.042*** (0.009)
<i>constant</i>	-0.135 (0.324)	5.578*** (0.271)	0.683 (0.723)	0.458 (0.733)
N	256	256	240	256
Time dummies	Yes	Yes	Yes	Yes
Adj. R <sup>2</sup>	0.966	0.968		
FE test		2.00 (0.012)		
TE test		246.05 (0.000)		
Sargan			20.547 (0.114)	21.150 (0.883)
AB(1)			-3.451 (0.001)	-3.470 (0.001)
AB(2)			0.370 (0.712)	0.404 (0.686)
Instruments			34	50

AB / BB – Arellano-Bond / Blunell-Bond method with all the variables treated as exogenous. N – number of observations. AB(1) and AB(2) – Arellano-Bond test for serial correlation of first and second order. Sargan – Sargan/Hansen test of overidentifying restrictions.

Source: own estimates.

We verify the stability of the temporal pass-through effects of the minimum wage and allow it to vary in sub-periods. In order to examine the temporal evolution of inflation, we divide the sample into two sub-samples: 2003–2012 and 2013–2020. The former exhibits an average inflation rate of 2.8%, while the latter has a much lower average rate of 1.1%.

The results of the model for the two sub-periods (Table 7) show that for both overall inflation and food inflation, the minimum wage was statistically significant and higher in the first sub-period (2003–2012). This indicates that in the period of higher inflation, the minimum wage increase was an additional factor pushing up

prices. In the second sub-period (2013–2020), the increase in the price of oil and the situation on regional labor markets played a more important role. The positive sign of the parameter by the unemployment rate shows that, in this sub-period, an observed improvement in the labor market was accompanied by relatively low inflation. As interesting as these results are, they should be treated with caution, as the model is subject to some autocorrelation and overidentification problems.

Table 7

**The results of the estimation of parameters of model (1) for the whole sample of regions allowing the minimum wage parameter to vary in sub-periods (dependent variable: overall inflation and food inflation)**

	Dependent variable: overall inflation				Dependent variable: food inflation			
	2003-2012		2013-2020		2003-2012		2013-2020	
	AB	BB	AB	BB	AB	BB	AB	BB
$\pi_{i,t-1}$	0.053 (0.084)	0.058 (0.102)	0.505*** (0.037)	0.508*** (0.032)	0.004 (0.097)	0.007 (0.098)	0.367*** (0.090)	0.417*** (0.088)
$u_{i,t}$	0.010 (0.035)	0.010 (0.036)	0.063** (0.031)	0.055** (0.025)	-0.019 (0.066)	-0.013 (0.064)	0.317*** (0.063)	0.283*** (0.063)
$gy_{i,t}$	0.015 (0.011)	0.014 (0.011)	-0.019 (0.032)	-0.019 (0.033)	-0.030 (0.029)	-0.031 (0.030)	-0.003 (0.050)	-0.004 (0.051)
$WREL_{i,t}$	0.059** (0.028)	0.059** (0.029)	0.020 (0.022)	0.019 (0.023)	0.213*** (0.049)	0.218*** (0.051)	0.117* (0.060)	0.125** (0.060)
$gbrent_{i,t}$	0.012*** (0.003)	0.012*** (0.003)	0.048*** (0.002)	0.048*** (0.002)	0.026*** (0.003)	0.026*** (0.003)	0.048*** (0.008)	0.043*** (0.008)
<i>constant</i>	3.041*** (0.625)	3.021*** (0.678)	0.869*** (0.264)	0.944*** (0.223)	3.562*** (1.188)	3.458*** (1.161)	-1.538*** (0.432)	-1.490*** (0.441)
N	112	128	112	128	112	128	112	128
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AB(1)	-2.888 (0.004)	-2.800 (0.005)	-2.935 (0.003)	-2.929 (0.003)	-3.292 (0.001)	-3.320 (0.001)	-2.803 (0.005)	-2.900 (0.004)
AB(2)	-2.090 (0.037)	-2.016 (0.044)	0.263 (0.792)	0.253 (0.800)	-0.028 (0.978)	-0.004 (0.997)	0.548 (0.584)	0.660 (0.509)
Sargan	12.715 (0.470)	12.900 (0.912)	27.288 (0.038)	28.336 (0.246)	8.602 (0.802)	9.027 (0.989)	49.679 (0.001)	40.148 (0.021)
Instruments	25	33	28	36	25	33	28	36

AB / BB – Arellano-Bond / Blunell-Bond method with all the variables treated as exogenous. N – number of observations. AB(1) and AB(2) – Arellano-Bond test for serial correlation of first and second order. Sargan – Sargan/Hansen test of overidentifying restrictions.

