INTERNATIONAL MONETARY FUND

REPUBLIC OF POLAND

SELECTED ISSUES

June 2014

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June 5, 2014

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CONTENTS

GLOBAL FINANCIAL SPILLOVERS TO EMERGING MARKET SOVEREIGN BOND MARKETS: THE ROLE OF FOREIGN PARTICIPATION AND THE INVESTOR BASE[1]

Foreign holdings of Polish government bonds have increased substantially over the last decade. While foreign participation in local-currency sovereign bond markets provides an additional source of financing and reduces sovereign yields, it has also given rise to concerns about increased sensitivity to shifts in market sentiment. The analysis in this paper suggests that foreign participation plays an important role in transmitting global financial shocks to local-currency sovereign bond markets by increasing yield volatility and, beyond a certain threshold, amplifying these spillovers. For Poland, the implication is that the level of foreign participation poses risks for the country, but the well-diversified investor base, strong fundamentals, and sound policy frameworks are important mitigating factors that could help dampen the impact of adverse financial spillovers.

A.   Introduction

1.   Foreign participation in emerging market (EM) local-currency sovereign bond markets has increased in recent years. In the aftermath of the global financial crisis, supportive monetary policy by major central banks and ample global liquidity has been associated with an increase in foreign participation in EM local-currency sovereign bond markets (foreign participation in EM

foreign-currency bond markets was broadly stable, although much higher than in local-currency markets).[2] In Poland, as in many other EMs, foreign holdings of government bonds increased substantially, helping to lower government bond yields, particularly of those issued in local currency. The recent modifications to Poland's second pension pillar—which reduced private pension funds' holdings of government bonds—has led to further increases in the share of

Foreign Holdings of Government Bonds
(Percent; EM average)

- - - Share of foreign holdings of FX government debt (percent)
—— Share of foreign holding of LC denominated govt debt (RHS, percent)
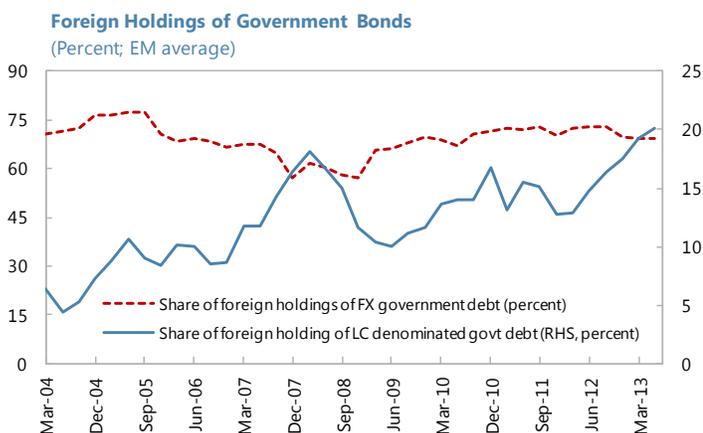
Sources: Arslanalp and Tsuda (2014); IMF staff calculations.

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[2] The opposite has been true for offshore issuance by the financial and non-financial corporate sectors which have taken advantage of depressed yields and ample liquidity to issue FX debt.

foreign investors in the sovereign bond market. Nonetheless Poland's overall investor base (which covers both holdings of foreign-currency and local-currency sovereign bonds) remains relatively well diversified compared to other EMs.[3]

2.   The increase in foreign participation in EM sovereign bond markets gives rise to questions about the transmission of global shocks. In mid-2013, and more recently in January 2014, global uncertainty, including over the future path of US monetary policy, led to sizeable capital outflows from EMs and increased volatility in financial markets. Indeed, Ebeke and Lu (2014) provide a robust empirical finding that the increase in foreign holdings of local-currency sovereign bonds in Poland and other EMs has been associated with higher volatility but lower yields. Their analysis also revealed the key role played by macroeconomic fundamentals (especially lower public debt and higher international reserves) in dampening the adverse effects of foreign participation on the volatility of EM sovereign bond yields.

