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SELECTED ISSUES

July 2015

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June 22, 2015

Approved By
European Department

Prepared by Lone Christiansen, Christian Ebeke, Krzysztof Krogulski, and Robert Sierhej.

CONTENTS

FORECASTING INFLATION IN POLAND[1]

Inflation in Poland has stayed below the lower bound of the target band for about two years with external shocks adding to downward pressure during 2014. Alongside, inflation developments have been increasingly disjoint from the gradual narrowing of the output gap, while declining inflation expectations suggest that indirect and second-round effects from low inflation may be taking hold. Forecasting inflation in the context of persistent low inflation requires a set of complementary analytical tools. To help inform monetary policy advice, we explore the drivers of inflation and forecast inflation using several different models, allowing also for indirect and second-round effects. Under a no-policy-change scenario, the models point to a protracted period of low inflation, despite continued growth momentum.

A. Stylized Facts

1. Inflation in Poland has declined markedly since mid-2012 despite monetary easing. After running well above the 2.5 percent target,[2] year-on-year inflation declined rapidly from 4.3 percent in June 2012 to 0.2 percent one year later as growth weakened. Despite a substantial monetary easing cycle, which entailed a decline in the main policy interest rate from 4.75 percent at end-October 2012 to 2.5 percent in July 2013, inflation failed to return to target and fell into deflationary territory in July 2014. Since then, disinflation has continued, with year-on-year inflation reaching a historic low of -1.6 percent in February 2015 before moderating in March and April. Two additional policy interest rate cuts were implemented (50 basis points in October last year and again in March this year).

2. Low inflation has been prevalent across all major components of inflation. Contributing to the slowdown in headline inflation was not only subdued food and energy price inflation (as well as disappearing base effects[3] in July 2014) but also weakening core inflation. While the primary measure of core inflation (headline inflation, excluding food and energy) declined less rapidly than headline inflation, it nonetheless fell to close to zero toward the end of last year (Figure 1).

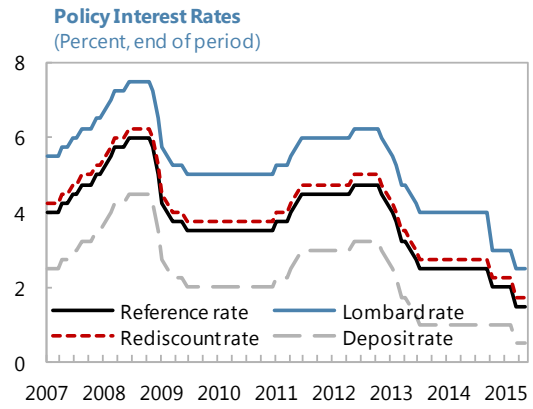
[1] Prepared by Lone Christiansen and Christian Ebeke. The econometric analysis in this chapter is based on information available as of March 30, 2015.

[2] Since the beginning of 2004, the monetary policy guidelines have consisted of a continuous inflation target of 2.5 percent with a permissible fluctuation band of ±1 percentage point.

[3] Various tariff changes in July 2013 led to a net one-off increase in inflation. Hence, the disappearance of the base effect in July 2014 resulted in a discrete decline in year-on-year inflation.

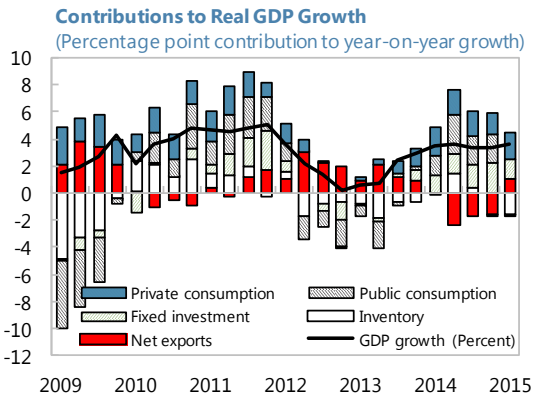
Figure 1. Recent Inflation Developments, 2004–15

The 2013 easing of monetary policy…



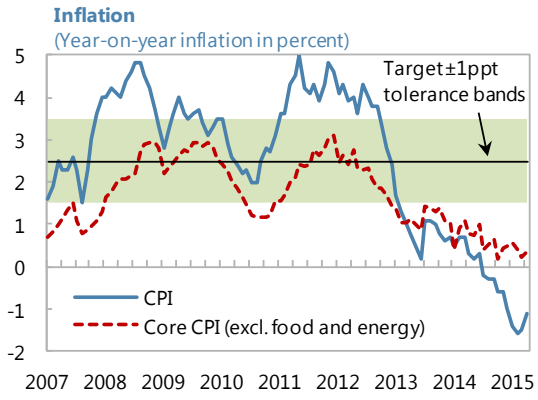
Sources: Haver Analytics, Narodowy Bank Polski (NBP), and IMF staff calculations.

…provided support for the recovery.



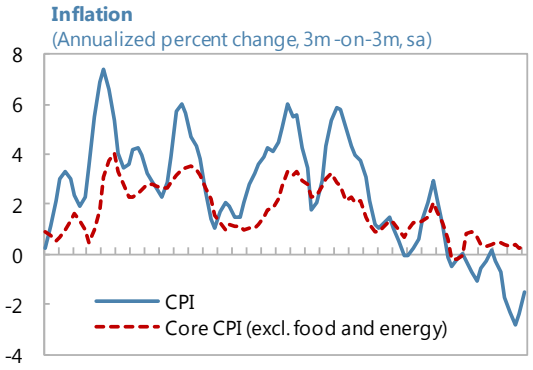
Sources: Statistics Poland and IMF staff calculations.

Yet, inflation has continued to diverge from the target…



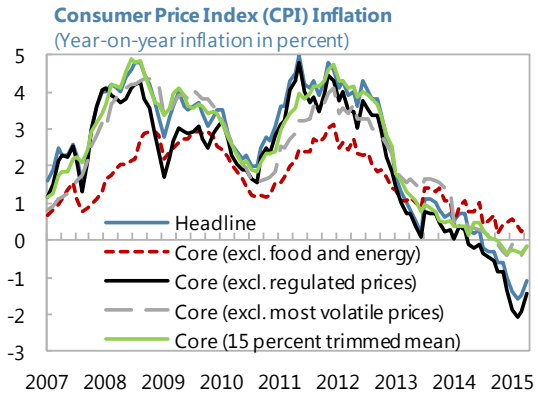
Sources: Haver Analytics, NBP, Statistics Poland, and IMF staff calculations.

…and inflationary pressures remain weak.



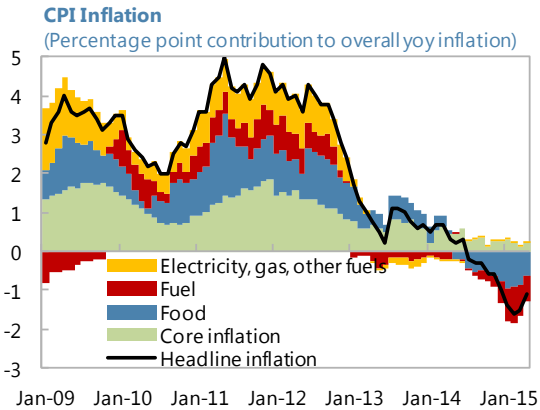
Sources: Haver Analytics, NBP, Statistics Poland, and IMF staff calculations.

While core inflation is also subdued,…



Sources: Haver Analytics, NBP, Statistics Poland, and IMF staff calculations.

…it remains the primary support for headline inflation.



Sources: NBP, Statistics Poland, and IMF staff calculations.

3. While economic growth strengthened, inflation remained low. As the monetary easing translated into a pick-up in economic activity,[4] real GDP growth strengthened. Quarter-on-quarter (seasonally adjusted) growth picked up in the second quarter of 2013, marking a start of recovery. As a result, the negative output gap started to narrow. In 2014, growth reached 3.4 percent on the back of robust domestic demand growth, while external demand remained subdued. The strong growth, combined with continued disinflation, highlights the challenge in projecting inflation over the monetary policy horizon.

4. In this chapter, we employ a suite of models to determine the main drivers of inflation and provide a range of inflation forecasts to assess the likelihood of protracted low inflation. First, we consider the main factors underlying recent inflation developments and assess the importance of first-round indirect[5] (working through input-output linkages) and second-round (working through expectations) effects of external shocks for headline inflation. Then, using a variety of models, we provide possible forecast paths for inflation. This should help inform the likelihood of inflation returning to the target band in the near term in the absence of further monetary policy action.

B. Drivers of Recent Inflation Developments

5. The historically tight link between headline CPI and the output gap has weakened. Allowing for a transmission lag of two quarters, year-on-year headline inflation has until recently closely followed output gap developments (Figure 2).[6] This is also evident from a quarterly regression of headline CPI on the 2-quarter lagged output gap, using data since the introduction of the 2.5 percent inflation target in 2004. However, since late-2013, inflation has started to diverge from the path implied by the output gap. This suggests that other factors than the degree of domestic slack are currently important for understanding inflation dynamics. Hence, a traditional model that relies only on the output gap for projecting inflation is becoming less reliable and need to be complemented with more elaborate models.

6. The output gap-inflation link is also weakening for core inflation. A regression of core inflation on the two-quarter lagged output gap suggests core inflation dynamics have until recently been better anchored to real sector activity than headline inflation. While this simple relationship cannot fully capture the magnitude of all past fluctuations in inflation, it has often fared well in fitting the direction of change. However, core inflation has also failed to pick up recently, despite the narrowing output gap and accelerating domestic demand and wages.

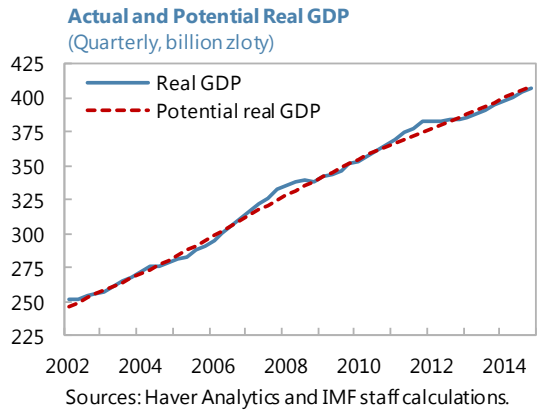
[4] Demchuk et al. (2012) estimate that the maximum response of annual GDP growth following a rise in short-term interest rates, maintained for four quarters, occurs 4 quarters after the rate change. The maximum response of inflation occurs after six quarters.

[5] We use the terms "first-round indirect effect" and "indirect effect" interchangeably throughout this chapter.

[6] Please see Appendix I for methodological details on the quarterly output gap series.

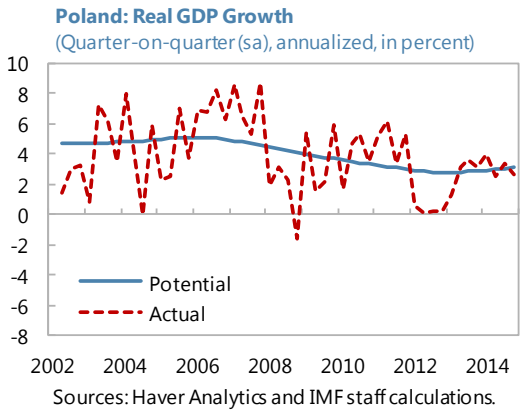
Figure 2. Potential Output and Inflation, 2004–14

Potential GDP has held up well,...



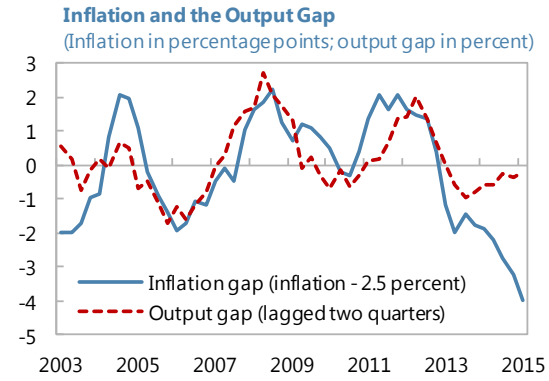
Sources: Haver Analytics and IMF staff calculations.

...though potential growth has weakened.



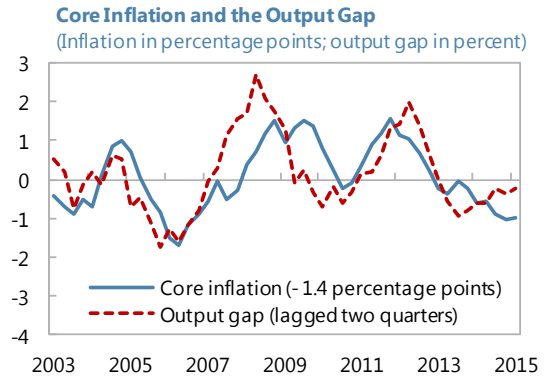
Sources: Haver Analytics and IMF staff calculations.

Inflation used to follow closely the lagged output gap...



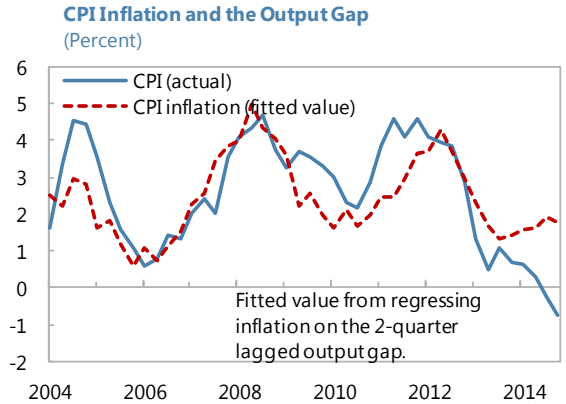
Sources: Haver Analytics and IMF staff calculations.

...as did also core inflation.



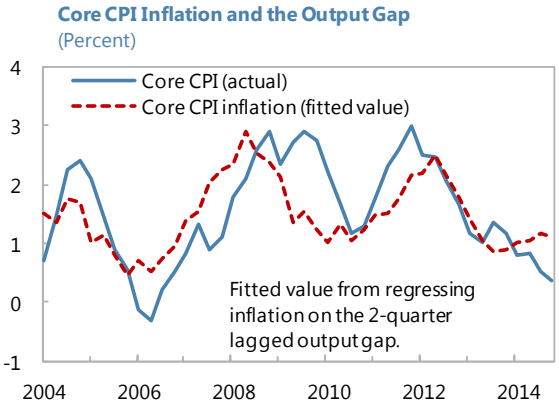
Sources: Haver Analytics, NBP, and IMF staff calculations.

Just as headline inflation is now diverging from its guide,...



Sources: Haver Analytics, Statistics Poland, and IMF staff calculations.

...divergence has begun also for core inflation.



Sources: Haver Analytics, Statistics Poland, and IMF staff calculations.

7. Weak core inflation may indicate economic slack or increasing prevalence of indirect and second-round effects. On the one hand, weak core inflation may indicate that the output gap is currently larger than what some measures suggest.[7] However, various publicly available output gap estimates point to a narrowing gap, which also appears consistent with the rapid pace of unemployment reduction and robust nominal wage growth. On the other hand, the protracted nature of the weak core inflation implies that the dynamics are not solely explained by one-off factors. Subdued core inflation amid falling international commodity prices and accelerating domestic demand may indeed imply the presence of first-round indirect and second-round effects on inflation.

8. Indirect and second-round effects can occur on the back of a number of factors, exogenous to Polish economic growth (Figure 3).

- **Weak food price inflation.** Weak food price inflation materialized on the back of subdued world food price inflation, an unseasonably mild 2013–14 winter in Poland, and the Russian ban on imports from Poland (and other European Union (EU) countries) for a number of food and vegetable items.

- **Weak energy price inflation.** Subdued energy price inflation has been a drag on headline CPI during 2013–14. In addition, tax changes (including a reduction in electricity tariffs in July 2013 and January 2014) and a decline in communication prices further reduced year-on-year inflation. The sharp drop in world oil prices in late-2014 exerted additional strong downward pressure.

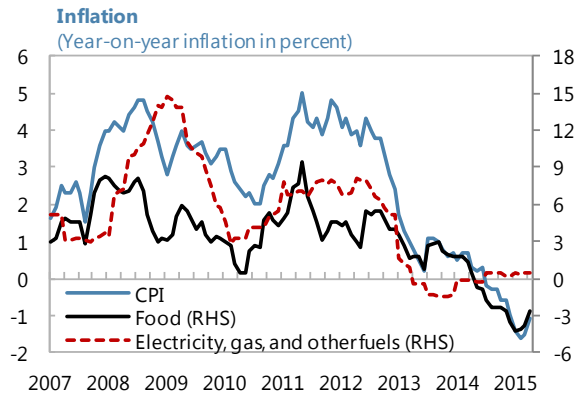
- **Weak imported inflation.** Spillovers from low inflation in the euro area have also been a drag on Polish inflation. Foreign value added in Polish domestic aggregate demand amounts to about 18 percent with 40 percent originating from the euro area. Hence, German and euro area inflation at -0.1 and -0.3 percent, respectively, in February 2015, against the backdrop of a relatively stable euro/zloty exchange rate, have put a drag on Polish inflation.

9. Weak producer price inflation suggests the prevalence of indirect effects. As imported inflation weakened, producer prices started to decline, while headline CPI inflation was not immediately affected. With producer prices declining sharply during 2012 and remaining subdued since then, low inflation became increasingly prevalent throughout the economy, as low producer prices fed into headline CPI. Hence, headline inflation was affected not only by the direct effect of oil prices and their presence in the consumer basket but also through indirect effects such as declining transport costs resulting from lower oil prices. The decline was also reflected in the GDP deflator, with year-on-year inflation in the GDP deflator falling below zero at the end of last year.

[7] The revision in potential output across a number of countries following the onset of the 2008–09 global financial crisis points to the inherent uncertainty associated with this measure.

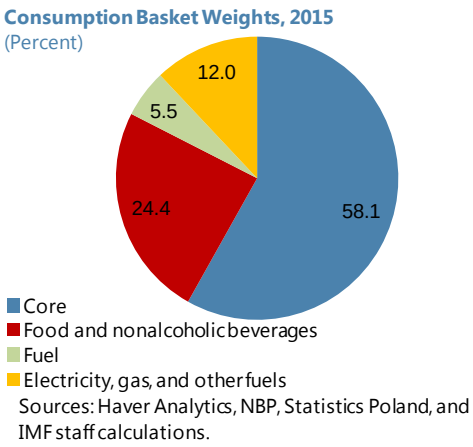
Figure 3. Drivers of Recent Inflation Developments, 2004–15

Declining food prices and weak energy price inflation,...



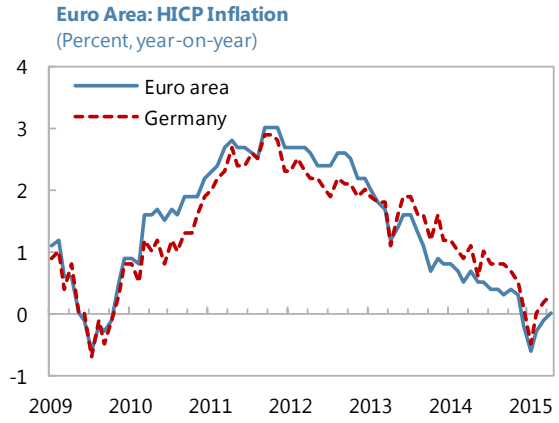
Sources: Haver Analytics, Statistics Poland, and IMF staff calculations.

...are weighing on headline inflation.



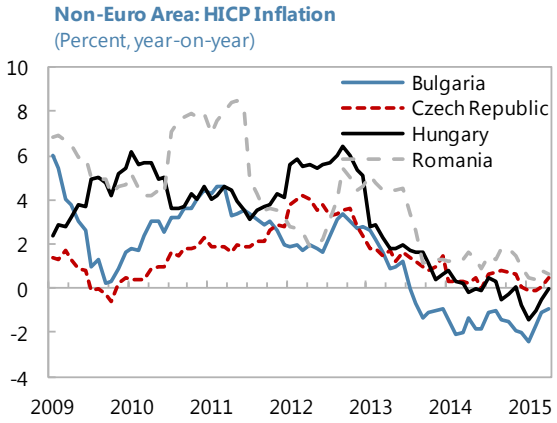
Sources: Haver Analytics, NBP, Statistics Poland, and IMF staff calculations.

Imported low inflation from the euro area...



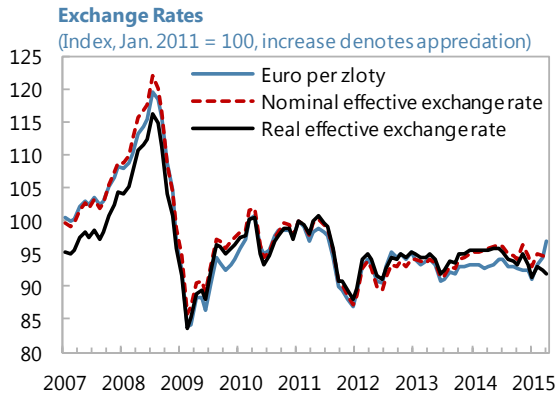
Sources: Eurostat, Haver Analytics, and IMF staff calculations.