Source: own estimates.

In the final step, the stability of the pass-through effect of the minimum wage on inflation across regions is examined. The sample is divided into a group of

regions with average low unemployment and another with average high unemployment in order to see whether the inflationary pressure from the minimum wage is higher in the first group. We calculated the average unemployment rates for every region, and assigned the eight regions with the lowest average unemployment to the low-unemployment group and the other eight to the high-unemployment group. The results (see Table 8) show that, for both overall inflation and food inflation, the parameter by the minimum wage variable is statistically higher in low unemployment regions. Interestingly, the pass-through effect of increases in the price of oil is also statistically higher in low unemployment regions.

Table 8

**The results of the estimation of parameters of model (1) for the regions with low and high average unemployment rates (dependent variable: overall inflation and food inflation)**

	Dependent variable: overall inflation				Dependent variable: food inflation			
	Low UR		High UR		Low UR		High UR	
	AB	BB	AB	BB	AB	BB	AB	BB
$\pi_{i,t-1}$	0.055 (0.059)	0.073 (0.045)	0.432*** (0.091)	0.439*** (0.089)	-0.119 (0.073)	-0.132* (0.073)	0.110 (0.085)	0.113 (0.080)
$u_{i,t}$	0.011 (0.046)	0.008 (0.049)	0.021 (0.038)	0.037 (0.027)	-0.054 (0.081)	-0.038 (0.082)	-0.019 (0.031)	-0.041 (0.031)
$gy_{i,t}$	0.007 (0.014)	0.008 (0.015)	0.014 (0.014)	0.011 (0.015)	-0.049* (0.026)	-0.050* (0.026)	0.025 (0.029)	0.029 (0.028)
$WREL_{i,t}$	0.065*** (0.023)	0.066*** (0.022)	0.041 (0.046)	0.035 (0.047)	0.141*** (0.043)	0.146*** (0.046)	0.097 (0.061)	0.088 (0.063)
$gbrent_{i,t}$	0.031*** (0.006)	0.031*** (0.006)	0.015** (0.006)	0.013** (0.005)	0.062*** (0.010)	0.061*** (0.010)	0.033*** (0.005)	0.035*** (0.004)
<i>constant</i>	0.313 (0.596)	0.309 (0.606)	-0.468 (0.670)	-0.692 (0.564)	1.418 (0.963)	1.266 (0.962)	0.245 (0.248)	0.519** (0.243)
N	120	128	120	128	120	128	120	128
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AB(1)	-2.084 (0.037)	-2.223 (0.026)	-2.781 (0.005)	-2.745 (0.006)	-2.515 (0.012)	-2.512 (0.012)	-2.680 (0.007)	-2.673 (0.008)
AB(2)	-1.785 (0.074)	-1.734 (0.083)	-0.063 (0.949)	-0.077 (0.939)	1.300 (0.194)	1.241 (0.214)	-0.888 (0.374)	-0.908 (0.364)
Sargan	39.244 (0.097)	39.490 (0.704)	23.944 (0.737)	26.015 (0.990)	21.414 (0.844)	22.598 (0.998)	39.581 (0.091)	42.976 (0.558)
Instruments	49	65	49	65	49	65	49	65

N – number of observations. AB/BB – Arellano-Bond/Blunell-Bond method with all the variables treated as exogenous. AB(1) and AB(2) – Arellano-Bond test for serial correlation of first and second order. Sargan – Sargan/Hansen test of overidentifying restrictions.

Source: own estimates.