3.   In Poland, understanding the role of foreign participation in local currency bond markets is important. Given the expected tightening in global financial conditions arising from eventual normalization of US monetary policy, alongside the substantial increase in foreign holdings of Polish sovereign bonds in recent years, Poland could be adversely affected by a withdrawal of foreign capital. More specifically, an increased presence of foreign investors could raise concerns about higher volatility and larger sensitivity of Polish government bond yields to shifts in market sentiment.

Poland: Yield and Foreign Participation
(Percent)
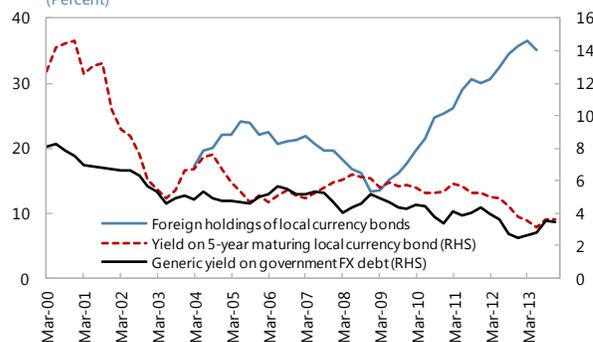
Sources: Country authorities; Haver Analytics; Bloomberg.

4.   This paper investigates the role of foreign participation in transmitting global financial shocks into EM government bond markets. It models the sensitivity of EM sovereign bond yields to global financial shocks, conditioned on the extent of foreign participation and the concentration of the investor base. The paper also examines whether the impact of foreign

Concentration of the Investor Base in EMs
(Normalized Herfindahl index; higher values indicate concentration)
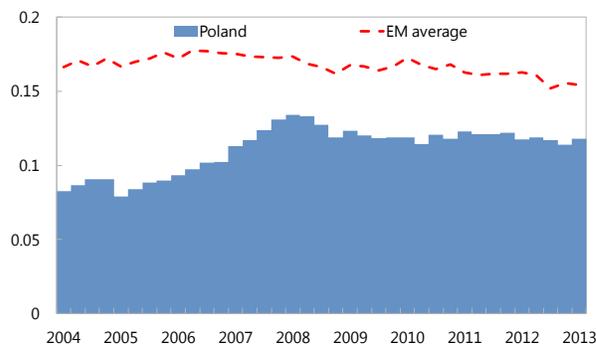
Source: IMF staff calculations.

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[3] We discuss in Section C the methodology used to compute country-specific indices of investor base concentration using the Herfindahl index. Compared to the typical EM, Poland has always exhibited a more diversified investor base (disaggregated by type of institutions and by the residency criterion).

participation differs between sovereign foreign-currency denominated bond yields and local-currency denominated yields.

5.   The paper finds that foreign participation and the concentration of the investor base matter for the transmission of global shocks.

- Higher foreign participation in *local-currency denominated* sovereign bond markets increases the transmission of global financial shocks, but especially once a threshold has been reached (foreign participation above 30 percent).

- At the same time, higher foreign holdings of *foreign-currency denominated* bonds do not appear to have an impact on the transmission of shocks. Possible reasons for this finding are discussed below (Section B). But such a distinction between the behavior of foreign investors in EM local- vs. foreign-currency bond markets does not exist in the literature to our knowledge.

- A higher concentration of the investor base (approximated using disaggregated data of the institutional profile of investors holdings EM total government debt) makes EM local-currency sovereign yields more sensitive to global financial shocks. Conversely, a diversified investor base can help ameliorate the impact of shocks.

- Finally, the paper finds that strong macroeconomic fundamentals—such as low inflation, strong and stable output growth, and moderate public debt levels—help reduce the level and the volatility of EM sovereign bond yields.

6.   The remainder of this paper is structured as follows: Section B examines the impact of foreign participation on the level and volatility of government bond yields. Section C assesses the transmission of global financial shocks, and Section D concludes.