...and other European emerging markets contributed...



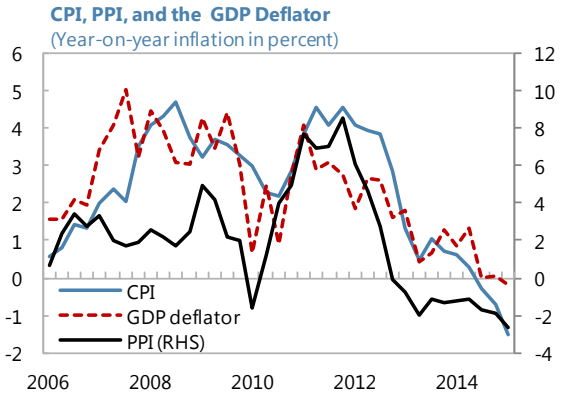
Sources: Eurostat, Haver Analytics, and IMF staff calculations.

...to low Polish inflation amidst a stable exchange rate.



Sources: Haver Analytics, INS, NBP, and IMF staff calculations.

Low inflation is now prevalent throughout the economy.

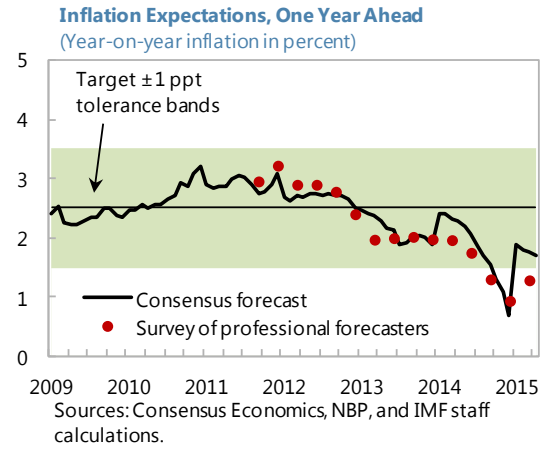


Sources: Eurostat, Haver Analytics, Statistics Poland, and IMF staff calculations.

10. In addition, declining inflation expectations indicate that second-round effects may be materializing. Consensus forecasts for the following year have dropped significantly. Similarly, the 8-quarter ahead inflation forecast from the Narodowy Bank Polski (NBP) survey of professional forecasters suggests medium-term inflation expectations are also drifting downward (Figure 4). Hence, low inflation is becoming increasingly entrenched in expectations, highlighting concerns about second-round effects in inflation dynamics. Nonetheless, nominal wage growth continues to hold up well at around 3 percent year-on-year.

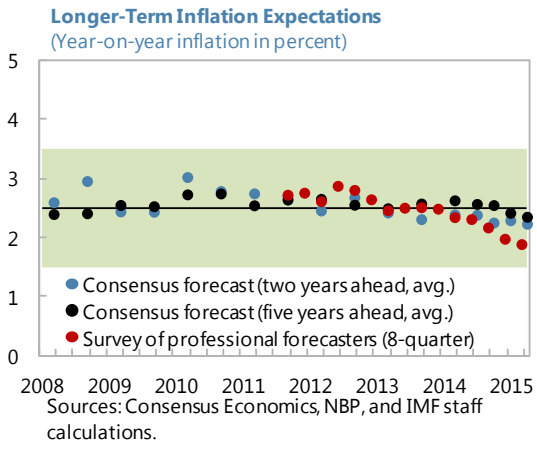
Figure 4. Inflation and Interest Rate Expectations and Inflationary Pressure, 2006–15

One-year ahead inflation expectations are coming down…



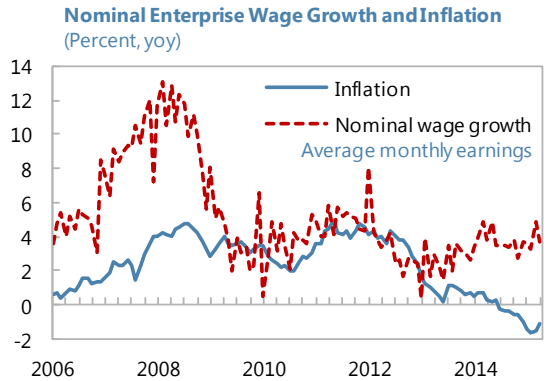
Sources: Consensus Economics, NBP, and IMF staff calculations.

…and two-year ahead expectations are also starting to slide.



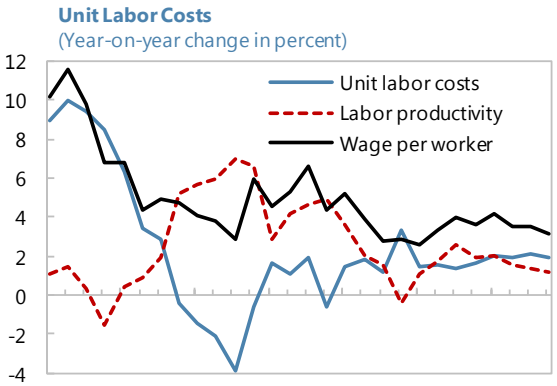
Sources: Consensus Economics, NBP, and IMF staff calculations.

While wage growth has stabilized recently…



Sources: Haver Analytics, Statistics Poland, and IMF staff calculations.

…it remains above labor productivity growth.



Sources: Statistics Poland and IMF staff calculations.

Quantifying indirect and second-round effects

11. Indirect and second-round effects translate shocks into core inflation and inflation expectations. While a transitory supply shock affects headline inflation, in the absence of indirect and second-round effects, it may not necessarily alter core inflation, which is mainly driven by

domestic demand pressures. However, supply shocks can feed into core inflation through its impact on subcomponents of CPI and on inflation expectations. For example, as transport costs drop following a decline in oil prices, services inflation may eventually decline as well. In turn, this exerts downward pressure on core inflation. And as some other components of the CPI affect each other (through input-output type linkages), expectations can adjust and create second-round effects on inflation.

12. Determining the significance of second-round effects is important for policy decisions. Assessing the magnitude and persistence of second-round effects is instrumental in understanding the extent to which current food and energy supply shocks feed into core inflation and become entrenched in inflation expectations. This is particularly important for policy makers who should aim to minimize unanchoring of inflation expectations and the associated second-round effects to the largest extent possible. If models do not account for second-round effects, the policy response needed to contain these effects may be underestimated. While Section C below explores a number of different models for forecasting inflation, we start by quantifying the combined indirect and second-round effects. As a complement to this analysis, the Cross-Country Selected Issues Paper (IMF, 2015) examines the causes and drivers of low inflation in the Czech Republic, Poland, Sweden, and Switzerland. It disentangles the impact of external shocks into direct first-round, indirect first-round, and second-round effects, highlighting the importance of the latter two and associated policy considerations.

Estimating indirect and second-round effects in a disaggregate model

13. We estimate a disaggregate model that allows to decompose shocks to inflation into an inertial component and a factor capturing indirect and second-round effects (Leon, 2012).[8] This method involves solving a system of equations to provide a path for year-on-year inflation, taking into account indirect and second-round effects through the various components of inflation and allowing for exchange rate pass-through. The system can be described as follows:

- *Producer price index* (*PPI) equation:* Inflation in the PPI at period *t* is modeled as a function of exogenous macro and external variables:

$$\pi_t^{PPI} = \alpha^{PPI} + \beta^{PPI}\pi_{t-1}^{PPI} + \boldsymbol{x}^{\boldsymbol{PPI}'}\boldsymbol{Z_t} + \varepsilon_t^{PPI}, \qquad t = 1, 2, \ldots, T$$

  Here, Z_t is a vector of variables capturing macro factors, such as the nominal exchange rate vis-à-vis the euro (to account for the pass-through into producer prices), world oil and coal price inflation, labor market dynamics (proxied by the monthly unemployment rate from the labor force survey), and inflation in the euro area to take into account production linkages in supply chain networks with core European countries such as Germany.

[8] We would like to thank Jorge Leon for his guidance in the implementation of the disaggregate inflation model.

- *Disaggregate equations:* Inflation in each of the 12 components (i) of headline CPI (see Appendix II) in period t are expressed as functions of their own lags, lags of other components of headline CPI (which captures indirect and second-round effects), and the PPI:

$$\pi_t^i = \alpha^i + \beta^i \pi_{t-1}^i + \sum_{i \neq j}^{12} \sum_{k=0}^{L} \gamma_k^{ij} \pi_{t-k}^i + \delta^i \pi_{t-m}^{PPI} + \varepsilon_t^i, \qquad t = 1, 2, \ldots, T$$

  To allow for sufficient degrees of freedom, we reduce each equation by assessing which variables and lag lengths are most informative in each equation.

- *CPI equation:* The headline CPI equation aggregates the CPI components using weights as they appear in the consumption basket:

$$\pi_t = \sum \omega^i \pi_t^i$$

- *Solving the system:* Using data starting in January 2010, we solve the system using Broyden's Method (Broyden, 1965) (see Appendix II for further details and the full set of results). Estimating the model over this period provided a good fit of the model, while still allowing for substantial in-sample fluctuations in inflation.

14. The disaggregate model has a number of advantages. First, it is particularly suitable to examine the determinants of inflation during periods of low inflation as the granularity provided by disaggregate data allows to understand the multi-sectoral linkages, which explain the low inflation environment. That is, the source of forecast variation does not depend only on aggregate macro-economic data but also on the information contained at the disaggregate level. Second, the model allows to estimate the magnitude of combined indirect and second-round effects as measured through (Granger) causality and interaction amongst components forming the CPI. Third, the framework allows to build various scenarios, including shocks to specific macroeconomic variables or idiosyncratic shocks to the CPI components. Finally, the labor market is captured by including the unemployment rate in the PPI equation. As evidenced by the declining unemployment rate and relatively robust wage growth, labor market dynamics do not currently point to significant second-round effects. Nonetheless, weak inflation expectations could gradually result in lower wages as these get renegotiated.

Assessing second-round effects

15. We identify combined indirect and second-round effects by simulating exogenous shocks in the model. We begin the analysis of indirect and second-round effects by assuming a transitory (and alternatively a more protracted) exogenous shock to PPI inflation. Two modes of interaction across CPI components are then explored:

- One that allows for feedback effects between groups of the CPI (i.e., uses the model with the full interaction—see interaction term in the disaggregate equation above); and
- One that captures inertia by not allowing for feedbacks between components (i.e., assuming the interaction term is zero).

Indirect and second-round effects are then computed as the difference between the effects of the shock on overall CPI inflation derived from the two models.

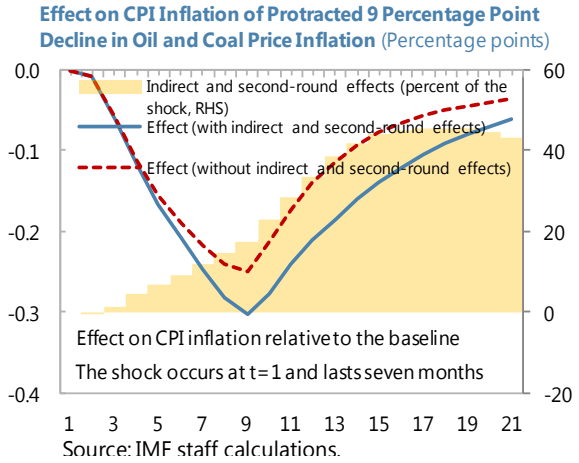
16. The results suggest that combined indirect and second-round effects are important in Poland. We estimate the effects of declines in energy commodities prices (oil and coal prices) and the effects of disinflation in the euro area. The energy commodity price shock mimics the recent sharp decline in international oil prices. That is, for the oil and coal price shock, we assume a protracted 9 percentage point drop in year-on-year commodity price inflation every month for 7 months as observed between June 2014 and February 2015. For the euro area inflation shock, we assume a decline in the monthly year-on-year euro area inflation rate by 0.1 percentage point for 18 months as observed between July 2013 and January 2015. The results suggest strong and persistent indirect and second-round effects, which remain sizeable, exhibiting strong persistence, for more than a year following the shock. Hence, while the greatest initial impact is explained by inflation inertia, the effect through other CPI components (the indirect and second-round effect) in the consumer basket could be substantial and persistent and should not be disregarded (Figure 5). The effects are sizeable:

- The cumulative 63 percentage points decline in oil and coal price inflation over 7 months lowers headline CPI inflation by 0.3 percentage points compared to the baseline CPI inflation (the path suggested by the model absent a shock) after nine months. About 20 percent of this effect is accounted for by indirect and second-round effects. After a year and a half, indirect and second-round effects continue to affect inflation and represent more than 40 percent of the change in CPI inflation.
- The cumulative 2 percentage points decline in euro area CPI inflation over 18 months lowers headline CPI inflation by 0.15 percentage points compared to the baseline CPI inflation after about one year. At this horizon, about 25 percent of the effect is accounted for by indirect and second-round effects. Half a year later, indirect and second-round effects continue to affect inflation and represent more than 25 percent of the change in CPI inflation.

17. The results of these simulations are important to understand the sources of deflationary pressures. The simulations, aimed at replicating long-lasting shocks to commodity and trading partner inflation, show that indirect and second-round effects reach their peak in about a year. This would imply that some of the current deflationary pressures on CPI inflation are carrying over indirect and second-round effects of shocks that materialized in the past and which continue to have contemporaneous effects. The decline in oil prices observed since late-2014 is therefore likely to continue feeding deflationary pressures as indirect and second-round effects emerge with a lag and then persist.

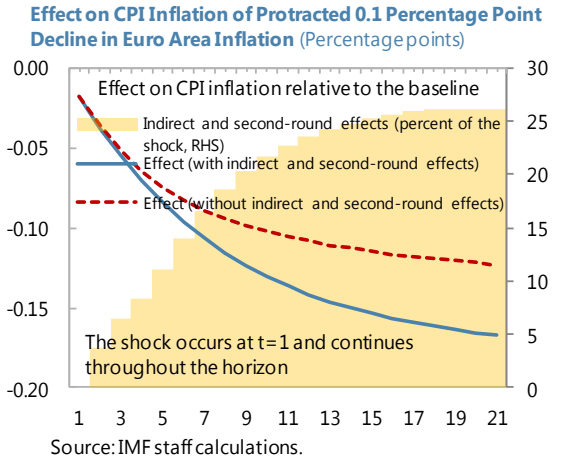
Figure 5. Disaggregate Model with Indirect and Second-Round Effects, 2010–16

Second-round effects from a decline in energy price inflation are substantial,...



Source: IMF staff calculations.

...as are those stemming from a protracted decline in euro area inflation.



Source: IMF staff calculations.

C. Forecasting Inflation

18. To assess inflation going forward, we estimate a range of different forecasting models. This section provides the details of three underlying models: (i) a Short-Term Forecasting System (STFS); (ii) an augmented Phillips curve; and (iii) the disaggregate model with indirect and second-round effects presented above. We allow for different lengths of the underlying time series for the various methods to obtain the best fit for the regressions. Specific forecast assumptions are listed in Appendix I.

Short-term forecasting system

19. The STFS model provides quarterly forecasts based on six different underlying models:

- *Autoregressive (AR)*. Fits a univariate autoregressive process of order *p* on inflation.
- *Bridge Equations (BRIDGE)*. Bridges monthly data on various indicators with quarterly inflation data, using increasing amount of information as provided by the most recent data releases.
- *Bivariate VARs (BIVAR)*. Combines, at the monthly frequency, VAR forecasts from a number of bivariate VARs with indicators for inflation together with inflation.
- *Bayesian VAR (BVAR)*. Similar to the BIVAR but extends by pooling a set of useful indicators that may exhibit dynamic interactions with inflation into a single VAR equation.
- *Dynamic Factor Model (DFM)*. Utilizes the information content of a large set of macroeconomic indicators by assuming that the co-movement of macroeconomic variables is driven by a few (unobserved) common factors.

- *Dynamic Factor Model with Targeted Predictor (DFTMTP).* More parsimonious version of DFM by using a small subset of monthly indicators ("targeted predictor") to estimate a single common factor (as opposed to *r* factors in DFM).

20. The STFS model suggests a quarterly inflation path consistent with the desk baseline (Table 1). Based on data dating back to the early 2000s, the STFS model point to seasonally adjusted quarter-on-quarter inflation of around 0.3 percent in the third quarter. While this is broadly in line with the desk baseline of 0.2 percent, the estimate is subject to substantial variation, depending on the underlying model considered. In fact, the STFS forecast for the third quarter varies from 0.1 percent quarter-on-quarter for the DFM model to 1.2 percent for the BRIDGE model.

21. The STFS model is mainly useful at the short-term horizon. The STFS model may be particularly useful for forecasts at the current-quarter horizon, before the final inflation data are available but after underlying high-frequency indicators have been released. As these models are notoriously backward looking and rely on actual data releases, forecasts at longer horizons are subject to large standard errors. Hence, researchers tend to focus only on near-term forecasts when using the STFS model. In addition, the STFS model can usefully inform about the direction of change in the forecast, hence providing a view on whether the release of new high-frequency data point to upward or downward revisions relative to the previous projection.

Table 1. STFS Model: Inflation Forecast
(Percent, quarter-on-quarter, seasonally adjusted)

	2014Q1	2014Q2	2014Q3	2014Q4	2015Q1	2015Q2
Actual	0.0	-0.3	0.0	-0.4	-0.6	
As of April 1, 2015						
AR					-0.8	-0.4
BRIDGE					1.0	1.1
BIVAR					-0.8	-0.6
BVAR					-0.8	-0.6
DFM					-0.7	0.0
DFMTP					-0.7	0.0
Current desk baseline						0.1

Source: IMF staff estimates.

Augmented Phillips curve

22. We estimate an open-economy augmented Phillips curve. Our baseline model links inflation to inflation expectations as determined by adaptive expectations, real activity, and the nominal effective exchange rate. Using monthly data from 2004, we explore various permutations of the following equation, including by allowing for forward-looking expectations (Gali and

Gertler, 1999) and controlling for imported inflation and supply shocks. This approach is similar to that used in some other recent studies such as Iossifov and Podpiera (2014) and IMF (2014):

$$\pi_t = \alpha + \beta\pi_t^E + \delta gap_t + \rho\pi_t^{EA} + \boldsymbol{x_t\theta} + \varepsilon_t, \qquad t = 1, 2, \ldots, T$$

Where

π_t = headline inflation.

π_t^E = inflation expectations. We explore results, using both forward-looking consensus forecasts as well as lagged inflation, consistent with adaptive consumer expectations.

gap_t = real activity gap. Obtained at the monthly frequency by interpolation (cubic spline) of a quarterly output gap series.

π_t^{EA} = inflation in the euro area.

$\boldsymbol{x}_t$ = vector of supply-side shocks and other leading indicators. This includes year-on-year world oil price inflation, world food price inflation (based on prices in U.S. dollars), and the nominal effective exchange rate.

23. The various models explain the majority of fluctuations in inflation. Table 2 shows the results from exploring the significance of lags and taking into account various explanatory variables including year-on-year growth in the money supply (M3) (see for example Kim and Molagoda, 2011). Overall, the models can account for around 95 percent of the variation in inflation. Lagged inflation and the output gap are highly important, and an appreciation of the nominal effective exchange rate is, as expected, associated with lower inflation.

24. The Phillips curve regressions point to inflation remaining below the target band for a protracted period (Figure 6). While the sixth model predicts inflation to reach the target by the end of 2016, the other models point to a more gradual pick-up, with several models remaining below the target band during the projection period. The models suggest that after accounting for monetary policy transmission lags from the recent policy interest rate cuts as factored into staff's baseline growth projections, inflation is not expected to reach the 2.5 percent target by end-2016. While staff's baseline projection is set to reach the lower end of the target band by end-2016, the results point to downside risks to this forecast.

Disaggregate model with indirect and second-round effects

25. The disaggregate model also points to inflation well below the target band for a protracted period (Figure 7). As an alternative forecast method, we project inflation using the disaggregate model presented in section B above. While the model is somewhat sensitive to assumptions on lags in the underlying models for CPI components, the baseline forecast from this approach points to inflation of around 1.3 percent by end-2016. This is broadly in line with results from the augmented Phillips curve presented above.