To verify these results more thoroughly, we divided the sample into low-wage and high-wage regions. We calculated the average wages for every region and divided the sample into a low-wage group containing the eight regions with the lowest average wages and a high-wage group containing the other eight regions. Table 9 shows the results for both when overall inflation and food inflation is the dependent variable. The minimum wage is statistically significant in the high-wage group and is higher than it is in the low-wage regions for every specification. The pass-through effect of the minimum wage is therefore higher in regions with strong labor markets and higher wages.

Table 9

**The results of the estimation of parameters of model (1) for the regions with low and high average wages (dependent variable: overall inflation and food inflation)**

	Dependent variable: overall inflation				Dependent variable: food inflation			
	Low wages		High wages		Low wages		High wages	
	AB	BB	AB	BB	AB	BB	AB	BB
$\pi_{i,t-1}$	0.266**	0.308**	0.186**	0.207**	0.053	0.091	0.067	0.064
	(0.132)	(0.123)	(0.092)	(0.095)	(0.066)	(0.067)	(0.084)	(0.086)
$u_{i,t}$	0.024	0.012	0.027	0.022	0.021	0.014	-0.033	-0.020
	(0.032)	(0.030)	(0.065)	(0.065)	(0.041)	(0.041)	(0.087)	(0.092)
$gy_{i,t}$	0.010	0.012	0.003	0.006	-0.075	-0.070	-0.040**	-0.040**
	(0.017)	(0.017)	(0.019)	(0.019)	(0.046)	(0.048)	(0.018)	(0.018)
$WREL_{i,t}$	0.021	0.024	0.074***	0.069***	0.071	0.075	0.113***	0.119***
	(0.044)	(0.045)	(0.024)	(0.024)	(0.065)	(0.071)	(0.038)	(0.041)
$gbrent_{i,t}$	0.023***	0.022***	0.022***	0.022***	0.038***	0.036***	0.042***	0.040***
	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)	(0.010)	(0.010)
<i>constant</i>	-0.228	-0.155	-0.029	-0.020	0.172	0.123	0.705	0.544
	(0.629)	(0.586)	(0.769)	(0.768)	(0.608)	(0.667)	(1.038)	(1.083)
N	120	128	120	128	120	128	120	128
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AB(1)	-2.482	-2.541	-2.471	-2.559	-2.621	-2.635	-2.542	-2.534
	(0.013)	(0.011)	(0.013)	(0.011)	(0.009)	(0.008)	(0.011)	(0.011)
AB(2)	-0.260	-0.162	-1.321	-1.364	-1.265	-1.0137	0.004	-0.021
	(0.794)	(0.872)	(0.187)	(0.173)	(0.206)	(0.311)	(0.997)	(0.983)
Sargan	29.767	29.611	42.660	48.631	25.123	27.326	22.768	23.718
	(0.426)	(0.963)	(0.049)	(0.329)	(0.672)	(0.983)	(0.787)	(0.996)
Instruments	49	65	49	65	49	65	49	65

N – number of observations. AB/BB – Arellano-Bond/Blunell-Bond method with all the variables treated as exogenous. AB(1) and AB(2) – Arellano-Bond test for serial correlation of first and second order. Sargan – Sargan/Hansen test of overidentifying restrictions.

Source: own estimates.

## 6. Conclusions

This study is part of a research stream that analyzes the impact of minimum wage increases on inflation. Minimum wages can be an element of a policy to overcome poverty and reduce wage inequalities. Higher minimum wages, however, inevitably increase production costs. These can be absorbed by dismissing workers and/or accepting lower mark-ups and consequently reduced profits. Alternatively or concurrently, they can be completely or partly passed on to consumers by raising prices. Even if the minimum wage raises prices without causing a reduction in employment, it might hurt rather than aid the poor, who suffer disproportionately from inflation, especially with respect to goods that have a low price elasticity of demand, e.g. food.

We analyzed the pass-through effect of the minimum wage on inflation in 16 regional labor markets in Poland in 2003–2020. The results demonstrate that this effect is statistically significant and positive. Increases in the minimum to average wage ratio in the analyzed period positively contributed to higher inflation. Moreover, the minimum wage pass-through effects were higher in the case of food inflation. This is in line with economic theory and confirms previous empirical findings.