B.   Foreign Participation and Government Bond Yields

Empirical Approach

7.   We examine the impact of foreign participation on the level and volatility of local- and foreign-currency denominated government bond yields. Our sample uses quarterly data for 17 emerging market economies over 2004:Q1–2013:Q2. The specification extends the work of Ebeke and Lu (2014) in two areas. First, we explicitly differentiate between EM foreign-currency sovereign bonds and local-currency sovereign bonds when investigating the effect of foreign participation. As Figure 1 shows (see Appendix), EM foreign-currency sovereign bonds are mostly held by non-residents and these holdings appear relatively stable compared to foreign holdings of EM local-currency bonds. Second, we have a larger sample of countries and cover a longer period (which includes both the pre and post-crisis period) to better capture the dynamics in the foreign participation in EM sovereign debt markets. The estimated model takes the form:

$$r_{it} = \vartheta_1 F_{it} + X_{it}^{'}\Gamma + u_i + \tau_t + \varepsilon_{it} \qquad (1)$$

- The dependent variables (r_{it}) are the level and volatility of the *5-year local currency yield* and *EMBI benchmark foreign currency yield*.[4] Volatility is computed as the log of the standard deviation of weekly changes in the yield over each quarter (12 weeks) capturing the within country-quarter volatility of the government bond market in each country over time.

- Foreign holdings of local and foreign currency-denominated bonds are given by F_{it}. In the case of local-currency (foreign-currency) denominated sovereign bonds, foreign participation is measured as foreign holdings of local-currency (foreign-currency) denominated government debt in percent of total government local-currency (foreign-currency) denominated government debt. Foreign holdings data are drawn from the Arslanalp and Tsuda (2014) dataset, which draws on a range of official sources and provides a decomposition of holdings of government bonds by the residency of the holders (foreign versus domestic) and by type of investors (official sector, banks, non-banks).[5]

- X_{it} are controls for country fundamentals: (i) the current account balance to GDP; (ii) real GDP growth (or the volatility of growth); (iii) inflation; and (iv) forward exchange rate volatility. A modified set of control variables is included for each specification, as determinants of the first (the quarterly average yield) and second moments (the standard deviation of the yield) of bond yields differ somewhat. The model includes country fixed effects (u_i) to account for unobserved time-invariant factors and time effects (τ_t) to account for unobserved global shocks.[6]

8.   We control for endogeneity in two ways. Foreign participation in EM sovereign bond markets is potentially endogenous to the current and expected dynamics of yields—the more volatile a country, the less likely foreign investors will be interested in holding its bonds. To control for endogeneity, we first simply instrument with two quarter lags of the foreign participation. Next, we use the *predicted* values of foreign holdings ratios explained by a geographical measure of "financial remoteness", which has the advantage that it is plausibly exogenous to fluctuations in EM sovereign bond yields.[7] While financial remoteness is time-invariant for a country, the time-varying estimates (quarter-by-quarter) of its impact on the composition of the investor base adds a time-varying dimension at the country level. In all bond yield models where foreign participation enters

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[4] The 5-year bonds are chosen over other maturities to maximize sample size and to capture the most widely traded paper in the secondary market.

[5] We tested the disaggregated components (i.e. foreign bank and non-bank participation) individually but since coefficients are not significantly different from one another we use aggregate foreign holdings.

[6] When global financial shock variables are accounted for, controlling for time dummies becomes redundant.

[7] Rose and Spiegel (2009) discuss why geographical distance could matter for international finance. Empirical evidence suggests that distance exacerbates information symmetries. We use their data in our estimation. We control for the volatility of the forward bilateral exchange rate (as a proxy for market characteristics and expectations) in each auxiliary equation predicting the geographical-based measure of foreign holding and investor base concentration.

the equation contemporaneously, we use instrumental variable techniques to tackle endogeneity concerns.

Results

9.   The results suggest that foreign investors behave differently in local-currency *vs*. foreign-currency sovereign bond markets.

- In the case of local currency-denominated government bonds, higher foreign participation increases the volatility of the yield, but decreases the level of the yield (Tables 2 and 4). In all specifications, the results show a positive association between foreign participation and local-currency bond yield volatility, but the coefficient only becomes significant when we instrument foreign holdings with its lagged values or using the financial remoteness-based instrument. Similar findings are documented in Ebeke and Lu (2014) for the period after the global financial crisis and, Peiris (2010) for the period before the crisis.