Table 2. Augmented Phillips Curve: Coefficient Estimates

(Dependent variable: CPI inflation, year-on-year in percent)

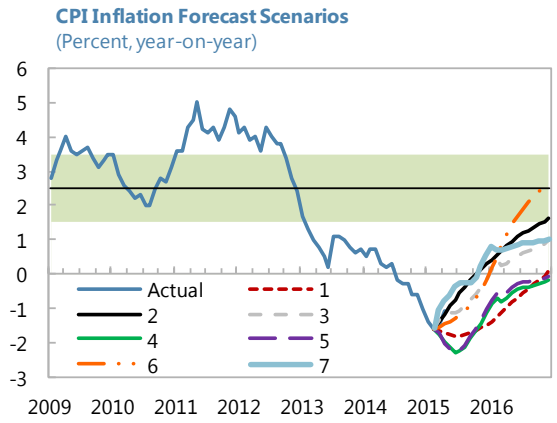
	1	2	3	4	5	6	7
Constant	1.3205	0.8131	1.2037	-1.0441	-1.0422	2.6043	-1.9214
	(0.0115)	(0.0683)	(0.0102)	(0.0000)	(0.0000)	(0.0003)	(0.0000)
CPI inflation (-1)	0.9427	1.1281	0.9411	0.7696	0.7536	1.1350	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	
CPI inflation (-2)		-0.1851				-0.2006	
		(0.0466)				(0.0192)	
Inflation expectations 1-year ahead							1.5672
							(0.0000)
Inflation expectations 1-year ahead (-3)				0.5619	0.5893		
				(0.0000)	(0.0000)		
Output gap (-1)				0.3661			
				(0.0105)			
Output gap (-2)		0.9930	1.0075	-0.3140	0.6671		
		(0.0025)	(0.0004)	(0.0318)	(0.0056)		
Output gap (-3)		-1.5498	-1.6923		-1.0169		
		(0.0095)	(0.0015)		(0.0219)		
Output gap (-4)		0.6933	0.8129		0.4264		
		(0.0254)	(0.0043)		(0.0701)		
Output gap (-5)	0.0819						
	(0.0809)						
Output gap (-6)							0.7651
							(0.1446)
Output gap (-7)							-2.1668
							(0.0270)
Output gap (-8)							1.9145
							(0.0003)
Unemployment gap (-3)						-0.1155	
						(0.0014)	
NEER	-0.0131					-0.0259	
	(0.0122)					(0.0003)	
NEER (-1)		-0.0072	-0.0114				
		(0.1049)	(0.0141)				
NEER appreciation							-0.0548
							(0.0000)
NEER appreciation (-1)				-0.0261	-0.0263		
				(0.0000)	(0.0000)		
World food price inflation	0.0100					0.0081	
	(0.0009)					(0.0057)	
World food price inflation (-3)			0.0223	0.0206	0.0232		
			(0.0006)	(0.0003)	(0.0000)		
World food price inflation (-4)			-0.0152	-0.0175	-0.0209		
			(0.0127)	(0.0016)	(0.0001)		
World oil price inflation	0.0004					0.0028	0.0141
	(0.8031)					(0.0761)	(0.0026)
World oil price inflation (-1)			0.0082	0.0075	0.0094		
			(0.0009)	(0.0011)	(0.0000)		
World oil price inflation (-2)			-0.0095	-0.0049	-0.0060		
			(0.0003)	(0.0359)	(0.0063)		
Euro area CPI inflation				0.1969			
				(0.0746)			
Euro area CPI inflation (-1)				-0.1739			
				(0.1025)			
M3 growth (-2)					0.0495		
					(0.0032)		
M3 growth (-3)					-0.0501		
					(0.0030)		
R-squared	0.9503	0.9532	0.9625	0.9743	0.9753	0.9553	0.8647
Adjusted R-squared	0.9484	0.9510	0.9597	0.9720	0.9729	0.9532	0.8583
Observations	134	134	134	134	134	134	134

Source: IMF staff calculations.

Note: P-values in parentheses. Data cover January 2004 through February 2015.

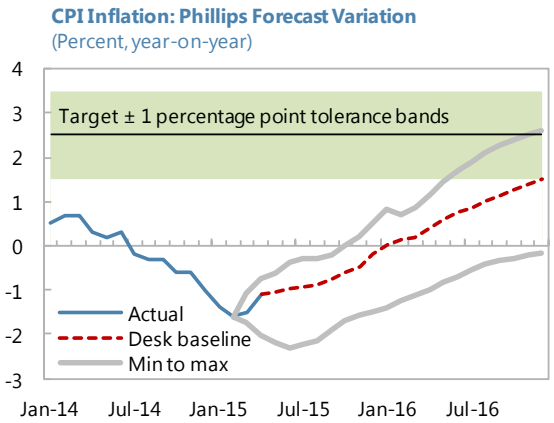
Figure 6. Augmented Phillips Curve, 2009–16

Most Phillips curve models indicate only a slow pick-up…



Sources: Haver Analytics and IMF staff calculations.

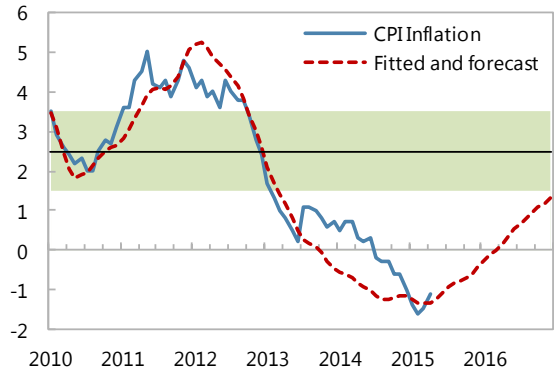
…though there is substantial forecast uncertainty.



Sources: Haver Analytics and IMF staff calculations.

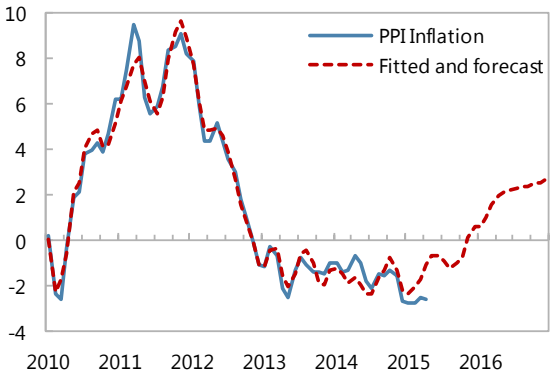
Figure 7. Disaggregate Model with Second-Round Effects, 2010–16

Results point to a gradual return toward the target band…



Sources: Haver Analytics and IMF staff calculations.

…as PPI is also expected to begin to recover in 2016.



Sources: Haver Analytics and IMF staff calculations.

D. Outlook and Risk

Assessing the inflation forecast

26. Staff's current baseline inflation forecast incorporates continued temporary deflation followed by protracted low inflation. Year-on-year deflation is expected to continue through 2015. This results from a generalized lack of inflationary pressure. With world oil prices assumed to increase only at a gradual pace, energy price inflation would remain a relatively minor contributor to positive inflation. Food price inflation is also expected to remain subdued at a worldwide level. In turn, despite robust domestic demand growth, indirect and second-round effects as well as

imported low inflation will prevent a marked pick-up in core inflation. Overall, headline inflation is therefore projected to return to the lower end of the target band only by late-2016.

Risks to the inflation outlook

27. The models suggest the baseline inflation forecast is subject primarily to downside risk (Table 3 and Figure 8). The current baseline inflation projection falls in the upper range of what the models indicate. Hence, the likelihood of further prolonged low inflation is high. Nonetheless, the 2016 year-average is broadly in line with the NBP's March projection of just below one percent (Table 4).

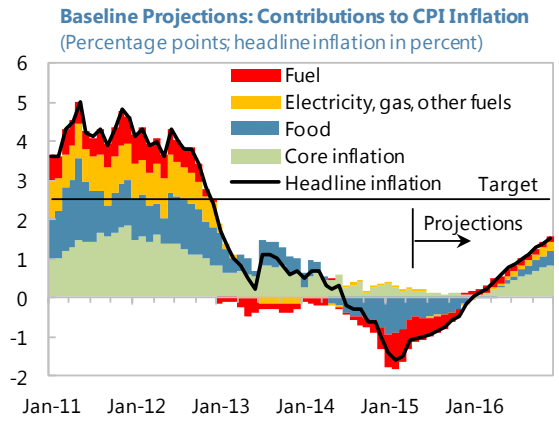
Table 3. Inflation Forecasts From Various Models
(Percent, year-on-year)

			Actual	Phillips							Disagg.	Desk baseline	NBP March 2015
				1	2	3	4	5	6	7			
	2014	July	-0.2										
		August	-0.3										
		September	-0.3										
		October	-0.6										
		November	-0.6										
		December	-1.0										
	2015	January	-1.4										
		February	-1.6										
		March	-1.5	-1.6	-1.4	-1.4	-1.7	-1.7	-1.5	-1.1	-1.3		
		April	-1.1	-1.7	-1.2	-1.2	-2.0	-2.0	-1.5	-0.8	-1.3		
		May		-1.8	-0.9	-1.1	-2.2	-2.2	-1.4	-0.6	-1.3	-1.1	
		June		-1.8	-0.7	-1.1	-2.3	-2.3	-1.3	-0.4	-1.1	-1.0	
		July		-1.8	-0.6	-1.1	-2.2	-2.2	-1.2	-0.3	-0.9	-0.9	
		August		-1.8	-0.4	-0.9	-2.1	-2.1	-1.1	-0.3	-0.8	-0.9	
		September		-1.7	-0.2	-0.8	-1.9	-1.8	-0.9	-0.2	-0.8	-0.8	
		October		-1.6	0.0	-0.6	-1.7	-1.6	-0.7	-0.1	-0.7	-0.6	
		November		-1.6	0.1	-0.4	-1.4	-1.4	-0.5	0.2	-0.6	-0.5	
		December		-1.5	0.3	-0.2	-1.1	-1.0	-0.2	0.5	-0.4	-0.2	
	2016	January		-1.4	0.4	0.1	-0.8	-0.7	0.2	0.8	-0.2	0.0	
		February		-1.2	0.6	0.4	-0.7	-0.5	0.5	0.7	-0.1	0.1	
		March		-1.1	0.7	0.2	-0.8	-0.7	0.9	0.7	0.0	0.2	
		April		-1.0	0.8	0.3	-0.7	-0.6	1.2	0.7	0.2	0.4	
		May		-0.8	1.0	0.4	-0.5	-0.4	1.4	0.8	0.4	0.6	
		June		-0.7	1.1	0.5	-0.5	-0.3	1.7	0.9	0.5	0.8	
		July		-0.6	1.2	0.6	-0.4	-0.3	1.9	0.9	0.7	0.9	
		August		-0.4	1.3	0.7	-0.4	-0.2	2.1	0.9	0.8	1.0	
		September		-0.3	1.4	0.7	-0.3	-0.2	2.3	0.9	1.0	1.1	
Forecast		October		-0.2	1.5	0.8	-0.3	-0.2	2.4	1.0	1.1	1.3	
		November		0.0	1.5	0.9	-0.2	-0.1	2.5	1.0	1.2	1.4	
		December		0.1	1.6	1.0	-0.2	0.0	2.6	1.0	1.3	1.5	
Avg.		2015		-1.7	-0.7	-1.0	-1.8	-1.8	-1.1	-0.5	-1.0	-0.9	-0.5
		2016		-0.6	1.1	0.6	-0.5	-0.3	1.6	0.9	0.6	0.8	0.9

Sources: NBP and IMF staff calculations.

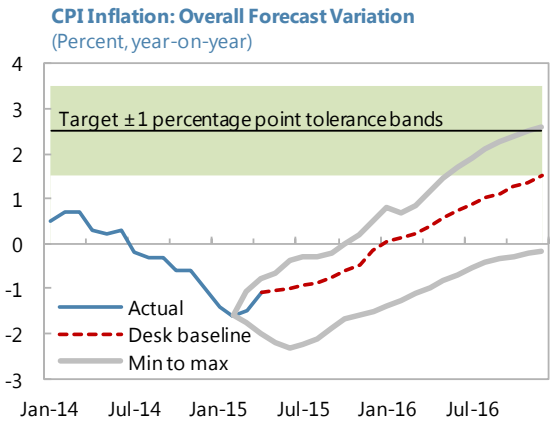
Figure 8. Baseline Forecast and Model Results, 2010–16

Core inflation is expected to support inflation,...



Sources: Haver Analytics, NBP, and IMF staff calculations.

...though substantial uncertainty remains.



Sources: Haver Analytics and IMF staff calculations.

Table 4. NBP Inflation Projections as of March 2015

(Percent, year-on-year, unless otherwise indicated)

	2014	2015	2016	2017
CPI	0.0	-0.5	0.9	1.2
Food	-0.9	-0.7	1.4	1.6
Energy	-1.0	-3.0	1.1	1.7
Core (net of food and energy)	0.6	0.4	0.6	0.9
Output gap (percent of potential)	-1.0	-0.6	-0.6	-0.3

Source: NBP, March 2015 Inflation Report.

28. The risk of continued deflation remains high, though some upside risks could materialize.

- **Sustained decline in energy prices.** Energy price inflation has historically been an important contributor to headline inflation. On the downside and considering the presence of sizable indirect and second-round effects on inflation, additional oil price declines could delay the projected pick-up in inflation. On the upside, the potential for a rapid turnaround in oil prices would help counter existing indirect and second-round effects already at work.
- **Low imported inflation.** On the downside, persistently low inflation in the euro area could continue to weigh on imported inflation. Additional downside risks stem from potential zloty appreciation in the context of abundant liquidity associated with European Central Bank (ECB) quantitative easing and sizable positive interest-rate differentials with European emerging market peers. On the upside, the ECB's monetary easing could have larger-than expected positive effects on euro area inflation, lifting imported inflation.

29. While models may be poor predictors of turning points, a near-term rapid pick-up in inflation is unlikely. While models may fit well historical observations, they often do poorly when forecasting turning points. Hence, results should be interpreted with care, considering the uncertainty related to the forecast of underlying input variables as well as general model uncertainty. In fact, history has shown that Polish inflation can quickly pick up in response to exogenous shocks. Nonetheless, considering the general low-inflation environment in Europe, a substantial near-term pick-up in inflation is considered a low probability event.

E. Conclusion

30. The empirical analysis shows strong evidence of combined indirect and second-round effects. Simulations of shocks to oil price inflation or euro area inflation reveal that a substantial portion of the decline in inflation is owing to feedback effects among the components of the CPI. These feedback effects, generated by the indirect impact of supply shocks on CPI subgroups or by affecting inflation expectations, maintain the downward pressure on prices.

31. The inflation forecasting models point to continued low inflation, with the current baseline in the upper range of the suggested paths. The current baseline projects inflation to enter the target band by end-2016, following continued near-term deflation, and to reach the 2.5 percent target during 2018. While a couple of models predict a return to the target band by end-2016, the majority of the models predict a more gradual pick-up. Hence, there are potential downside risks to the baseline path.

32. Given downside risks to the inflation forecast, monetary policy should remain accommodative. The presence of sizeable and persistent indirect and second-round effects, combined with low imported and commodity price inflation, suggests that the likelihood of a rapid return to the inflation target is low. In this environment, further downward shocks to commodity prices or unwarranted upward exchange-rate pressures could undermine the inflation objective. Policy makers should therefore stand ready to implement additional policy interest rate cuts if inflation expectations continue to decline or if interest-rate differentials continue to widen, attracting unwarranted capital inflows.

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Appendix I. Data and Forecast Assumptions

Data

The quarterly output gap is computed from the annual estimate of potential real GDP. A cubic spline is fitted to the annual potential real GDP series, inserting the annual value as the second-quarter observation. The level of the series is then adjusted such that the average difference with the original annual series is zero. The output gap is then computed, using data on actual quarterly (seasonally adjusted) real GDP. A monthly output gap series is subsequently obtained from a cubic spline of the quarterly series.

Forecast

Quarterly forecasts for world oil and food prices are from the World Economic Outlook, Global Assumptions. Monthly forecast paths are then computed consistent with the quarterly paths. Other assumptions are consistent with staff's macroeconomic framework at the time of estimation.

Appendix II. Disaggregate Model

Year-on-year CPI inflation is decomposed into 12 underlying components and their current weights in the consumption basket are recorded (Table AII.1).

Table AII.1. CPI Components and Weights in the Consumption Basket
(Percent)

Component	Weight
Headline CPI	100
Food & nonalcoholic beverages	24.4
Alcoholic beverages & tobacco	6.5
Clothing & footwear	5.4
Housing, water, electricity, gas, & other fuels	21.1
Furnishing, house equipment, & routine maintenance	4.9
Health	5.2
Transport	9.0
Communication	5.3
Recreation & culture	6.4
Education	1.0
Restaurants & hotels	5.2
Miscellaneous goods & services	5.7

Source: Statistics Poland.

Forecasting CPI

As discussed by Leon (2012), using data available from the dynamics of the components allows setting up a disaggregate model for inflation. The transmission mechanism from domestic and external macroeconomic variables into the CPI inflation is as follows: macro-economic variables enter the model via the PPI and then affect the components that form the CPI indirectly via the effect of the PPI on each component. The different components then interact with each other and headline CPI is re-constructed using the consumption basket weights for each particular group.

The model is composed of the following equations:

PPI equation:

$$\pi_t^{PPI} = \alpha^{PPI} + \beta^{PPI}\pi_{t-1}^{PPI} + \boldsymbol{x}^{\boldsymbol{PPI}'}\boldsymbol{Z_t} + \varepsilon_t^{PPI}, \qquad t = 1, 2, \ldots, T$$

where *Z* is a vector of variables capturing macro factors, such as the nominal exchange rate (to account for the pass-through into producer prices), world oil and coal price inflation, labor market

dynamics (proxied by the monthly unemployment rate from Eurostat, based on the quarterly labor force survey), and inflation in the euro area to take into account production linkages in supply chain networks with core European countries such as Germany. Results from estimating the PPI equation are shown in Table AII.2.

Disaggregate equations:
Each of the components (*i*) of CPI at period *t* can be expressed as a function of their own lags, lags of other components of the CPI (the interaction terms capture the combined indirect and second-round effects) and the PPI:

$$\pi_t^i = \alpha^i + \beta^i \pi_{t-1}^i + \sum_{i \neq j}^{12} \sum_{k=0}^{L} \gamma_k^{ij} \pi_{t-k}^i + \delta^i \pi_{t-m}^{PPI} + \varepsilon_t^i, \qquad t = 1, 2, \ldots, T; m=0, 1, \ldots M$$

To allow for sufficient degrees of freedom, we reduce each equation by assessing which variables and lag lengths are most informative. Some equations exclude intercepts whenever those are not statistically significant or exhibit unrealistically large values that may adversely affect the forecast of some components of the CPI. The full representations of the CPI group equations are shown in Table AII.2.

Headline CPI equation:
The model then adds the final equation, which aggregates the CPI groups into headline CPI using historical weights in the consumption basket:

$$\pi_t = \sum \omega^i \pi_t^i$$

Solving the system of equations:
In turn, this creates a system of 14 equations to be solved. To solve the model, we use Broyden's Method (Broyden, 1965). Broyden's method is a modification of Newton's method, which tries to decrease the calculational cost of each iteration. Hence, the method shares many of the properties of Newton's method, including the fact that it is not dependent on the ordering of the equations in the system and that it will generally converge quickly in the vicinity of a solution.

The period of analysis covers January 2010 and onwards. Data on year-on-year inflation are from the National Institute of Statistics (GUS).

Assessing indirect and second-round effects

We identify combined indirect and second-round effects by simulating exogenous shocks in the model. We begin the analysis of indirect and second-round effects by assuming a transitory (an alternatively a longer-lasting) exogenous shock to PPI inflation. Two effects of the shocks are then derived: (i) one that uses the model with interaction terms between components of CPI; and (ii) one that captures inertia by not allowing for feedbacks between components (i.e., assuming the interaction terms are zero). Combined indirect and second-round effects are then computed as the difference between the effects of the shock on overall CPI inflation derived from the two models.

Table AII.2. Coefficient Estimates from PPI and CPI Component Equations

Dependent variables →	(1) PPI	(2) G01	(3) G02	(4) G03	(5) G04	(6) G05	(7) G06	(8) G07	(9) G08	(10) G09	(11) G10	(12) G11	(13) G12
PPI inflation (-1)	0.340***	0.145***	0.0854**	0.0829**	0.105***	0.0220*	0.111**	0.378***	0.227**	0.106***	0.246***	0.0404***	0.0681***
	(0.0535)	(0.0394)	(0.0340)	(0.0394)	(0.0335)	(0.0121)	(0.0442)	(0.102)	(0.106)	(0.0392)	(0.0744)	(0.00919)	(0.0133)
Euro area inflation	1.543***												
	(0.201)												
Unemployment rate	-0.668***												
	(0.177)												
Oil price inflation (-1)	0.00785**												
	(0.00349)												
Coal price inflation (-2)	0.0413***												
	(0.00326)												
NEER (percent change)	-0.179***												
	(0.0187)												
G01(-1)		0.838***						0.342***	-0.595***			0.0292**	
		(0.0570)						(0.121)	(0.164)			(0.0110)	
G02(-1)			0.891***	-0.245***				0.981***					0.0797***
			(0.0669)	(0.0879)				(0.275)					(0.0227)
G03(-1)				0.383***	0.148***					-0.177**		-0.0201**	
				(0.0917)	(0.0521)					(0.0725)		(0.00984)	
G04(-1)					0.593***	0.0622**			0.669***		-1.271***		0.0960***
					(0.0814)	(0.0271)			(0.187)		(0.277)		(0.0246)
G05(-1)				-0.852***		0.750***				0.282**	2.588***	-0.0724**	
				(0.167)		(0.0479)				(0.138)	(0.547)	(0.0313)	
G06(-1)							0.249*					-0.0876***	
							(0.127)					(0.0230)	
G07(-1)			0.0514*		0.0579**			0.578***	0.215**	-0.101***			
			(0.0308)		(0.0246)			(0.106)	(0.0843)	(0.0304)			
G08(-1)									0.655***	-0.0645***	0.239***		
									(0.0796)	(0.0239)	(0.0445)		
G09(-1)					0.0859*				-0.362*	0.705***			
					(0.0470)				(0.200)	(0.0757)			
G010(-1)					0.0367*		0.0655*				0.611***		0.0223***
					(0.0191)		(0.0355)				(0.0735)		(0.00771)
G011(-1)			0.877***	1.229***		0.0769*						1.013***	0.821***
			(0.283)	(0.233)		(0.0410)						(0.0260)	(0.0467)
G012(-1)			-1.000***				0.445**		-1.383***				
			(0.277)				(0.172)		(0.405)				
Intercept	4.972***	0.0233	-0.835*	-3.905***	1.509***	-0.221**	0.823***	-4.639***		-0.725**	2.060***		-1.588***
	(1.531)	(0.148)	(0.479)	(0.606)	(0.332)	(0.0878)	(0.222)	(1.172)		(0.348)	(0.535)		(0.0967)
Observations	62	62	62	62	62	62	62	62	62	62	62	62	62
R-squared	0.986	0.918	0.885	0.865	0.964	0.977	0.831	0.943	0.894	0.837	0.913	0.998	0.985

Notes: Standard errors in parentheses. Stars denote significance as follows: *** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff calculations.