The results show that the minimum wage effects differ both temporally and across regions. Minimum wage increases are more significant during times of high inflation than in low-inflation periods. The minimum wage also exerts greater inflationary pressure in regions with strong labor markets and relatively high wages. These are mostly regions with big cities (Mazovia, Silesia, Pomerania, Lesser Poland, Greater Poland) where there is more competition among employers. The results show that companies in these regions can pass on more of their increased labor costs to consumers.

The findings of this study are of particular importance for the labor market and regional policy. They show that even if minimum wage increases do not lead to large disemployment effects, they may generate additional inflationary pressure, especially during economic booms and in regions with low unemployment.

These findings are especially important in view of the high inflation rate recently observed in Poland and the minimum wage increases planned for the coming years. The results show that minimum wage increases may well cause further inflationary pressure, especially on goods and services with a low elasticity of demand (e.g. food). For this reason, it is recommended that minimum wage policy be closely monitored.

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## DOES THE MINIMUM WAGE AFFECT INFLATION?

### Abstract

This study examines the relationship between minimum wage increases and the inflation rate. Data from 16 Polish regional labor markets in 2003-2020 are used to analyze the pass-through effect of the minimum wage on inflation. The New Keynesian model, supported by the Minimum Wage Augmented Phillips Curve approach, and dynamic panel data methods, are utilized.

The results show that the minimum wage effect on inflation is statistically significant and positive and is higher when food inflation is the dependent variable. Minimum wage effects vary temporally and across regions. Minimum wage increases are more significant during times of high inflation than in low-inflation periods. As for regional differences, inflationary pressure is greater in regions with strong labor markets and relatively high wages, i.e. regions where companies can pass on more of their increased labor costs to consumers.

These findings are important for both the labor market and regional policy, especially given the high inflation rate recently observed in Poland and the minimum wage increases planned over the coming years. They show that even if minimum wage increases do not lead to a reduction in employment, they may generate additional inflationary pressure, especially during economic booms and in regions with low unemployment.

**Keywords:** Poland, regional labor markets, minimum wage, inflation, pass-through effect.

**JEL:** E31, J31, R23

## CZY WYNAGRODZENIE MINIMALNE ODDZIAŁUJE NA INFLACJĘ?

### Streszczenie

Celem artykułu jest zbadanie wpływu zmian płacy minimalnej na stopę inflacji. Analizy oparte są na danych dotyczących 16 regionalnych rynków pracy w Polsce, badany okres to lata 2003–2020. Do badania wykorzystano koncepcję regionalnych krzywych Phillipsa rozszerzonych o płacę minimalną. Analizy empiryczne przeprowadzone były z wykorzystaniem dynamicznych modeli panelowych.

Wyniki badania wskazują na istotny statystycznie i dodatni wpływ wzrostu płacy minimalnej na stopę inflacji w Polsce. Efekt ten jest jeszcze silniejszy, gdy zmienną objaśnianą są zmiany cen żywności. Wpływ płacy minimalnej na zmiany poziomu cen różni się zarówno w czasie, jak i w przekroju regionów. Podwyżki płacy minimalnej miały większe znaczenie w okresie wyższej inflacji niż w okresach niskiej inflacji. Efekty płacy minimalnej różnią się także w zależności od regionu; presja inflacyjna była wyższa w regionach o dobrej sytuacji na rynku pracy i relatywnie wysokich płacach. Oznacza to, że w tych regionach firmy w większym stopniu przerzucają wyższe koszty pracy na konsumentów.

Wyniki naszych badań są ważne z punktu widzenia polityki rynku pracy, jak i polityki regionalnej, w szczególności biorąc pod uwagę obserwowaną w ostatnim okresie wysoką stopę inflacji i planowane dalsze podwyżki płacy minimalnej w Polsce. Pokazują one, że nawet jeśli podwyżki płacy minimalnej nie prowadzą do dużych efektów bezrobocia, mogą generować dodatkową presję inflacyjną, zwłaszcza w okresach boomu gospodarczego i w regionach o napiętej sytuacji na rynkach pracy.

**Słowa kluczowe:** Polska, inflacja, wynagrodzenie minimalne, wpływ płacy minimalnej, regionalne rynki pracy.

**JEL:** E31, J31, R23

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