- In contrast, the extent of foreign holdings of foreign currency-denominated bonds is not found to have an impact on either the level or the volatility of foreign currency-denominated bond yields (Tables 1 and 3). One possible explanation is the role of currency risk, which is important in the case of local currency-denominated bonds. Other explanations might be related to the type of investor (those choosing foreign-currency sovereign bonds may be buy-and-hold investors, while those holding local-currency sovereign bonds may have a shorter-term horizon), their associated degrees of risk aversion, and their ability to hedge foreign currency risk.

10.   Stronger macroeconomic fundamentals are generally associated with lower yield levels and reduced yield volatility. Higher indebtedness increases yield volatility, as does higher output growth volatility. Both factors serve to increase uncertainty in the real economy, which likely spills over into greater bond yield volatility. Higher real GDP growth decreases the level and volatility of both local and foreign-currency bond yields, as better growth prospects encourage more capital inflows and the country's debt burden becomes easier to service. Higher inflation is positively associated with the level of bond yields.

C. Foreign Participation, Investor Base Concentration, and the Transmission of Shocks

Empirical Approach

11.   We examine the impact of foreign participation and the concentration of the investor base on the transmission of shocks.[8] Specifically, we focus on differences in the reaction of EM

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[8] Our prior is that the structure of the investor base would not directly impact the level or the volatility of the yield (as does foreign participation) but rather serves to amplify or dampen global financial shocks. Hence, we include the concentration interacted with the global financial shock in this specification and not on its own as previously.

sovereign bond yields to global financial shocks depending on the level of foreign participation and the concentration of the investor base.

12.   There are several channels through which external shocks may affect EM sovereign bond yields (see Lim et al., 2014):

- *The liquidity channel is captured by the U.S. 3 month t-bill rate (US3mt).* Higher t-bill rates raise the opportunity costs of investing in EM assets. A normalization of financial conditions in the United States would lead to a rise in U.S. short-term interest rates. This, in turn, would reduce global liquidity, possibly resulting in outflows from (or fewer inflows to) EMs and higher EM sovereign bond yields.

- *The portfolio balance channel is captured by the U.S. 10-year Treasury bond rate (US10Y).* This measure captures the effect Fed action can have on long-term yields, resulting in portfolio rebalancing. Changes in long-term U.S. yields may trigger portfolio rebalancing in favor or against risky assets, which include EM sovereign bonds.

- *The confidence channel indicator is the VIX (VIX).* The indicator captures market sentiment (global risk aversion) for investing in risky assets. As monetary policy normalizes in major advanced country central banks, uncertainty created by shifts in assets prices and associated spillovers into EMs could lead to an increase in the VIX.

13.   The specification examines the impact of global shocks on EM sovereign bond yields, conditional on the level of foreign participation and the concentration of the investor base.[9] To capture the transmission of shocks, we interact U.S. interest rate shocks and global risk aversion (VIX) with foreign participation and the concentration of the investor base to investigate whether financial spillovers into EMs increase with the level of foreign participation or decrease with the diversity of investors holding EM assets. The model takes the form:

$$r_{it} = \theta_1 IF_{it-1} + \left(\theta_2 + \theta_3 D_{it-1}\right) S_t + X_{it} \Gamma + u_i + \varepsilon_{it} \qquad (2)$$

- The dependent variable (r_{it}) measures either the yield associated with the 5-year government local-currency bond or alternatively, the country-specific sovereign benchmark bond yield.

- IF_{it-1} in this specification represents foreign participation (defined as in the previous specification) and, in alternative specifications, the concentration of the investor base. The concentration of the investor base is computed for each country and time period by creating a Herfindahl index using the decomposition of the holdings of total gross government debt into its 6 components: foreign (central bank, bank, and non-bank holdings) and domestic (central bank, bank, and non-bank holdings). The index is normalized to range between 0 and 1. A higher *H*-index implies more concentration and a less diversified investor base, which could amplify the transmission of adverse shocks. A more diversified investor base is

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[9] As the financial shock is expressed in levels and we are interested in gauging the effects in basis points, we keep the dependent variable expressed in levels of the yield rather than standard deviations (the volatility of the yield).

generally considered to provide a cushion against shocks, as investors may have different preferences in terms of the maturity profile of their investments ("buy and hold" vs. speculative), their degree of risk aversion, and their hedging capacity.