BALANCE SHEET EFFECTS FROM LOWFLATION[1]

Private and public sector balance sheets in Poland are generally healthy and have weathered well two years of below-target inflation. However, the recent softening of banking sector profits and public sector revenue indicates that low inflation has started to feed into income flows, albeit so far with only mild consequences for the economy. Against this backdrop and in light of still-high risks of continued very low inflation (lowflation), this chapter assesses balance sheet risks from prolonged lowflation for households, nonfinancial corporations (NFCs), banks, and the general government, taking into account interlinkages across sectors. The chapter finds that while sectoral balance sheets are generally resilient to periods of deflation, a protracted spell of lowflation could exacerbate existing vulnerabilities and in a tail risk scenario reduce household debt tolerance, put a dent in corporate and bank profits, and increase government deficit and debt. This could occur in the context of an adverse loop of lower consumption and investment, higher nonperforming loans (NPLs), lower bank lending, and lower growth. These findings underscore the importance of bringing inflation back to target in a timely manner and managing risks from lower-than-expected inflation.

A. Introduction

Balance sheets are generally healthy…

1. Sound policies have helped sustain balance sheet health. Able macroeconomic management helped avoid a boom-bust cycle experienced in many other countries around the 2008–09 global financial crisis. Poland was the only EU country to maintain positive growth in 2009. As a result, despite pockets of vulnerabilities (including relatively sizable external corporate debt and a still-large legacy stock of foreign currency-denominated mortgages in banks), overall balance sheet health is stronger than in many other European economies. Despite rapid rise during the past decade, household debt is still manageable, particularly when compared to more advanced European peers. NFCs are competitive and profitable. Poland's banking sector is well capitalized and liquid and is able to withstand substantial stress. Public sector debt has been declining steadily.

2. Overall, this has made the economy resilient to moderate deflation, with only limited impact so far. Growth in the fourth quarter held up well on the back of strong domestic demand, suggesting that lowflation has so far not fed into the real economy. Strong consumption and still-robust investment growth indicate that both households and NFCs remain unscathed by deflation, not least as declining prices have increased real disposable income and NFCs are helped by lower non-wage input costs. However, fiscal revenue has softened somewhat in recent months, while banks' interest-rate margins have narrowed, weighing on profits. These developments highlight the risks associated with a protracted period of low inflation, which could ultimately negatively affect balance sheets and growth.

[1] Prepared by Lone Christiansen and Christian Ebeke.

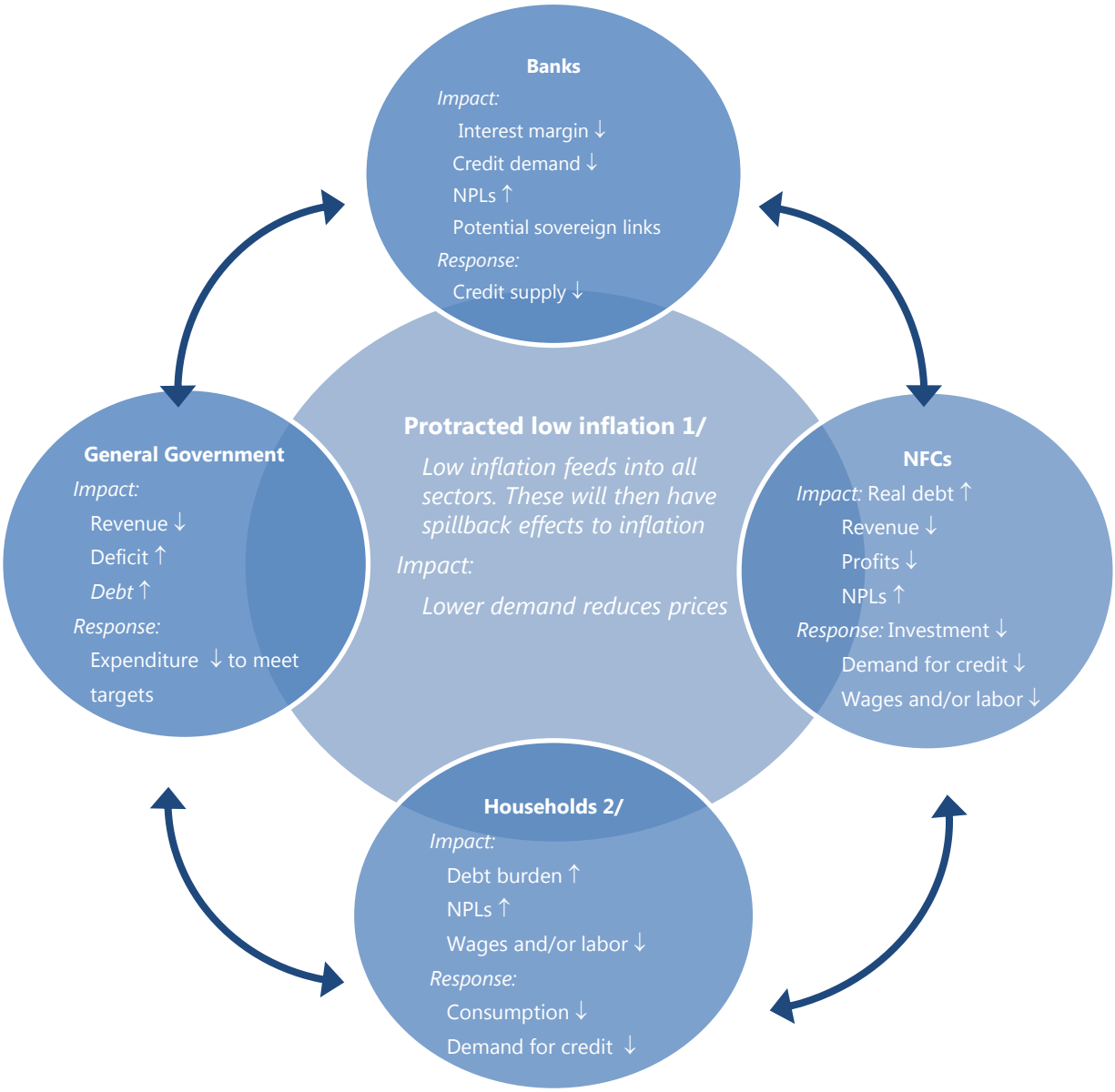
…but an adverse scenario with protracted lowflation is associated with risks

3. While the near-term consequences of lowflation appear manageable, risks surrounding a severe adverse scenario of protracted lowflation remain a concern. Protracted low inflation, combined with sluggish disposable income, increases the household debt burden, which could prompt households to cut back on consumption. In turn, this could weigh on corporate profits and induce firms to postpone investment, further reducing domestic demand. In addition, corporations may be affected already in the near term by low inflation alongside still-sticky wages. For the banking sector, lower interest rates could squeeze bank interest-rate margins, which combined with lower demand for credit and rising nonperforming loans would weigh on bank profits. Lower public sector revenues, combined with public wage rigidities, would increase deficit and debt, making it more difficult to achieve fiscal targets, potentially triggering procyclical fiscal consolidation, which could further harm growth. The unfortunate outcome could be a self-perpetuating negative feedback loop where low inflation leads to a decline in domestic demand, which reduces inflation further (Figure 1).

4. Our findings suggest that while all four sectors in Poland are generally resilient to periods of deflation, prolonged lowflation could have negative economic repercussions. In particular, a protracted period of low inflation could exacerbate existing pockets of vulnerabilities, including the rising household debt burden and narrowing interest margins in banks. In a tail-risk adverse scenario, a protracted spell of lowflation could reduce household debt tolerance, put a dent in corporate and bank profits, and increase government deficit and debt. This could result in an adverse loop of lower consumption and investment, higher NPLs, lower bank lending, and lower growth.

5. The findings underscore the importance of bringing inflation back to target in a timely manner and managing risks from lower-than-expected inflation. Given the heightened sensitivity of household debt dynamics to the real interest-income differential, higher inflation would mitigate the risks from unwarranted increases in debt and debt service, and allow households to continue expanding consumption at a healthy pace. Alongside, stronger macroprudential regulations would help contain risks of rapid debt accumulation. The potential adverse effects from narrowing corporate and bank profit margins in the context of prolonged lowflation call for setting aside sufficient buffers to reduce vulnerabilities and manage risks. These risks should be internalized in the authorities' routine stress tests to ensure that banks have sufficient capital buffers to withstand prolonged periods of low inflation. Similarly, fiscal risks from lowflation could be addressed by using conservative inflation projections in preparation of budget forecasts and identifying contingency measures to facilitate a timely and effective response to any inflation surprises.

Figure 1. Balance Sheet Effects from Protracted Low Inflation



[1/] The initial decline in inflation may arise from external factors. However, in the protracted lowflation scenario, an adverse feedback loop would maintain low domestic inflation.

[2/] Near-term effects of low inflation on households are likely positive as lower prices increase disposable income, boosting consumption. However, in the protracted lowflation case, lower wages and/or higher unemployment would worsen consumption.

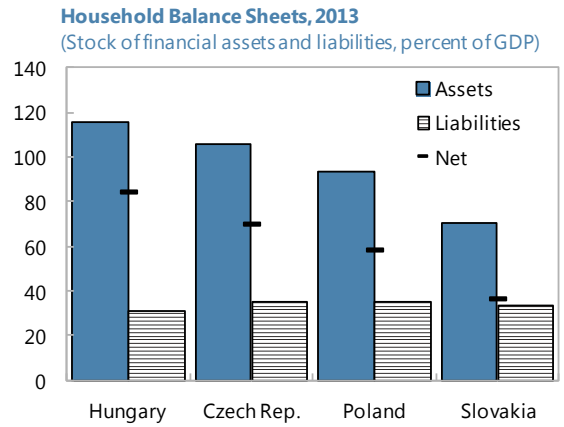
B. Households

Households are on average net creditors with largely long-term liabilities, and household debt is manageable in international comparison. Amid improving labor market conditions and positive nominal wage growth, risks related to near-term debt defaults are limited. However, low inflation has recently contributed to a rising debt-to-income ratio. Hence, should deflation continue for a protracted period, some households may begin to experience debt servicing problems and cut back on consumption.

6. Household balance sheets have so far remained strong. Household assets are more than twice as large as household liabilities and more than 40 percent of assets are held in the form of currency and deposits. Household liabilities are essentially long-term, and variable-rate mortgages are currently benefitting from low interest rates, helping to contain debt servicing costs. In addition, nominal wage growth at above 3 percent alongside deflation has supported real disposable income, boosting purchasing power (Figure 2).

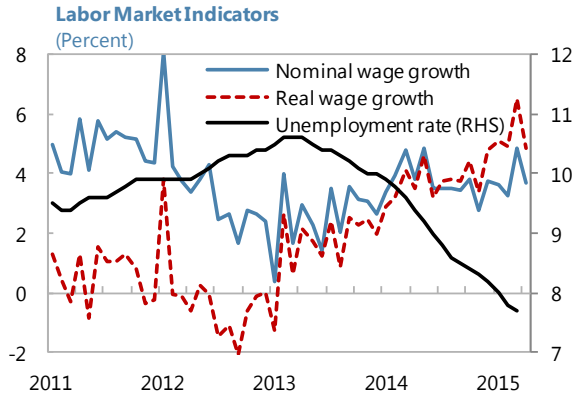
Figure 2. Household Economic Position

Household balance sheets have remained strong…



Sources: Eurostat and IMF staff calculations.

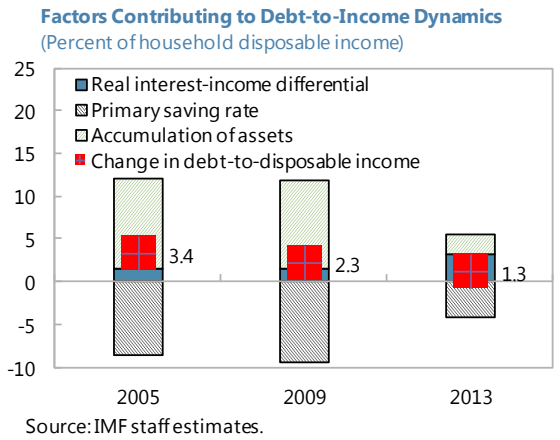
…and households currently benefit from rising real wages.



Sources: Eurostat, Haver Analytics, Statistics Poland, and IMF staff calculations.

7. However, Poland's household debt has tripled over the past decade and is now one of the highest in the Central Eastern and Southeastern Europe (CESEE). While household gross debt has remained broadly constant relative to GDP during the post-crisis period, it went up notably in terms of disposable income in recent years, increasing from about 20 percent of disposable income in the early 2000s to 58 percent in 2013 (Figure 3). Most of this debt is in the form of long-term mortgage loans, while the share of short-term debt has been stable over time, limiting roll-over risks. At the same time, household incomes are highly pro-cyclical as they mostly originate from wages and government transfers.

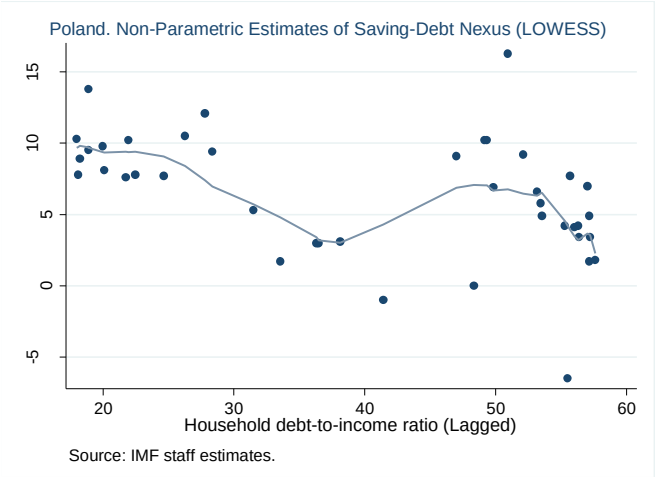
8. Declining inflation has been contributing to debt accumulation. To analyze household debt dynamics, the change in the debt-to-income ratio is decomposed into contributions from the interest rate and income growth differential ($i_t - \pi_t - g_t$), primary savings rate (s_t), and financial and residential asset accumulation aa_t as a share of disposable income (see equation (1) below). The decomposition shows that the increase in the interest-growth differential—driven in part by the rise of real interest rates on the back of declining inflation—has become an important contributor to debt accumulation in recent years.



Source: IMF staff estimates.

(1) $$\Delta d_t \approx \frac{(i_t - \pi_t - g_t)}{(1+g_t)(1+\pi_t)} d_{t-1} - s_t + aa_t$$

9. High levels of debt are associated with lower household savings. The household primary saving rate has declined from 10 percent of disposable income in 2002 to only 4 percent in 2013 as the debt-to-income ratio increased. Recent high-frequency data also confirm this trend, with the saving rate declining further to 1.3 percent in the third quarter of 2014. To better examine the relation between savings and the level of debt, two econometric exercises are conducted: a nonparametric model (LOWESS) and an OLS regression (see Appendix I). The results suggest that current levels of household debt are weighing on household saving rates.

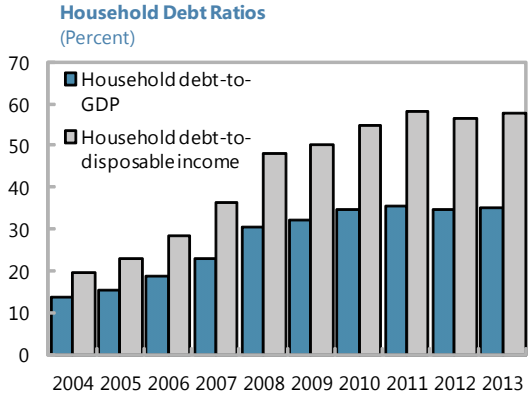


Source: IMF staff estimates.

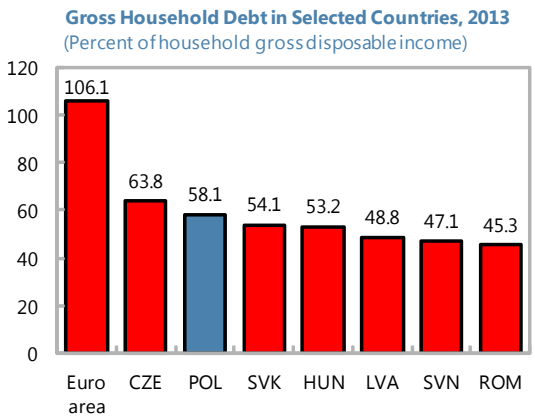
10. This suggests that some households may be facing reduced debt tolerance. The decline in household savings alongside the increasing debt ratios could indicate that debt service payments for some households may be approaching the levels at which they have to dip into their savings to maintain consumption levels. This suggests that some highly indebted households may be reaching their debt tolerance limits, at which they are no longer willing or able to reduce their consumption to generate savings to service the level of debt. This phenomenon might become more widespread if protracted lowflation negatively affects labor markets, while further increasing debt servicing costs.

Figure 3. Household Balance Sheets

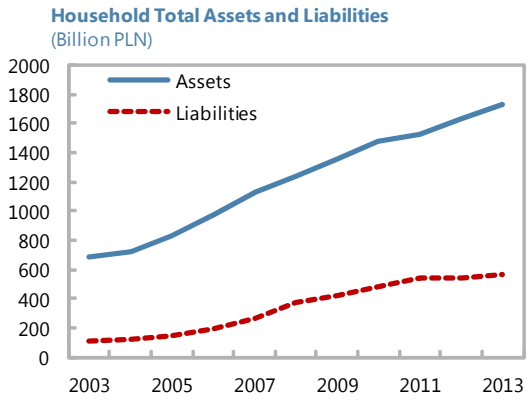
Household debt has risen rapidly ...



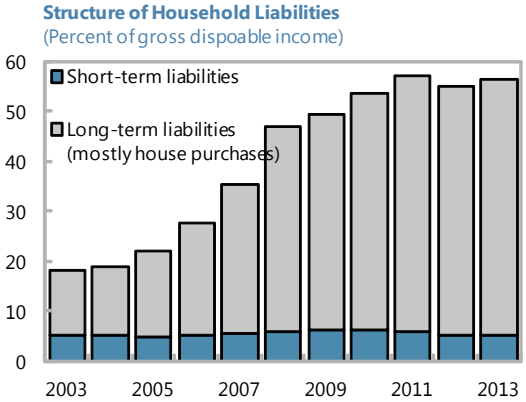
...and is one of the highest in CESEE.



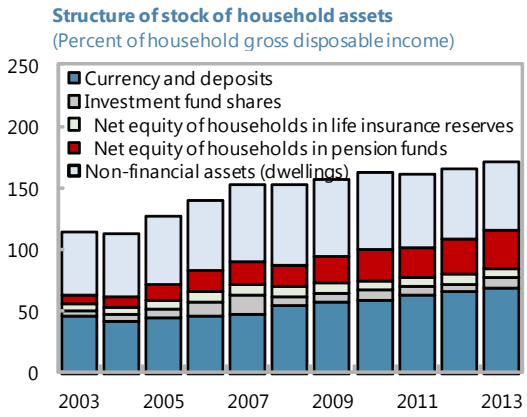
Households on average are net creditors ...



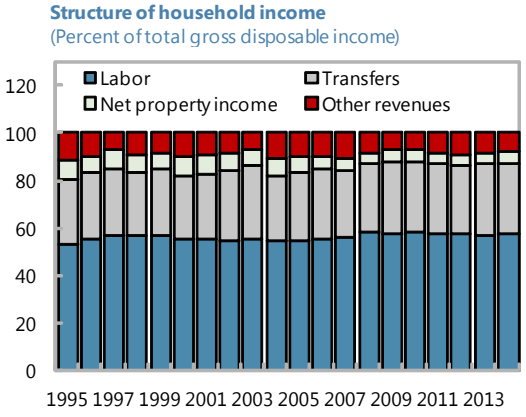
...with most debt in the form of mortgages.



About two-thirds of assets are illiquid...

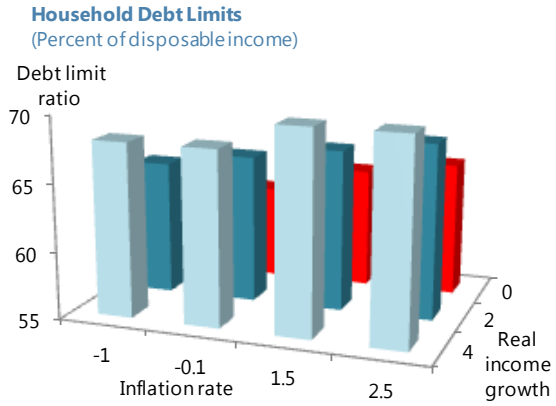


...and main sources of income are pro-cyclical.



Sources: Eurostat Annual Macroeconomic Database, Organisation for Economic Cooperation and Development (OECD) statistics, Haver analytics and, IMF staff estimates.

11. Stress tests of household debt suggest that a protracted period of low inflation could lower debt tolerance. We adapt the approach traditionally used by the IMF to assess public debt sustainability to analyze household debt dynamics as in Lee and Lim (2014). The framework also allows to examine the impact of low inflation and income growth on changes in debt limits and to assess the existing debt space available to households (see Appendix I). While disaggregate data would provide a richer picture, allowing to differentiate between households with foreign currency debt and varying income levels, detailed household-level balance sheet data are not easily available. For the purpose of this analysis, we therefore rely on aggregated data. Assuming unchanged macroeconomic conditions (the baseline), the aggregate household debt limit is estimated at 68 percent of disposable income. With the current household debt ratio at 58 percent of disposable income, this implies a debt space of 10 percentage points of disposable income. However, under various stress scenarios (of deeper deflation and sluggish disposable income growth), the aggregate debt space declines further to as little as 2 percentage points of disposable income.



Source: IMF staff calculations.

12. Lower debt tolerance would ultimately weigh on growth and increase financial stability risks. Considering the need to maintain some precautionary liquidity, this implies that as households approach their debt limits, they will have an increasing tendency to cut on consumption with negative implications for growth. At the same time, reduced debt tolerance and smaller liquidity cushions increase the likelihood that households would default on their debt obligations, with negative consequences for financial stability.

13. This underscores the importance of tackling deflation before it becomes entrenched and strengthening macroprudential regulations. With the increased role played by the interest-income differential in explaining debt dynamics, bringing inflation back to target would help contain the dynamics of the debt-to-income ratio, expand the household debt space, and reduce macroeconomic risks. The strengthening of macroprudential policies to reduce risks of rapid household debt accumulation would further reduce macro-financial risks.

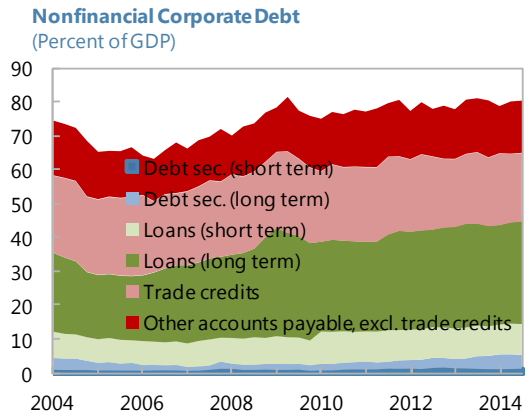
C. Nonfinancial Corporations

Corporate balance sheet vulnerabilities appear manageable. The recent period of deflation has had little impact on corporate performance to date. Going forward, an adverse scenario with a protracted period of lowflation, particularly if combined with slowing growth, could reduce corporate profits and weigh on investment and growth.

14. Corporate balance sheet vulnerabilities appear manageable. NFC nonconsolidated corporate debt[2] is elevated, accounting for about 108 percent of equity and 80 percent of GDP. This reflects an increase of around 12 percentage points of GDP over the past decade. Alongside, the share of debt with interest coverage ratio (ICR)[3] below 1 has gradually increased over the past years (Figure 4). Nonetheless, NFC debt is lower than in many other European countries both in terms of gross operating surplus and equity. And while NFC external debt is high when compared to non-European emerging peers, there are a number of mitigating factors, including a high share of the relatively stable intercompany debt. In addition, the median expected default rate is low (see IMF, 2014, for further analysis of corporate sector vulnerabilities).

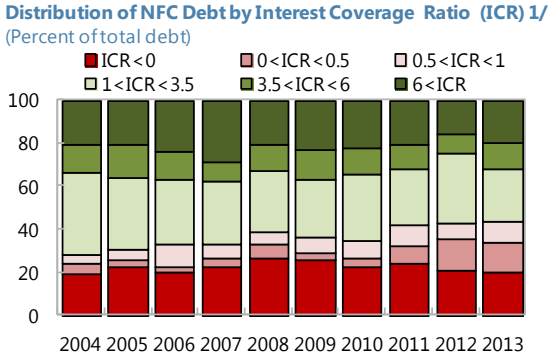
Figure 4. Assessing Corporate Default Risk

Corporate debt is elevated...



Sources: Eurostat and IMF staff calculations.

...and the share of debt at risk has increased.



Sources: Orbis, IMF Regional Economic Issues, and IMF staff calculations.
1/ ICR below one indicates potential payment difficulties.

15. So far NFCs appear to be unscathed by the recent spell of deflation. Private investment has been increasing at a healthy pace, contributing to the recovery. Purchasing Managers Index (PMI) in expansionary territory points to continued positive investment prospects, and growth in NFC bank deposits suggests still-strong profits (Figure 5). However, healthy performance in a lowflation environment is not surprising in the near term. To the extent that low inflation is matched

[2] NFC debt is defined as the sum of liabilities of debt securities, loans, and other accounts payable.

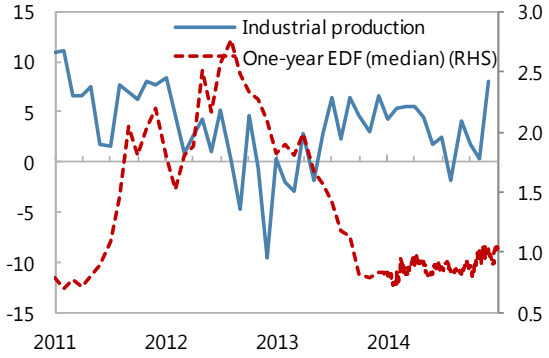
[3] ICR is defined as earnings before interest and taxes (EBIT) in a given period relative to interest expenses for the same period.

by low input costs, arising from low commodity prices and imported inputs from the euro area, and domestic demand growth remains robust (which is currently the case), profit margins may initially be little affected by low consumer prices.

Figure 5. Recent Corporate Developments

The median expected default rate remains low…

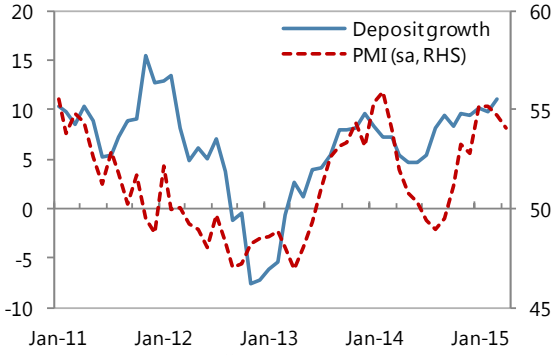
Industrial Production and One-Year- Expected Default Frequency (LHS: Year-on-year growth in percent; RHS: percent)



Sources: Moody's CreditEdge and IMF staff calculations.

…and PMI and deposits are holding up well.

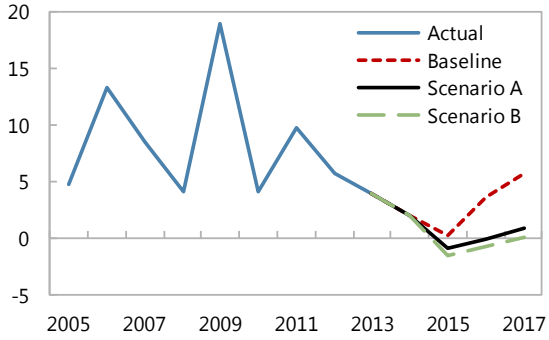
Assessing Nonfinancial Corporate Balance Sheet Health (LHS: Percent; RHS: percent balance)



Sources: KNF and IMF staff calculations.

16. However, protracted low inflation could reduce profits, weighing on investment and growth. While output prices have been declining, wages have continued growing at a robust pace of more than 3 percent year-on-year. Should compensation of employees continue to grow at unchanged pace (e.g., owing to temporary wage rigidities associated with multiyear labor contracts) in an environment of subdued price growth, corporate profit margins would eventually narrow, crowding out investment. In this regard, investment and profit prospects are closely correlated in Poland, with corporate (nominal) fixed investment declining by more than 10 percent during 2009–10 following a sharp deterioration in the gross profit share—uncertainty related to euro area growth at the time likely also impacted investment prospects. Over the longer run in a downside tail-risk scenario, firms could turn to additional cost-cutting measures, including a reduction in employment or a downward adjustment of wages. Subsequently, lower employment, household demand, and investment would pull down growth (Figure 6).

Scenario Analysis: Gross Operating Surplus 1/
(Percent change)

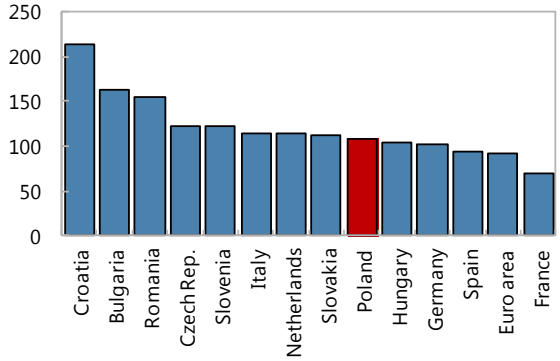


Sources: Eurostat and IMF staff calculations.
1/ See Appendix for detailed assumptions.

Figure 6. Republic of Poland: Corporate Balance Sheets

Corporate debt is high but manageable relative to peers...

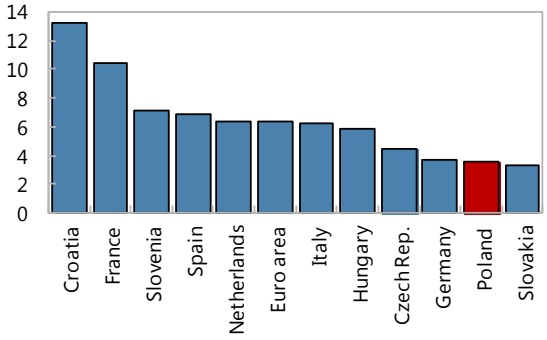
Corporate Debt to Equity, 2013
(Percent)



Sources: Eurostat and IMF staff calculations.

...and debt relative to earnings compares favorably.

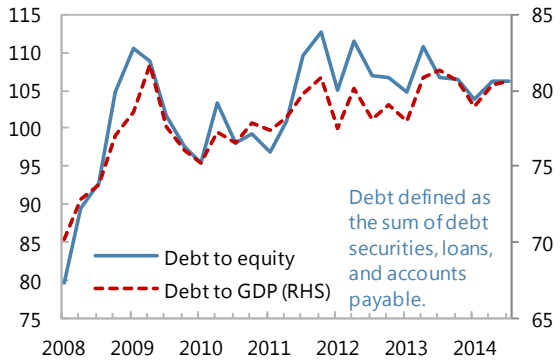
Corporate Debt to EBITDA, 2013 1/
(Ratio)



Sources: Eurostat and IMF staff calculations.
1/ EBITDA is defined as gross operating surplus.

Nonetheless, debt ratios have been edging up.

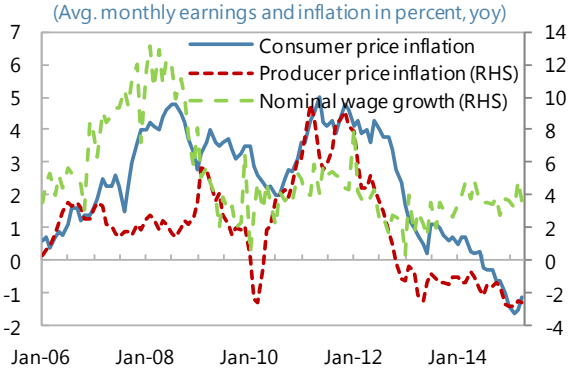
Poland: Corporate Debt Ratios
(Percent)



Sources: Eurostat and IMF staff calculations.

While prices are declining, labor costs continue to grow,...

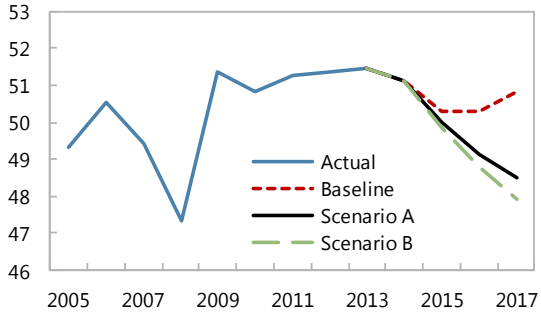
Input and Sales Price Inflation
(Avg. monthly earnings and inflation in percent, yoy)



Sources: Statistics Poland and IMF staff calculations.

...which could affect profits...

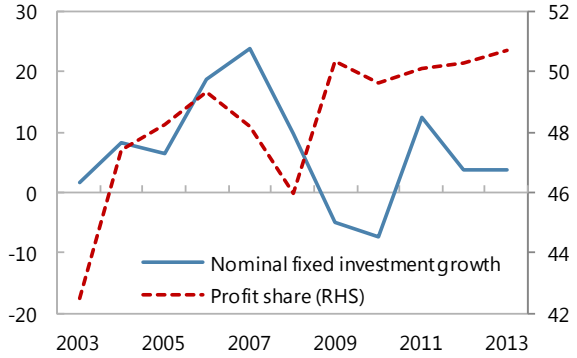
Scenario Analysis: Corporate Profit Share 1/
(Gross operating surplus in percent of value added)



Sources: Eurostat and IMF staff calculations.
1/ Scenario A: low inflation and robust growth. Scenario B: low inflation and growth.

...and lead to a decline in investment.

Investment and Profits
(LHS: percent; RHS: percent of value added)



Sources: Eurostat and IMF staff calculations.

D. Banks

Banks have healthy capital buffers and are able to withstand substantial stress. So far, there are only mild signs of deflation impacting bank balance sheets. Effects have mainly been observed through narrowing interest margins on the back of declining lending rates alongside easing monetary policy, putting pressure on profit margins. In an adverse scenario with protracted lowflation, further narrowing of interest margins could reduce profits, deterring credit supply.

17. The Polish banking sector is able to withstand substantial stress. Banks have ample capital buffers, with capital adequacy ratios at around 15 percent. Reliance on foreign funding has declined and stress tests routinely show that the sector is able to withstand substantial stress. Amid continued deflation since July last year, the authorities have also initiated work to examine the potential consequences of low inflation on the banking sector.

18. So far, there are no substantial signs of balance sheet spillovers. A steady decline in nonperforming loans in the consumer loan segment supports the finding that household balance sheets remain resilient. Nonetheless, nonperforming corporate loans picked up moderately in late-2014, though NPLs may not provide the full picture of credit risk (for example, length of recovery, including legal proceedings, impacts these statistics) and are somewhat impacted by end-year seasonal factors. Hence, substantial balance sheet spillovers have not materialized on account of the overall still-robust household and corporate sector health.

19. However, interest margins have narrowed. A reduction in policy interest rates to reinvigorate growth and inflation fed into lending rates. In particular, the 100 basis point reduction in the Lombard rate in October 2014 translated into lower interest rates on consumer credit with 4×Lombard rate defining the upper limit for lending rates. The recent additional 50 basis point reduction in March would likely further squeeze margins. With declining lending rates, the interest rate spread[4] gradually narrowed, reaching its lowest level in ten years at 3.3 percentage points in December 2014. As market interest rates tend to impact the interest rate on assets faster than on liabilities, net interest margins also started to decline. In the bank lending survey, banks reported easing interest rate spreads on average corporate and housing loans. Nonetheless, non-interest charges, such as fees, limit the full spillover from declining interest rate margins to profits. In addition, as the interest rates on liabilities fully reflect changes in market interest rates, the net interest margin would likely stabilize.

20. The narrowing interest margins are weighing on bank profitability, despite still-robust credit growth. Narrowing interest margins have adversely impacted bank profitability. While cumulative profits in 2014 grew about 7 percent, the return on assets declined toward the end of

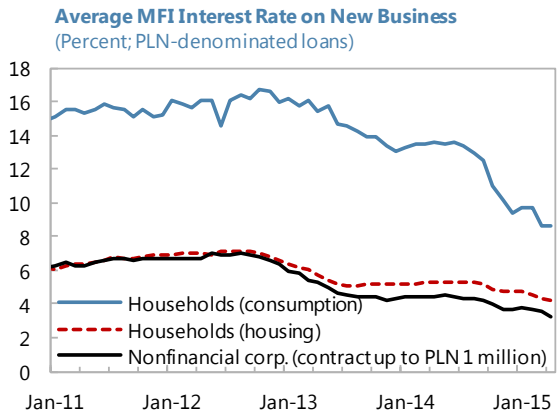
[4] The interest rate spread is defined as the percentage point difference between the rate on total new deposits and the rate on new zloty loans. The net interest margin is defined as the difference between 12-month interest income and 12-month interest expenses relative to 12-month average assets.

2014 (Figure 7). Nonetheless, year-on-year credit to the private sector strengthened during 2014, ending the year with credit growth at around 7 percent. However, consumer credit growth diminished about 2 percentage points to around 4½ percent during the last half of 2014, suggesting that domestic demand could weaken going forward.

21. Going forward, potential adverse balance sheet effects should be carefully monitored. To the extent that protracted lowflation in a tail risk scenario reduces the demand for credit by households and corporations, the profit-generating base for banks (i.e., lending) would be directly affected. In addition, the quality of outstanding credit would worsen and deter credit supply. This would feed into the real economy, resulting in slower economic activity. While strong capital buffers in banks help mitigate financial stability concerns, going forward it will be important to carefully monitor balance sheet health in light of the still-high risk of prolonged lowflation. In this regard, the ongoing work by the authorities to assess the potential implications of low inflation for the banking sector is welcome.

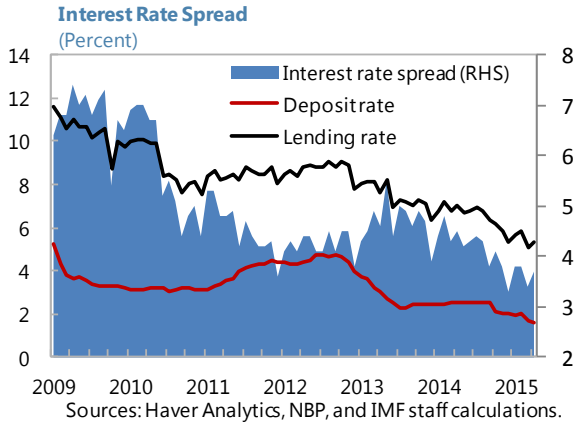
Figure 7. Republic of Poland: Assessing Effects on Bank Balance Sheets

Policy interest rate cuts fed through to customers...



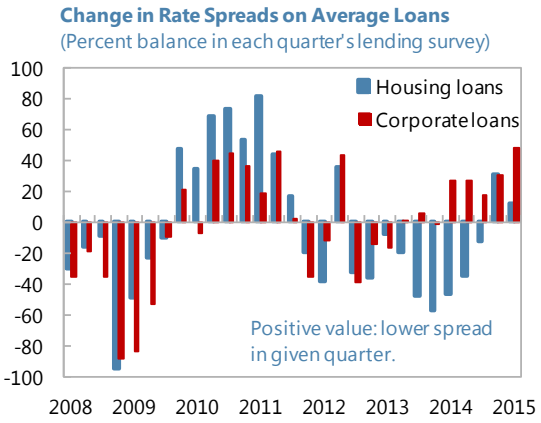
Sources: NBP and IMF staff calculations.

...and have narrowed the interest rate spread,...



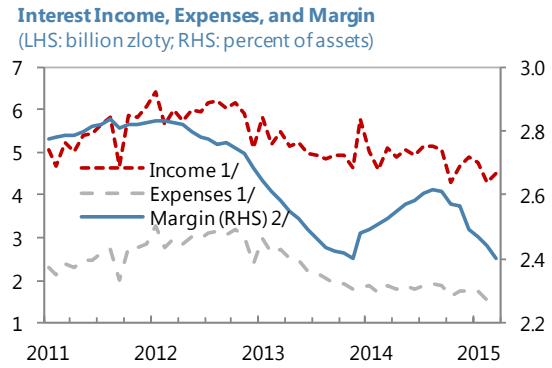
Sources: Haver Analytics, NBP, and IMF staff calculations.

...including for mortgages and corporations.



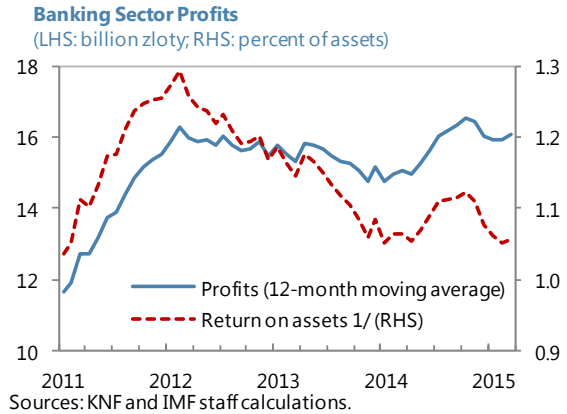
Sources: Haver Analytics and National Bank of Poland.