- $$H = \frac{\sum_k (s_k)^2 - 1/n}{1 - 1/n}$$ where $s_k = \dfrac{X_k}{\sum_{k=1}^{n} X_k}$ is the share of a certain type of investor and n is the number of categories (6 in this case).

- D is a dummy variable that takes the value 1 if the one quarter lagged foreign participation in local currency markets is large or equal to D^* (the threshold), and zero otherwise. More formally, we have $D_{it-1} = \mathbf{1}\left[IF_{it-1} \geq D^* \right]$. D ranges between 10 and 40 percent of foreign participation local currency debt; and between 0.1 and 0.25 for the concentration of the investor base.[10] D enters the model with a lag. This reduces the high colinearity between global financial shocks and foreign participation and also the structure of the investor base. Moreover, as threshold models are biased when the conditional variable is endogeneous, lagging foreign participation and the investor base reduces the endogeneity biases that may arise.[11]

- S_t are the global financial shocks: *US3mt, US10Y and VIX*. These are interacted with the dummy variable D and this interaction term is included as an additional explanatory variable in the regressions to test for the existence of a nonlinear effect of global financial shocks conditional on the exposure to foreign investors.

- X_{it} are controls for country fundamentals as defined above.
  θ_2 measures the effect of global financial variables on EM local currency government bond yields when foreign participation (or overall investor base concentration) is below the identified threshold.

- $\theta_2 + \theta_3$ gives the effect of global financial variables on EM yields when foreign participation (or overall investor base concentration) is above the given threshold.

- Finally, θ_3 measures the differential impact of global shocks between the two regimes (above *versus* below the threshold of foreign participation or investor base concentration).

- Foreign holdings ratio (alternatively the concentration of the investor base) cutoffs in the sample are explored, by 1 percentage point increments (or 0.01 unit increments in the case of the concentration of the investor base). The test for no nonlinear effect amounts to a test of the null hypothesis that the coefficient (θ_3) on the interactive variable is equal to zero. Under OLS, the optimal cutoff is the one that also minimizes the residual sum of squares.

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[10] This interval is chosen to allow sufficient data on the left and on the right sides of the range.

[11] This methodology for threshold determination in the case of endogenous regressors in a system- GMM framework has been used by Masten et al. (2008) and Chami et al. (2009) and, Combes and Ebeke (2011).

Results

14.   **The results suggest that the reaction of EM sovereign bond yields to global financial shocks depends on the extent of foreign participation.** As before, while we do not find an impact on the level of foreign-currency yields, we find that the transmission of shocks to the level of the local-currency yields is amplified at higher levels of foreign participation. In particular, the results suggest that, above 30–35 percent, foreign participation increases the transmission of global financial shocks in a significant way (Figure 2 and Table 5).[12] As this level of foreign participation has mostly been reached by EMs after the global financial crisis, our econometric results suggest that the post-crisis period has therefore seen an intensification of financial spillovers into EMs.

- When foreign holdings of local currency bonds lie above 35 percent, the transmission of a shock to the U.S. 10 year yield is amplified by an additional 100 bps. Past the 35 percent threshold, a 100 bps increase in the US yields results in a rise in EM yields of around 140 bps (compared with an increase of only 40 bps below the 35 percent threshold).

- The transmission of shocks to the U.S. 3 month yield also depends on the degree of foreign participation, especially when it exceeds 30 percent. Past this threshold, a 100 bps increase in U.S short-term interest rates increases EM yields by 140 bps (compared with no significant impact below the threshold).

- In periods of global risk aversion (captured by a rising VIX), EMs in which foreign holdings reach around 32 percent of outstanding local currency-denominated bonds experience a larger impact from a shock to the VIX. A two-standard deviation shock in the VIX translates to a 130 bps increase in yields in EMs with foreign participation past the threshold (compared to no significant impact below the threshold).