In turn, interest margins have recently declined,...



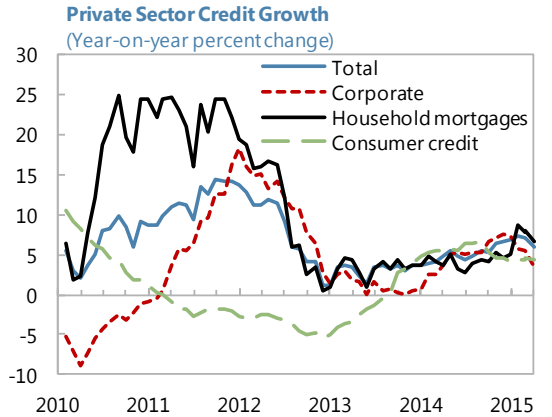
Sources: KNF and IMF staff calculations.
1/ Monthly income and expenses.
2/ 12-month sum in percent of assets.

...lowering profits,...



Sources: KNF and IMF staff calculations.
1/ 12-month profits in percent of 12-month assets.

...despite strong credit growth.



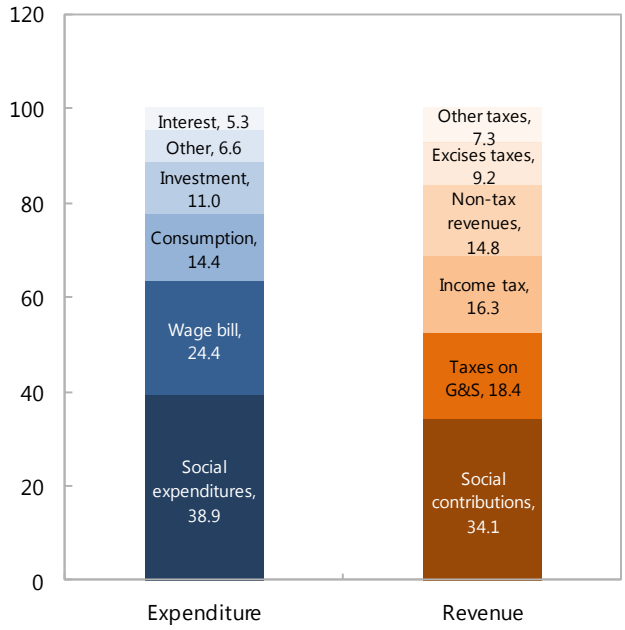
Sources: Haver Analytics, NBP, and IMF staff calculations.

E. General Government

Poland's budget structure makes it sensitive to price developments. While the recent spell of deflation has had limited effect on public finances so far, there are early indications that the decline in prices may have started to adversely affect revenue performance. Scenario analyses suggest that a protracted period of lowflation could reduce fiscal space and make it more challenging to achieve fiscal targets. Policies should therefore aim to manage the associated fiscal risks, including by using conservative inflation projections in preparation of budget forecasts and identifying contingency measures to support the implementation of the stabilizing expenditure rule and facilitate a timely and effective response to any inflation surprises.

22. Poland's budget structure makes it sensitive to price developments. On the revenue side, this is reflected in the prominence of taxes on goods and services, which account for about 18 percent of the annual revenue collection. On the spending side, while some expenditure categories are sensitive to price developments (e.g., government purchases of goods and services or social expenditures indexed to inflation), other categories, such as the public wage bill, are inherently more rigid. With the wage bill at around 10 percent of GDP (amounting to one quarter of primary expenditures), a combination of protracted low inflation and a rigid wage bill could significantly reduce fiscal buffers.

Poland: Composition of Revenues and Expenditures, 2014
(In percent of total)



Sources: IMF staff calcuations.

23. So far, deflation in Poland has had limited impact on fiscal space. Gradual fiscal consolidation continued in 2014, supported by wage restraint, lower debt service following the pension reform, and a partial rebound in tax revenues on the back of stronger domestic demand. As a result, the headline deficit declined by 0.8 percentage points of GDP. However, recent disappointing VAT revenue collection indicates that the decline in prices may have started to adversely affect revenue performance. And given the risk of protracted low inflation going forward, it is important to understand potential implications of such a scenario for the budget.

24. To analyze the impact of protracted low inflation on public finances, we augment the macro-fiscal framework with specific behavioral parameters.[5] The macro-fiscal framework takes into account specific characteristics underpinning the fiscal framework in Poland. With the ongoing wage freeze, we assume that public sector wages do not react to inflation.[6] Social benefits are indexed to inflation with some lags, and investment responsiveness to inflation is reduced by the high external financing content from EU funds. On the revenue side, Poland's high dependency on indirect taxes implies high sensitivity of tax revenue to inflation developments. Social contributions are linked to nominal wages, while income taxes are impacted by both current and past inflation developments. The simulation assumes that under the low inflation scenario, yields on government bonds would come down, reflecting easing monetary conditions. The framework also takes into account possible divergence between CPI inflation and the GDP deflator in the short-run.[7] The baseline CPI inflation path follows staff's baseline projection, whereas the downside scenario for inflation is presented in the Appendix.

25. A protracted period of low inflation could reduce fiscal space. A protracted period of low inflation would entail an increase in the primary deficit and overall fiscal deficit of 1 and 0.7 percentage points of GDP, respectively, compared to the baseline (Figure 8). This is the result of higher expenditure ratios, partly reflecting wage rigidities, which are only partially offset by higher revenue ratios on account of lower nominal GDP. At the same time, public debt is some 7 percentage points of GDP higher by 2020, thus breaching the debt threshold of 48 percent of GDP set in the Public Finance Law and used in the authorities' expenditure rule.[8]

26. A smaller fiscal space would make it more difficult to achieve fiscal targets. The authorities target a structural fiscal deficit of 1 percent of GDP (medium-term objective (MTO)) by 2019, and the expenditure rule has an objective of stabilizing the debt-to-GDP ratio below 48 percent of GDP. Reaching and maintaining these targets in a protracted low inflation scenario would require additional fiscal measures of more than 0.5 percent of GDP.

27. Policies should aim at managing the resulting fiscal risks. This calls for using conservative inflation projections in preparation of budget forecasts, particularly when the risks of lower-than-expected inflation are high, as is currently the case. The corrective mechanisms

[5] Simulations of the effects of deflation on fiscal aggregates have recently been discussed at the IMF by End et al. (2014): http://www.imf.org/External/Pubs/FT/irb/2014/04/index.pdf.

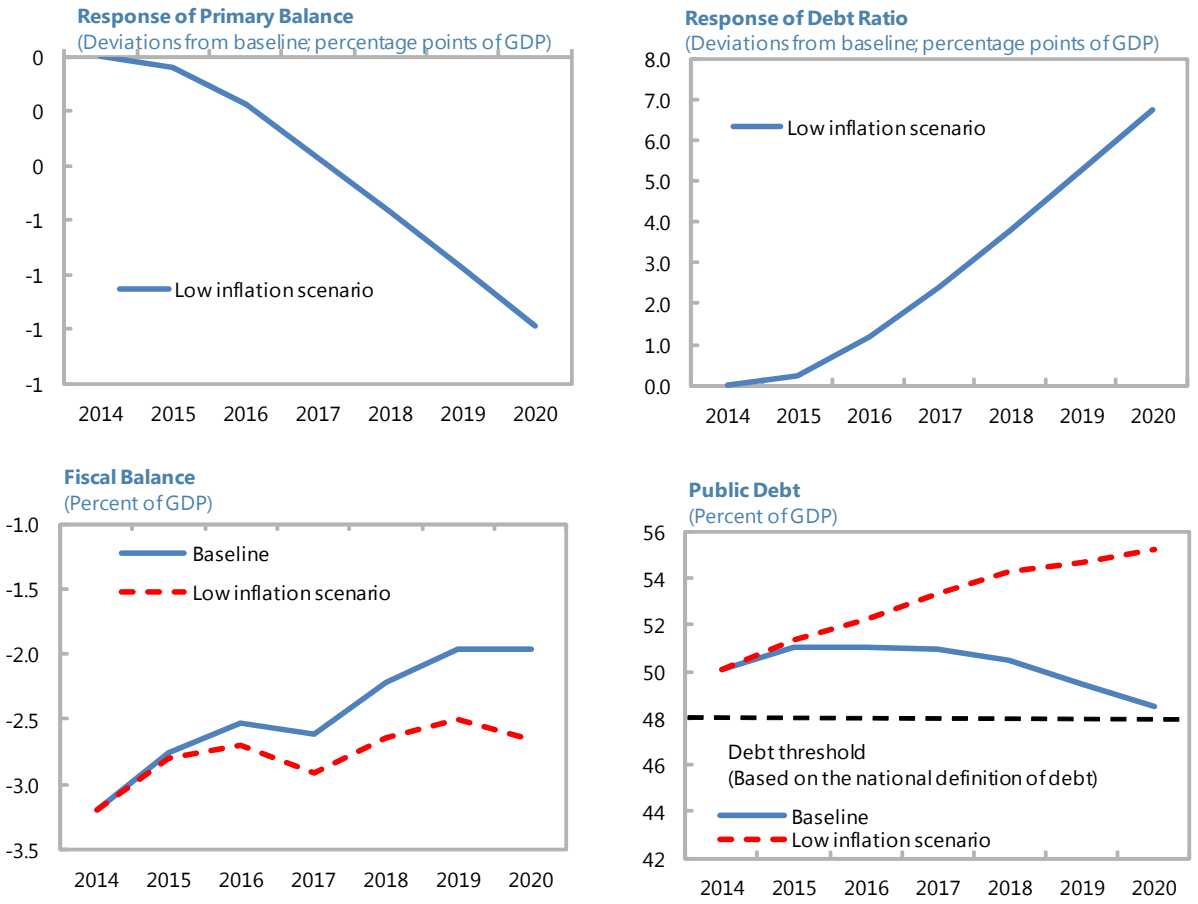
[6] An alternative scenario which assumes a gradual decline in wages (including public sector wages) would partially improve the fiscal aggregates. However, the gains from the reduced wage bill would be partially offset by a decline in social contributions.

[7] This aspect is crucial when assessing the effects of short-term CPI inflation shocks on fiscal ratios. For example, lower CPI inflation would affect revenues in the numerator, whereas any decoupling between CPI inflation and the GDP deflator would further lower the revenue-to-GDP ratio.

[8] The debt thresholds set in the Public Finance Law apply to the national definition of public debt, calculated using the average exchange rate for foreign-currency-denominated liabilities, and reduced by the value of liquid funds used for pre-financing of the following years' borrowing requirements.

embedded in the authorities' stabilizing expenditure rule require fiscal adjustment following accumulated deviations of the deficit from the MTO, including those stemming from erroneous inflation forecasts. While effective implementation of the rule should substantially reduce the risks of fiscal slippages, it should be supported by specific fiscal measures. Identifying contingency measures ahead of time would strengthen the credibility of the stabilizing expenditure rule and facilitate a timely and effective response to any inflation surprises.

Figure 8. Impact of Low Inflation on Public Finances



Source: IMF staff calculations.

F. Conclusion

28. Low inflation has so far had only limited economic impact. The generally healthy private and public sector balance sheets have shielded the economy from adverse developments. Household debt has increased but remains below debt tolerance thresholds. NFCs and banks remain profitable, though recent indicators point to some loss in banking sector profitability. In addition, public sector revenues have started to show signs of weakness.

29. However, protracted lowflation raises risks of adverse real-financial loops. While consequences of low inflation so far appear mild, in a tail-risk adverse scenario a protracted period of lowflation risks feeding into sectoral balance sheets and weighing on growth. Such a scenario could result in an adverse loop of reduced household consumption, weaker corporate and bank profits, declining investment, and lower domestic demand pulling inflation further down.

30. Policies should focus on guiding inflation back to target and managing risks from lower-than-expected inflation. To prevent a tail risk stagnation scenario, monetary policy should focus on avoiding low inflation becoming entrenched in expectations. Alongside, careful monitoring of the health of sectoral balance sheets would ensure timely policy response should lowflation persist. The authorities' ongoing work to assess potential implications for the banking sector of low inflation is therefore welcome. Conservative inflation projections in the public sector budget would help preempt unwarranted surprises for revenue collection and identifying contingency measures to respond to lower-than-expected inflation would facilitate meeting fiscal targets.

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Appendix I. Methodology

A. Households: Estimating household debt space and sensitivity analysis

A simple econometric model shows a strong response of household saving-to-debt ratios. The econometric model fits the household primary saving ratio to lagged levels of household debt ratios in a cubic form. The cubic form is chosen as it is found to be the closest representation of the functional form between the two variables as highlighted by a non-parametric LOWESS function. We use quarterly data for all variables from 2003:Q1 to 2014:Q1, including seasonally-adjusted series for household debt, saving, and disposable income. The model includes several other determinants of savings to check the robustness of the results (Table AI.1).

Table AI.1. Poland: Econometric Estimates of the Household Saving Reaction Function
(Dependent variable: Household primary saving-to-income ratio)

	(1)	(2)	(3)	(4)	(5)
Household debt-to-income (t-1)	-6.054***	-4.996*	-5.660*	-6.357**	-6.119**
	(-2.861)	(-1.928)	(-1.976)	(-2.486)	(-2.588)
[Household debt-to-income (t-1)]^2	0.145**	0.120*	0.137*	0.156**	0.148**
	(2.703)	(1.836)	(1.905)	(2.305)	(2.482)
[Household debt-to-income (t-1)]^3	-0.00107**	-0.000870*	-0.00103*	-0.00118*	-0.00109**
	(-2.442)	(-1.694)	(-1.792)	(-2.031)	(-2.277)
Real disposable income growth	0.475**	0.577**	0.469*	0.462*	0.468*
	(2.426)	(2.518)	(1.968)	(1.825)	(1.742)
PLN/CHF exchange rate	-8.647*	-7.386	-7.328	-8.028	-8.542
	(-1.699)	(-1.224)	(-1.257)	(-1.222)	(-1.347)
Household saving ratio (t-1)		0.346*	0.226		
		(2.023)	(0.961)		
Lombard rate			-0.936		
			(-0.978)		
Household loan rate				-0.289	
				(-0.359)	
CPI inflation rate					-0.0733
					(-0.157)
Intercept	105.1***	85.99*	100.6*	109.0**	105.5**
	(2.982)	(1.915)	(1.910)	(2.510)	(2.528)
Observations	41	41	41	41	41
R-squared	0.392	0.469	0.488	0.393	0.392

Source: IMF staff calculations.
Note: *T*-statistics in parentheses. Stars denote statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

The estimated saving reaction function is used to compute the household debt limit. Following Lee and Lim (2014), we estimate the household debt limit as the debt ratio at which household debt is stabilized and additional primary savings are no longer generated to meet the debt servicing needs. In other words, it is the intersection of the equilibrium saving rate (when debt and asset accumulation are null in the debt dynamics equation (1) of the main text) and the saving-debt reaction function estimated econometrically. Since the rate of inflation enters directly into the debt dynamics equation, it is possible to generate stress scenarios of the response of debt limits to inflation levels. The corresponding debt limits are depicted in the text chart "Household Debt Limits" of the main text.

B. NFCs: Scenario analysis

A simple scenario analysis can illustrate the transmission from low prices to profit shares. We use annual sectoral accounts data from Eurostat and compute the gross profit share as follows:

$$Gross\ profit\ share = \frac{Gross\ operating\ surplus}{Gross\ value\ added}$$

$$= \frac{Nominal\ output - intermediate\ goods - compensation\ of\ employees}{Gross\ value\ added}$$

$$= \frac{Gross\ value\ added - compensation\ of\ employees}{Gross\ value\ added}$$

Here, we deflate output and intermediate goods with consumer price inflation. Under different scenarios for the inflation path, real output and input growth, and the growth rate of compensation of employees, we explore the resulting implications for gross operating surplus and the gross profit share (see Table AI.2 for detailed assumptions and results).

Table AI.2. Nonfinancial Corporations: Adverse Scenario Simulation[1/]

(Percent)

	2013	2014	2015	2016	2017
Baseline					
Real output growth	0.8	*1.8*	*1.8*	*1.8*	*1.8*
Real input growth	-0.2	*1.3*	*1.3*	*1.3*	*1.3*
Nom. compensation of employees growth	3.5	*3.5*	*3.5*	*3.5*	*3.5*
Inflation	0.9	0.0	*-1.0*	*0.8*	*1.8*
Resulting profit share	51.5	51.1	50.3	50.3	50.8
Percent change in gross operating surplus	3.9	2.0	0.1	3.6	5.7
Scenario A					
Real output growth	0.8	*1.8*	*1.8*	*1.8*	*1.8*
Real input growth	-0.2	*1.3*	*1.3*	*1.3*	*1.3*
Nom. compensation of employees growth	3.5	*3.5*	*3.5*	*3.5*	*3.5*
Inflation	0.9	0.0	*-1.5*	*-1.0*	*-0.5*
Resulting profit share	51.5	51.1	50.0	49.1	48.5
Percent change in gross operating surplus	3.9	2.0	-1.0	-0.1	0.9
Scenario B					
Real output growth	0.8	*1.8*	*0.5*	*0.5*	*0.5*
Real input growth	-0.2	*1.3*	*-0.5*	*-0.5*	*-0.5*
Nom. compensation of employees growth	3.5	*3.5*	*3.5*	*3.5*	*3.5*
Inflation	0.9	0.0	*-1.5*	*-1.0*	*-0.5*
Resulting profit share	51.5	51.1	49.9	48.8	47.9
Percent change in gross operating surplus	3.9	2.0	-1.6	-0.9	0.0

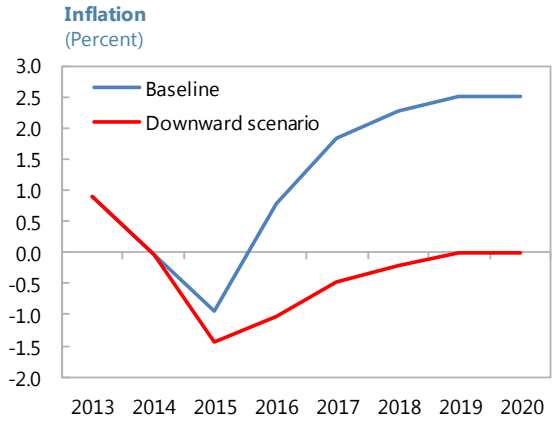
Sources: Eurostat and IMF staff calculations.

1/ Assumptions in italics. Real growth rates are computed from nominal values and CPI inflation.

C. General government: Assumptions

The set of assumptions is as follows:

- CPI inflation declines by 0.5 percentage points compared to the baseline in 2015 and by 1.8 percentage points in 2016. Throughout the forecast horizon, CPI inflation remains about 2.5 percentage points below the baseline. The resulting headline inflation path in the downside scenario corresponds to that of the corporate sector analysis, scenario A, above (Table AI.2).
- The GDP deflator is projected to co-move with CPI inflation. The pass-through from inflation to the changes in the deflator is 0.9, in line with past correlation.
- The pass-through from inflation to nominal wages is assumed to be 0.5, assuming some nominal rigidity. In other words, a 1 percentage point decline in inflation results in a 0.5 percentage point decline in the nominal wage growth in the enterprise sector.
- The pass-through from inflation to the nominal interest rate on public debt is 0.5 percentage point. In other words, a 1 percentage point decline in inflation results in a 0.5 percentage point decline in the nominal interest rate. In a deflationary environment, we make the assumption that monetary policy would remain accommodative with low interest rates.



Sources: IMF staff estimates.

RAISING PRODUCTIVITY GROWTH IN POLAND: THE ROLE OF STRUCTURAL TRANSFORMATION[1]

Poland's continued integration with global markets has benefited growth and income convergence. Over the past decade, sector-specific productivity gains, particularly in manufacturing, accounted for the bulk of aggregate productivity growth, while the remaining one-fifth came from labor reallocation toward higher-productivity sectors (structural transformation). Continued income convergence would require completing structural transformation, while securing further within-sector productivity improvements. Cross-country econometric estimations suggest that attracting greenfield investment, improving the business climate, addressing labor market rigidities, and tackling long-term unemployment are key factors facilitating positive structural change.

A. Introduction

1. Sustained productivity gains are a key driver of economic success. Countries that manage to sustain aggregate productivity gains enjoy strong and durable growth. Increases in aggregate labor productivity can originate from two main sources. First, aggregate labor productivity gains arise when labor and other resources relocate from low-productivity sectors (such as agriculture) toward modern economic activities. The speed with which this structural transformation occurs is one of the key factors that differentiate high-growing countries from low-growing ones (McMillan et al., 2014). Moreover, structural transformation has been found to result in lower aggregate output volatility (Moro, 2012). Second, increases in sector-specific productivity can also generate significant aggregate labor productivity gains, supporting economic convergence.

2. Understanding the relative importance of factors underlying aggregate labor productivity growth allows to better target economic policies to maximize productivity gains. For example, to facilitate structural transformation, policies would need to focus on removing obstacles to labor mobility across sectors, such as overly restrictive labor market regulations. On the other hand, improving within-sector productivity would require moving up the technological frontier. Policies incentivizing research and development and innovation would be helpful in this regard.

3. This paper decomposes aggregate labor productivity growth in Poland and its European peers. The decomposition gauges the relative contribution to aggregate productivity improvements from structural transformation and from within-sector productivity gains. The paper draws on the literature on the decomposition of aggregate labor productivity growth (Fabricant, 1942; McMillan et al., 2014; de Vries et al., 2013) using detailed sectoral-level data for a

[1] Prepared By Christian Ebeke, Krzysztof Krogulski, and Robert Sierhej.

large set of European countries.[2] An innovation compared to earlier literature (de Vries et al., 2013) is that the framework used here allows to distinguish between the contribution to productivity growth from the reallocation of workers to sectors with above average productivity levels (static reallocation effects or structural change) and the contribution from the reallocation to sectors with above average productivity growth (dynamic reallocation effects). As pointed out in de Vries et al. (2013), this distinction is crucial insofar as the traditional decomposition methods mix structural change (the static reallocation effect) with dynamic reallocation effects. The method is therefore better suited to obtain a more robust measure of the extent of structural transformation.

4. The decomposition shows that within-sector productivity gains have been a strong driver of aggregate labor productivity growth in Poland, although structural transformation has also played an important role. Over the past decade, within-sector productivity gains have accounted for the bulk of aggregate productivity growth, with the remaining one-fifth coming from structural transformation. The manufacturing sector, which has benefited from integration with Europe's supply chains, has been one of the main sources of increased productivity at the sectoral level.

5. Going forward, sustaining aggregate productivity improvements would require completing structural transformation, while boosting within sector productivity. Scenario analyses suggest that continued structural transformation would need to go hand-in-hand with further improvements in within-sector productivity to achieve meaningful catch-up gains for Poland.

6. Completing structural transformation would require facilitating labor mobility across sectors and promoting economic diversification. While previous research has generally focused on identifying the drivers of aggregate labor productivity growth, very few studies (McMillan et al., 2014) examined the determinants of structural transformation. To the best of our knowledge, our paper is the first to examine the key drivers of structural transformation in Europe. The econometric results show that securing large greenfield investments, improving the business climate, addressing labor market duality, and tackling long-term unemployment are key factors associated with positive structural change. In Poland, this would require reducing labor market duality by better aligning temporary employment contracts with regular contracts and continuing business climate improvements to encourage greenfield investments.

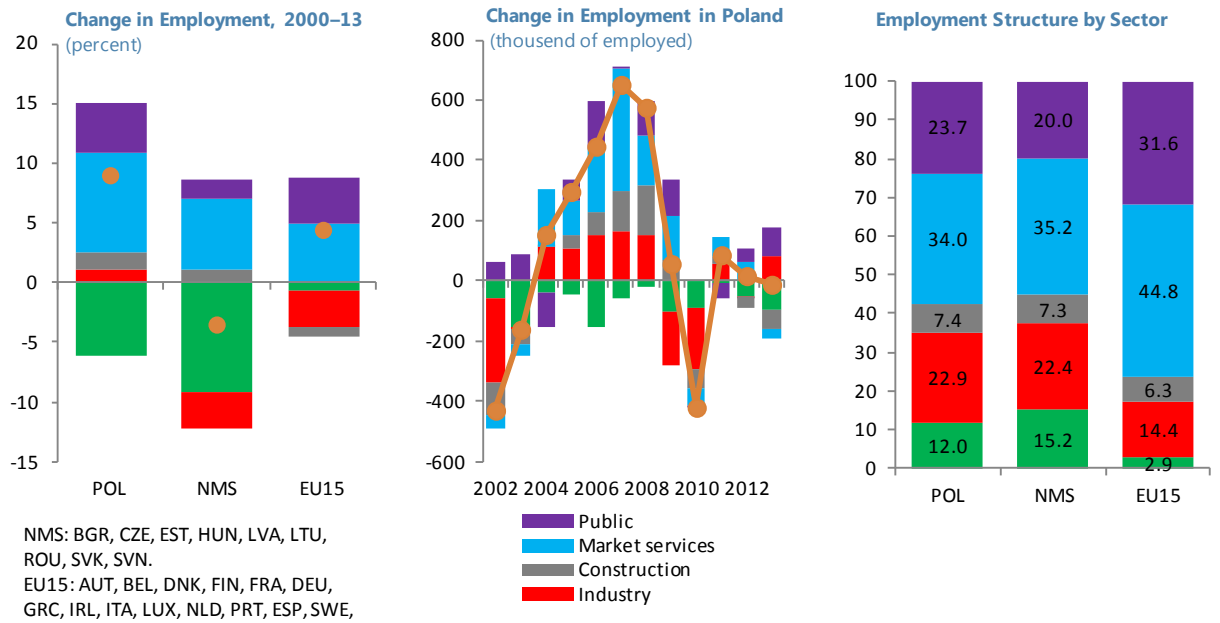
7. Earlier research suggests that further within-sector productivity enhancement entails moving up the value-added chain. Poland's participation in the European supply chains has led to substantial technological transfers (IMF, 2013). Export growth in knowledge-intensive sectors has picked up, and the sophistication of domestic value added embodied in overall exports has also increased rapidly. Further progress in these areas would positively contribute to productivity growth and enhance Poland's external competitiveness.

[2] The focus is on labor productivity given that detailed and comprehensive data on sectoral capital stock and deflators are not always available. Also, labor remains an important component of aggregate production.

B. Poland: Labor Market and Productivity Trends

8. Employment growth in Poland has been stronger than elsewhere in Europe, led by services and the public sector. Poland managed to secure high employment gains in the last decade compared to only modest growth in advanced EU economies and a decline in regional peers (Figure 1). Most of the employment growth occurred in the early years following the EU accession and can be attributed to the expanding services and public sector, while the importance of agriculture has diminished. Unlike in many other parts of Europe, construction and industry have also positively contributed to employment gains. As in other New Member States (NMS),[3] Poland's employment structure is more heavily skewed toward agriculture and industry, than in advanced European countries.

Figure 1. Employment Structure in Poland



NMS: BGR, CZE, EST, HUN, LVA, LTU, ROU, SVK, SVN.
EU15: AUT, BEL, DNK, FIN, FRA, DEU, GRC, IRL, ITA, LUX, NLD, PRT, ESP, SWE, GBR

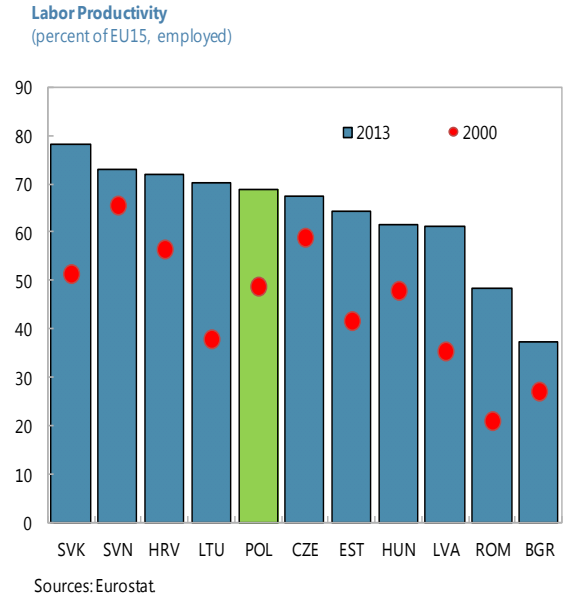
Source: Eurostat.

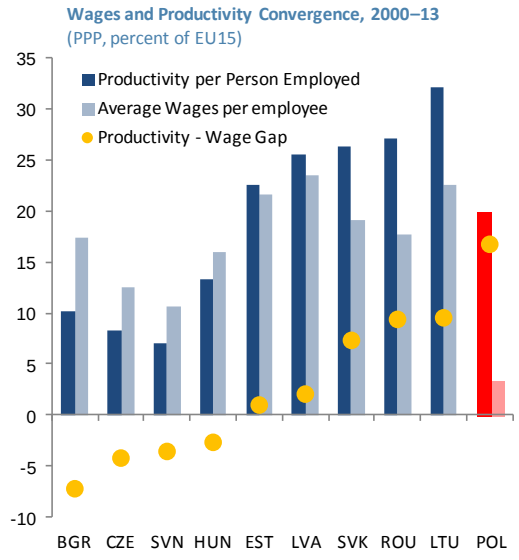
9. Poland's labor productivity has increased markedly over the past decade, helped by its participation in the German supply chain. Poland's labor productivity increased from 49 percent of EU average in 2000 to nearly 70 percent of EU average in 2013. Productivity gains in the industry and manufacturing sectors were particularly large, helped by technological transfers through Poland's participation in the German supply chain.

[3] NMS include: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Romania, Slovakia, and Slovenia.

10. However, cross-country comparison suggests that a sizable productivity gap remains. While Poland's is gradually catching up with EU average, the speed of productivity convergence has been slower than in regional peers with comparable initial productivity levels such as Slovakia and Lithuania (Figure 2). Nevertheless, wages in Poland increased less than productivity, boosting its competitiveness.

Figure 2. Labor Productivity and Wages

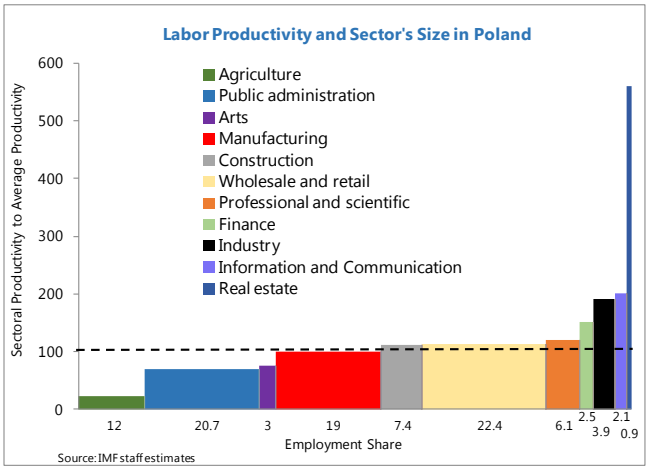




Sources: Eurostat.

11. Earlier research suggests that further productivity improvements can be achieved by moving up the value added chain. Participation in European supply chains has been found to be positively associated with substantial technological transfers and productivity growth in the manufacturing in Eastern European countries (IMF, 2013). In these countries, export growth in knowledge-intensive sectors has picked up and the sophistication of domestic value added embodied in overall exports has also increased rapidly, with positive implications for productivity, external competitiveness, and growth.

12. Furthermore, analysis of Poland's relative sectoral productivity suggests potential gains from relocating labor to more productive sectors. The text chart shows sectoral productivity relative to economy-wide average by economic sector and its share in total employment. While agriculture and the public sector combined employ a third of Poland's labor force, productivity in these sectors is significantly below economy-wide average. At the same time, productivity in the services sectors



Source: IMF staff estimates

(including wholesale and retail trade, professional and scientific activities, industry, information and communication, and finance and real estate)—which have high labor absorption capacity, currently employing 38 percent of the labor force—exceeds economy-wide average. This suggests that there is potential in Poland to increase aggregate labor productivity by relocating labor from less productive sectors (e.g., agriculture) to these more productive sectors, particularly in services.

C. Decomposing Aggregate Labor Productivity Growth Using Sector-Level Data

Methodology

13. We decompose aggregate productivity improvements into within and between effects. The "within effect" captures productivity growth within sectors, whereas the "between effect" measures the productivity effect of labor reallocation across sectors.

14. Three methods are used to perform the decomposition. Each method has important ramifications for the measurement and interpretation of structural change (see Appendix II for a full description of the methods and the underlying analytical presentation).

- The first method follows McMillan et al. (2014) and decomposes aggregate labor productivity into two terms: the *within-effect* which is positive when the weighted change in labor productivity levels in sectors is positive and the *reallocation-effect*, which measures the contribution to productivity growth of labor reallocation across sectors and is positive when labor moves to more productive sectors.
- The second method adds a dynamic element to the labor reallocation component and helps to improve the measure of structural change. Building on the decomposition proposed by de Vries et al. (2013), the reallocation term of the first method is split into two components: the first component captures whether workers move to sectors with above-average productivity levels (static reallocation effect), whereas the second component measures whether workers are moving to sectors that are experiencing positive (negative) productivity growth (dynamic reallocation effect). This allows for more granular analysis of labor reallocation, while helping to obtain a cleaner measure of structural change.
- The third method we use controls for the bias present in the other two methods—that all expanding sectors contribute positively to aggregate productivity, even when they have below average productivity levels or growth rates. The decomposition follows de Vries et al. (2013) and adjusts the static and dynamic reallocation effects of an expanding sector to take into account its relative productivity level and its relative productivity change. The adjusted decomposition does not affect aggregate contributions from the within-effects and structural change, but it allows to measure the contribution of each sector to aggregate labor productivity growth. For example, the decomposition allows to determine the contribution of the manufacturing sector to aggregate labor productivity growth while decomposing this contribution into within and between components.

Decomposition of aggregate labor productivity in Poland and in Europe

15. Across Europe, sources of aggregate labor productivity vary.

- In the CE3 group (Czech, Poland, and Slovakia) aggregate productivity growth has been mainly powered by within-sector productivity gains, particularly in manufacturing.
- In core Euro area, there is much more heterogeneity. In Germany, there is evidence of declining aggregate productivity driven by both negative within-sector productivity growth and negative structural change since the global financial crisis.[4] In France, the negative contribution from structural change is notable but dampened by positive within-sector productivity gains in the real estate, public administration, and manufacturing sectors. In Italy, the recent decline in aggregate labor productivity is due to productivity losses in almost all sectors.

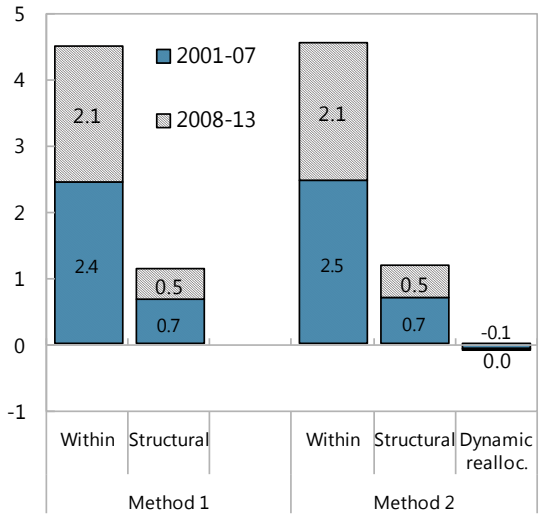
16. In Poland, labor productivity growth has been largely driven by within-sector gains, although structural transformation has also played an important role. Within-sector productivity growth accounted for the bulk of aggregate productivity growth during 2002–13, while the remaining one-fifth is explained by structural transformation. While this result is consistent across the three methods used in this study, it is likely only a lower bound estimate for the contribution of structural transformation. When using more granular sectoral data for Poland (which are not available for all countries in this study), structural transformation becomes much more important for overall productivity gains (Figure 3).[5]

[4] Due to missing data for the manufacturing sector in Eurostat for Spain, we were not able to proceed to the full decomposition of aggregate labor productivity for the country.

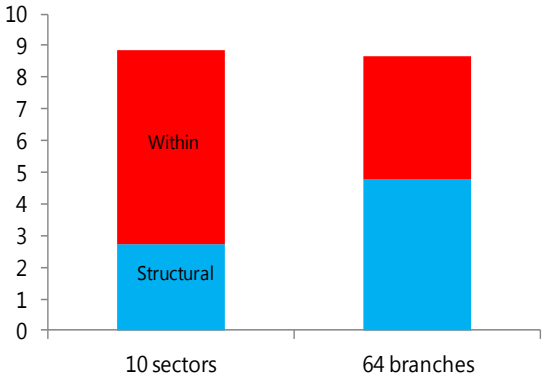
[5] This refers to the case of the economy divided into 64 branches instead of 10 sectors.

Figure 3. Poland: Decomposing Aggregate Labor Productivity

Poland: Decomposing aggregate labor productivity
(Average growth over seven years; in percent)



Structural Transformation Estimates
Decomposition of Changes in Labor Productivity, 2004–10
(thousands PLN 2000)



Source: Eurostat.; IMF staff estimates.

Source: IMF staff estimates.

17. Most of the within-sector productivity gains came from manufacturing. The sector has benefited from successful integration in pan-European supply chains and the associated technological and capital transfers, which helped to boost its productivity (Table 1).

Table 1. Decomposition of Aggregate Labor Productivity Growth in Poland

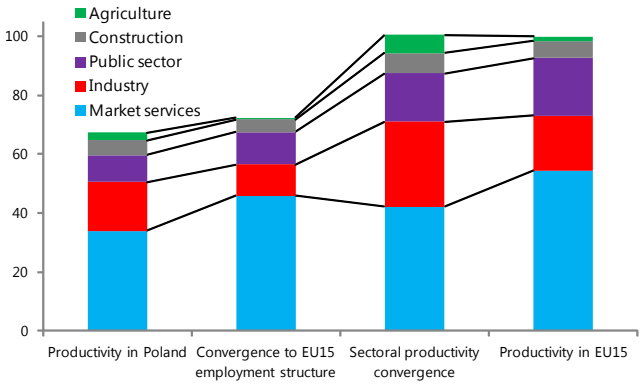
			Components due to:					
			Within		Between			
	Labor productivity growth				Static		Dynamic	
Sectors	2001–07	2008–13	2001–07	2008–13	2001–07	2008–13	2001–07	2008–13
Agriculture			0.20	0.11	0.22	0.07	0.08	0.04
Arts			0.04	0.01	0.02	0.01	0.00	0.00
Construction			0.05	0.18	0.02	0.05	0.00	0.00
Finance			0.05	-0.04	0.14	0.02	0.00	0.00
Industry			0.12	0.13	-0.02	0.03	0.00	0.00
Information and communication			0.01	0.10	0.14	0.06	-0.01	0.01
Manufacturing			1.09	1.08	0.00	-0.07	0.01	-0.04
Professional and Scientific activities			-0.01	0.06	0.17	0.15	-0.03	-0.01
Public administration			0.25	-0.01	0.00	0.08	0.00	-0.03
Real estate			0.36	0.01	-0.20	0.06	-0.08	0.00
Wholesale and retail			0.33	0.46	0.20	0.01	-0.02	0.00
Total economy	**3.2**	**2.6**	**2.5**	**2.1**	**0.7**	**0.5**	**-0.1**	**0.0**

Source: IMF staff calculations.

18. Structural transformation since the crisis has been led by the dynamic services sector. Notable structural transformation gains were recorded in real-estate, science and technology, and to a lesser extent in information and communication (Table 1). At the same time, contributions to structural transformation from traditional sectors, such as agriculture, were less significant than in the pre-crisis period.

19. Going forward, sustaining aggregate productivity improvements would require that structural transformation be accompanied by additional within-sector productivity enhancement. Our empirical findings suggest that while structural transformation is helpful, it should be accompanied by continued improvements in within-sector productivity to result in meaningful catch-up gains for Poland. The illustrative scenarios in the text-chart shows that simply aligning Poland's employment structure with the EU average, while maintaining within-sector productivity at its current levels ("convergence to EU15 employment structure" bar), is not sufficient to generate significant productivity improvements. This is because matching Poland's employment shares to the EU structure does not automatically imply reallocation of labor toward more productive sectors. For example, while reducing the share of agriculture in Poland toward the EU15 level would improve aggregate productivity (since agriculture is one of the least productive sectors in Poland), increasing the size of the public sector in Poland toward EU15 levels, while maintaining its current productivity level, would have negative productivity implications for Poland, given the current below-average productivity in this sector. Similarly, reducing the share of industry in Poland to the EU15 average would have an immediate negative impact on aggregate productivity in Poland, given that this sector currently exhibits above-average productivity in Poland. This suggests that to maximize aggregate labor productivity gains, structural transformation has to go hand-in-hand with continued enhancement of within-sector productivity.

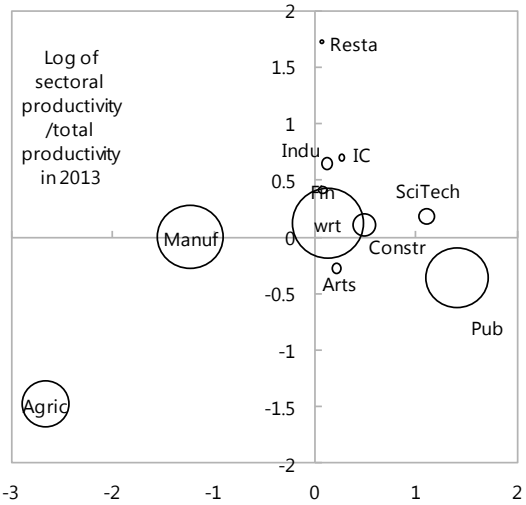
Illustrative scenarios of productivity convergence
(Productivity decomposition; percent of productivity in EU15)



Note: Convergence to EU15 employment structure assumes adopting EU15 employment structure in Poland with sectoral productivity levelsunchanged. Sectoral productivity convergence assumes increase of sectoral productivities to EU15 levels with employment structure unchanged.

Sources: Eurostat and IMF staff calculations.

Poland: Sectoral Productivity and Changes in Employment
(Size of the bubble indicates initial employment share in 2008)



Sources: IMF staff calculations.

D. Factors Facilitating Structural Transformation

20. Exploratory regressions are performed to identify the main determinants of structural transformation. While previous research has generally focused on identifying the drivers of aggregate labor productivity growth, few studies (McMillan et al., 2014) examined the determinants of structural transformation. To the best of our knowledge, our paper is the first to examine the key drivers of structural transformation in Europe. McMillan et al. (2014) provides a framework to model structural transformation. We use similar methodology to identify the main determinants of structural transformation in Europe. Structural transformation is measured by static reallocations (see equation (3) in Appendix II). We then regress this measure on a large set of control variables which includes:

- **Initial level of economic development.** Since the pattern of structural transformation might evolve with economic development, we control for a quadratic term of lagged real GDP per capita in PPP terms.
- **The initial share of agriculture in total employment.** We expect as in McMillan et al. (2014), a positive contribution of this variable to structural change. The wider the initial structural gaps the larger the room for growth-enhancing structural change. Data are from Eurostat and are measured at the beginning of each period.
- **The share of temporary employment.** We expect the share of temporary employment to be negatively correlated with structural transformation. The high share of temporary contracts is in general associated with lower onsite investments in vocational training. Low quality of jobs is a key impediment to labor mobility from low-productivity to high-productivity sectors. Data on this variable are from the OECD.
- **The importance of long-term unemployment.** Long-term unemployment has been shown to have an adverse effect on the quality of the labor force and on the likelihood of job seekers to find new higher-quality jobs. Long-term unemployment is also an indication of structural impediments in the labor market, such as skill mismatches, which ultimately would impede structural transformation. The Eurostat share of unemployed people for more than a year is used.
- **Globalization is measured by greenfield foreign direct investment (FDI).** High integration into the global economy, characterized by large inflows of greenfield FDI, should facilitate the creation of new firms, bringing about economic diversification and structural change. We use the share of greenfield FDI in GDP from the United Nations Conference on Trade and Development (UNCTAD) database.
- **The quality of the business climate.** Favorable business climate encourages the development of new industries and sectors and contributes to economic diversification and thereby supports structural transformation. We use the World Bank (Doing Business dataset) measure of the cost to enforce contracts as our main indicator of business climate quality.
- **The size of the public sector.** A disproportionately large public sector could be associated with lower structural transformation if labor productivity in the public sector lags aggregate labor

productivity in the economy. An unduly large government sector has also the potential of crowding-out private sector, and could impede competition and entrepreneurship through inefficient taxation or crowding-out effects in financial markets. We control in the specification for government expenses as a percentage of GDP.

- **Country specific random-effects** are controlled for to take into account unobserved country characteristics. Random effects are preferred over fixed-effects given the narrow time range (maximum observations per country is 3 non-overlapping periods of 7 years). This also ensures that the main focus remains on between-country variations rather than within-country effects. We are interested in understanding why some countries experienced large and positive structural transformation while others did not.
- **We control for period dummies** to account for common shocks affecting all countries in the sample.

21. The results are consistent with the intuition above—in particular a more welcoming business climate and a less rigid labor market contribute positively to structural transformation. Specifically, a country's attractiveness to greenfield FDI is positively associated with structural change. On the other hand, an unwelcoming business climate (e.g., weak enforcement of contracts and excessive) has a negative effect on structural transformation. The high share of temporary employment and long-term unemployment (capturing various structural labor market rigidities) are found to be negatively correlated with productive labor reallocations (Table 2). These results are robust to alternative specifications in which we expanded the list of explanatory variables. We controlled for education level, exchange rate depreciations, inflation, but their respective effects on structural transformation are not statistically significant.

Table 2. Correlates of Structural Transformation in Europe

Dependent variable: Structural transformation	(1)	(2)	(3)	(4)	(5)	(6)
Initial GDP per capita, ln	4.766	0.845	7.459*	5.186	4.507	2.983
	(3.471)	(3.586)	(4.001)	(3.807)	(5.041)	(5.455)
(Initial GDP per capita, ln)^2	-0.228	-0.0432	-0.344*	-0.253	-0.206	-0.133
	(0.169)	(0.174)	(0.192)	(0.186)	(0.243)	(0.262)
Initial share of agriculture	0.0571***		0.0426***		0.0580***	0.0579***
	(0.0148)		(0.0131)		(0.0147)	(0.0151)
Long-term unemployment rate	-0.00979**	-0.0104**	-0.00953**			
	(0.00407)	(0.00444)	(0.00428)			
Greenfield FDI-to-GDP		0.0697***	0.0859***	0.0637***		
		(0.0175)	(0.0145)	(0.0190)		
Constraints on business climate				-0.0140*		
				(0.00797)		
Share of temporary contracts					-0.0174*	-0.0168*
					(0.00934)	(0.00916)
Government expenses-to-GDP						-0.000613
						(0.00260)
Intercept	-24.55	-3.639	-40.13*	-26.12	-24.38	-16.44
	(17.87)	(18.55)	(20.94)	(19.54)	(26.05)	(28.27)
Observations	78	52	52	52	70	65
Number of countries	28	26	26	27	27	27

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff calculations.

E. Factors Facilitating Within-Sector Productivity

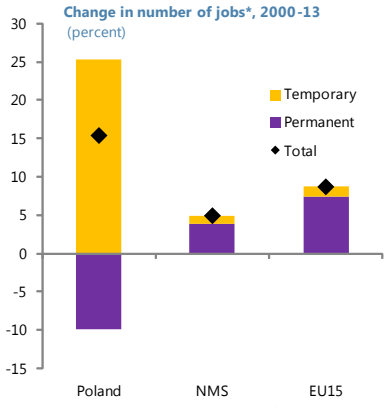
22. Recent cross-country research confirms the importance of investing in human capital and removing market frictions to boost sectoral productivity. Recent studies using macro-variables and focusing on within-sector productivity have identified credit and labor market frictions, such as wage rigidities and sectoral heterogeneity in the access to external financing, and insufficient investment in human capital as the primary obstacles to sectoral productivity growth (Nabar and Yan, 2013).

23. Vertical productivity spillovers and better business environment have also been found important. Studies adopting firm-level approaches emphasize the central role played by vertical productivity spillovers from multinational firms to local firms (Kinda, 2012). Recent IMF staff research confirms that participation in global supply chains is positively associated with substantial technological transfers and productivity growth in the manufacturing sector in Eastern European countries (IMF, 2013). Factors such as good management experience, agglomeration effects, and the provision of infrastructural services have also been found significant in explaining differences in productivity levels (Chaffai et al., 2012).

F. Implications for Poland

24. For Poland, continued economic convergence would require a concerted effort to complete structural transformation and further enhance within sector productivity. This would entail facilitating labor mobility across sectors and moving up the value-added chain (Figure 4).

25. Structural transformation would require facilitating labor mobility. Sectoral labor mobility is held back by the high prevalence of temporary contracts, the high numbers of regulated professions,[6] barriers to greenfield FDI, and barriers to internal migration. Temporary contracts reduce incentives to invest in worker's human capital and training, making it less likely that they acquire new skills necessary to succeed in new jobs. More generally, there is a need to increase adult participation in lifelong learning to diversify skills and factilitate labor mobility. Mobility to higher-productivity sectors is also impeded by a large number of regulatory requirements. Geographical mobility of labor is deterred by overly regulated rental market, including the strong protection of tenants, which discourages investment in rental properties and drives up rents in cities and other dynamic regions that generate jobs. And attracting greenfield investment, which supports economic diversification, requires improvements



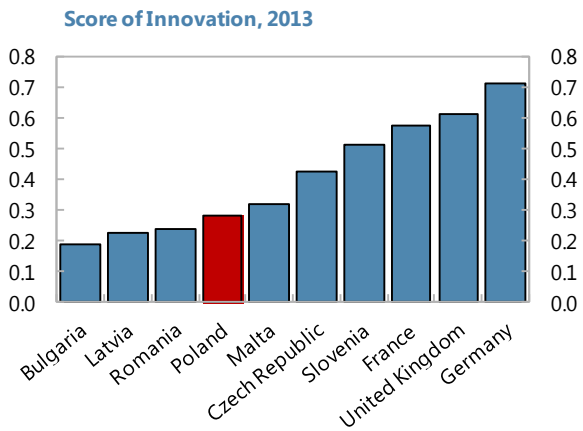
* Number of persons employed, excl. self-employed.

Sources: Eurostat and IMF staff calculations.

[6] Given ongoing measures to substantially reduce the numbers of regulated professions in Poland, the number shown in the text might not take into account those recent measures.

to the business climate. Policies should therefore focus on:

- Reducing labor market duality by better aligning temporary employment contracts (i.e., Civil Law Contracts) with regular contracts and limiting duration of consecutive short-term contracts. Temporary civil law contracts have often been used by employers to avoid paying employees' social security contributions; they have also been shown to reduce incentives for employers to invest in employee training (World Bank, 2015).
- Improving adult participation in lifelong learning to diversify skills.
- Further streamlining the list of regulated professions to facilitate labor mobility to services sectors.
- Further reducing regulatory hurdles in the rental market to ease geographical mobility.

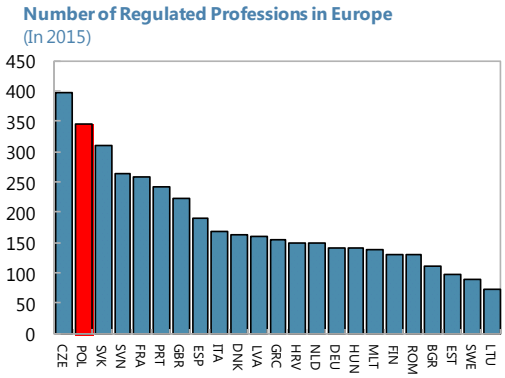


Source: European Commission

- Improving business climate to strengthen economic diversification and aid sectoral mobility.

26. Enhancing within-sector productivity entails moving up the value-added chain.

Poland's integration with the German supply chain has resulted in welcome technology transfers and has increased the sophistication of domestic value added embodied in exports. Further advancement along the value-added chain would require continued innovation—an area where Poland still lags behind its peers. Increasing research and development (R&D) expenditures, including through FDI, could help spur innovation. Better targeted vocational training would facilitate the absorption of new production methods and technologies. Policies should therefore focus on:

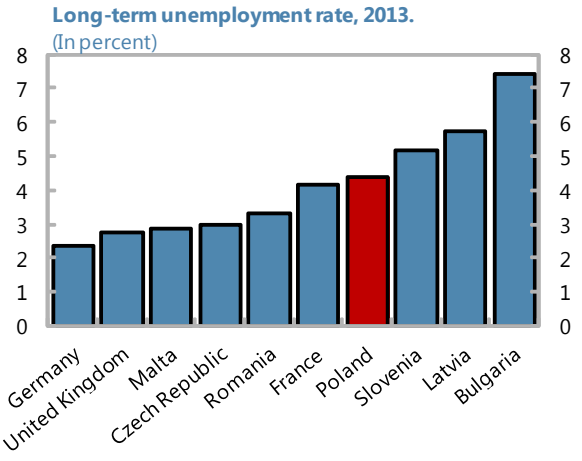


Sources: European Commission

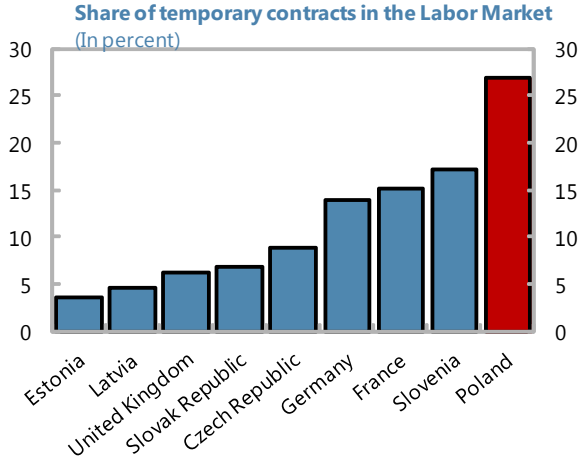
- Improving investment climate to attract new FDI and the associated new technologies and know-how, including by easing regulations for construction permits and strengthening contract enforcement.
- Incentivizing R&D spending in the business sector, including through well-targeted tax incentive schemes, supported by further improvements in tax administration to reduce potential abuse of such schemes for tax avoidance.
- Better aligning vocational training with employers' needs.
- Maintaining strong institutions and policies to increase the risk-adjusted returns to innovation.

Figure 4. Structural Developments in Poland

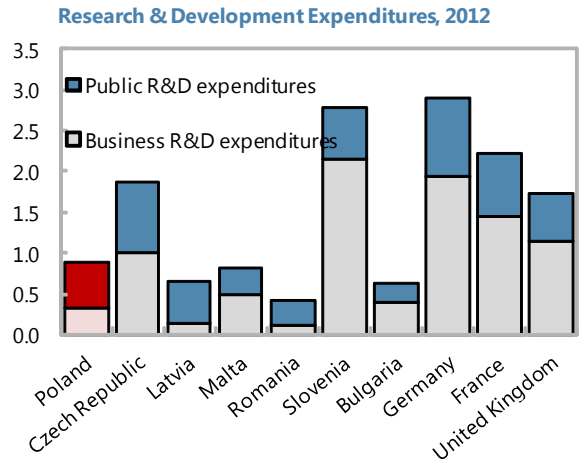
Long-term unemployment is high...



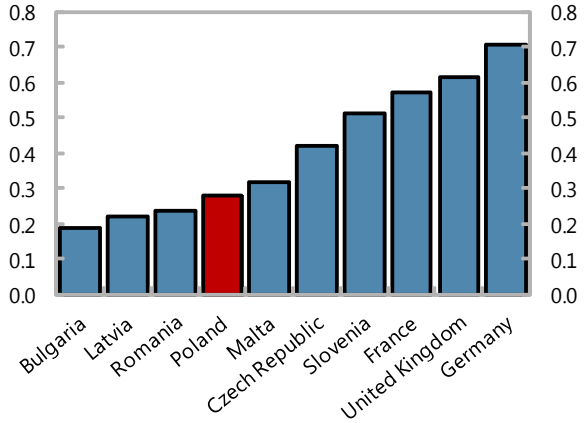
...and employment is dominated by temporary contracts.



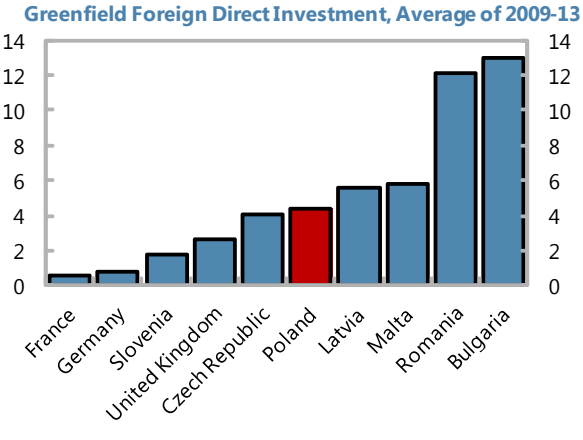
R&D spending has been low...



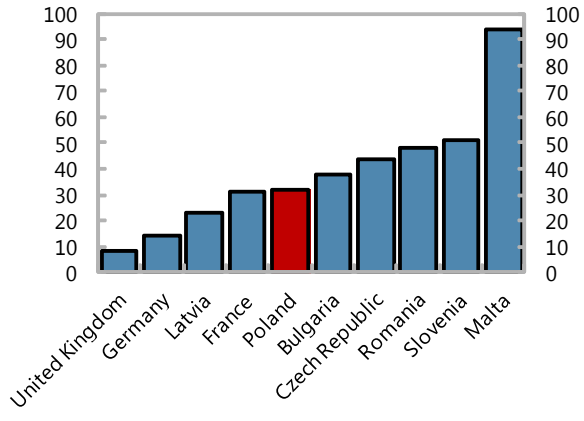
...and innovation has been lacking.



Greenfield FDIs should be increased further...



...including by improving the business climate.



Source: Haver analytics; OECD stat.; UNCTAD; European Commission; The World Bank.

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Appendix I. List of Sectors

We use a 10-sector decomposition for each EU member country. Annual sectoral data published by the European Commission on real sectoral value added and employment under the Nomenclature of Economic Activities (NACE) revision II, are used for each country (ESA 2010 data). This provides a unified and comparable breakdown of national account data by sectors over the past two decades.

Table AI.1. Sectors (NACE Rev. 2)

Agriculture, forestry and fishing	Agri
Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	Arts
Construction	Constr
Financial and insurance activities	Fin
Industry (excludes manufacturing and construction)	Indus
Information and communication	IC
Manufacturing	Manuf
Professional, scientific and technical activities; administrative and support service activities	SciTech
Public administration, defence, education, human health and social work activities	Pub
Real estate activities	Resta
Wholesale and retail trade, transport, accommodation and food service activities	Wrt

Source: Eurostat.

Appendix II. Methods to Decompose Aggregate Labor Productivity

We use a standard decomposition of aggregate labor productivity. Researchers typically use the framework from Fabricant (1942) which decomposes the change in aggregate productivity into a "within" and a "between" effects. The "within effect" captures productivity growth within sectors, whereas the "between effect" measures the productivity effect of labor reallocation across sectors. Three methods are used to perform the decomposition given that each method has important ramifications for the measurement and interpretation of structural change.

The first method uses initial employment shares and final period productivity levels. This follows closely McMillan et al. (2014). The change in aggregate labor productivity level (P_t) is decomposed as follows:

$$\Delta P_t = \sum_i \Delta P_{it} \left(\frac{L_{i0}}{L_0}\right) + \sum_i \Delta \left(\frac{L_{it}}{L_t}\right) P_{it} \qquad (1)$$

where *i* stands for the sector, *L* for the number of employed people, and *t* the period indicator. The second term on the right-hand side quantifies the degree of structural transformation. The change in aggregate productivity is decomposed into within-sector productivity changes (the first term on the right-hand side which we call the "within-effect" (also known as "intra-effect"), and the effect of changes in the sectoral allocation of labor which we call the "reallocation effect," (the second term, also known as the "shift-effect" or "structural-change effect"). The within-effect is positive when the weighted change in labor productivity levels in sectors is positive. The reallocation-effect measures the contribution of labor reallocation across sectors, being positive when labor moves from less to more productive sectors. As discussed by de Vries et al. (2013), it is worth noting that the reallocation term presented in equation (1) is only a static measure of the structural change as it depends on differences in productivity levels across sectors, not on growth rates.

The second method combines static and dynamic reallocation effects. Building on the decomposition proposed by de Vries et al. (2013), the reallocation term of equation (1) is split into two terms: whether workers move to above-average productivity level sectors (static reallocation effect) and whether workers are moving to sectors that are experiencing positive (negative) productivity growth (dynamic reallocation effect). This method has an advantage of better measuring the reallocation effects by splitting it into a static and a dynamic part: the contribution from the reallocation of workers to sectors with above average productivity levels (static reallocation effects or structural change) and the contribution from the reallocation to sectors with above average productivity growth (dynamic reallocation effects). The decomposition looks as follows:

$$\Delta P_t = \sum_i \Delta P_{it} \left(\frac{L_{i0}}{L_0}\right) + \sum_i \Delta \left(\frac{L_{it}}{L_t}\right) P_{i0} + \sum_i \Delta \left(\frac{L_{it}}{L_t}\right) \cdot (\Delta P_{it}) \qquad (2)$$

The third term in equation (2) represents the joint effect of changes in employment shares and sectoral productivity (Timmer, 2000).

The third method helps to assess sectoral contributions to labor productivity growth. The method controls for the bias—present in all previous methods—that all expanding sectors contribute positively to aggregate productivity, even when they have below average productivity levels or growth rates. The decomposition follows de Vries et al. (2013) and adjusts the static and dynamic reallocation effect of an expanding sector to take into account its relative productivity level and its relative productivity change. We divide sectors into expanding and shrinking ones based on changes in their employment shares and calculate the static between-effect relative to the average productivity level of the shrinking sectors and the dynamic between-effect relative to the average productivity change of the shrinking sectors. The modified decomposition is as follows:

$$\Delta P_t = \sum_i \Delta P_{it} \left(\frac{L_{i0}}{L_0}\right) + \sum_j \Delta \left(\frac{L_{jt}}{L_t}\right) \left(P_{j0} - P_0^*\right) + \sum_j \left(\Delta P_{jt} - \Delta P_t^*\right) \cdot \left(\Delta \left(\frac{L_{jt}}{L_t}\right)\right) \qquad (3)$$

where *j* is the set of expanding sectors, and *k* is the set of shrinking sectors, and average labor productivity of shrinking sectors at time *t* is given by:

$$P_t^* = \frac{\sum_k \Delta \left(\frac{L_{kt}}{L_t}\right) P_{kt}}{\sum_k \Delta \left(\frac{L_{kt}}{L_t}\right)} \qquad (4)$$

While this adjusted decomposition does not affect aggregate contributions from the within and structural change, it allows gauging individual sectors' contribution to aggregate productivity growth.