15.   **The concentration of the investor base also matters for the transmission of global financial shocks.** Our estimates suggest that a threshold of investor base concentration exists around the median of the Herfindahl index in the sample (around the value of 0.2). A high concentration of the investor base (above the 0.2 threshold) makes EM local-currency sovereign yields more sensitive to global financial shocks. A 100 bp increase in the 10-year U.S. yield increases local-currency sovereign bond yields by 70 bps when the investor base is significantly concentrated (i.e., above the 0.2 threshold) compared to 30 basis points when it is more diversified (below the

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[12] Figure 2 shows the value of the interaction coefficient θ_3 multiplied by the given financial shocks (in basis points or in standard deviation) at various levels of foreign participation or investor base concentration. The list of countries which have exhibited foreign holdings of local-currency government bonds around or above the 30 percent threshold is: Argentina, Hungary, Indonesia, Latvia, Malaysia, Mexico, Peru, Poland, South Africa and Ukraine. For most of these countries, foreign-currency government bonds also tend to be held mostly by foreigners (the average foreign participation in foreign-currency government markets is 70 percent) except in Argentina and South Africa where domestic investors are the main holders of foreign-currency government bonds.

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threshold). These findings suggest that efforts to broaden the investor base and promote asset diversification could improve resilience.[13]

16.   Macroeconomic fundamentals can help dampen the adverse spillovers arising from high foreign participation and a concentrated investor base. As demonstrated in Ebeke and Lu (2014), stronger macroeconomic fundamentals (especially lower public debt and higher international reserves) help dampen the destabilizing effects of a higher reliance on foreign investors in EM sovereign local-currency bond markets. Thus, countries that choose to rely more on foreign investors may have a stronger case for preserving a good macroeconomic environment to help insulate themselves against external shocks.

17.   These results should be interpreted with caution. First, the absence of data on the profile of foreign investors (i.e. whether these are retail or institutional investors) holding EM local-currency government bonds makes it difficult to generalize this threshold. Second, most countries reached this threshold after the global financial crisis (when global liquidity strengthened), which makes threshold results heavily dependent on the post-crisis period.

D. Conclusion

18.   This paper shows that foreign investors tend to behave differently in EM local-currency *vs*. foreign-currency sovereign bond markets. Higher foreign participation provides additional financing and decreases the level of the yields, but also increases yield volatility. This finding, however, only holds for foreign holdings of local-currency denominated EM government bond markets and not for foreign holdings of foreign-currency denominated (e.g. Eurobond) bond markets.

19.   Our results also find that higher foreign participation can amplify the impact of global financial shocks, but that a more diversified investor base can ameliorate the effect of the shocks. Higher foreign participation in local-currency denominated sovereign debt markets increases the transmission of global financial shocks (such as those associated with increases in US short- and long-term yields and increases in global uncertainty), but especially once a threshold level (around 30 percent foreign investor share) has been reached. However, some dampening factors exist. First, our results show that a more diversified investor base attenuates the impact of these shocks. Second, strong macroeconomic fundamentals would help insulate against global financial shocks.

20.   Foreign investors have a significant presence in Polish government bond markets, but spillovers from global financial shocks may be dampened by mitigating factors. In Poland, as

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[13] Investigating the impact of higher diversification on local currency asset markets could be a fruitful exercise, however we are constrained by the data that does not allow us to disaggregate who (disaggregation by type of investors instead of the residency principle) the holders of local currency debt are.

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for most EMs, the surge in foreign holdings of EM assets of local currency-denominated government bonds has translated into a significant reduction in government borrowing costs while exposing it to increased yield volatility. However, Poland's strong macroeconomic fundamentals, sound policy frameworks, and relatively diversified investor base can help insulate it against the effects of global financial shocks. Poland's Flexible Credit Line arrangement with the IMF provides additional insurance against external risks.

Figure 1. Global Financial Conditions and Foreign Participation in EMs Government Bond Markets

Global Risk Aversion and Foreign Participation in EM Government Debt Markets
(EM averages)
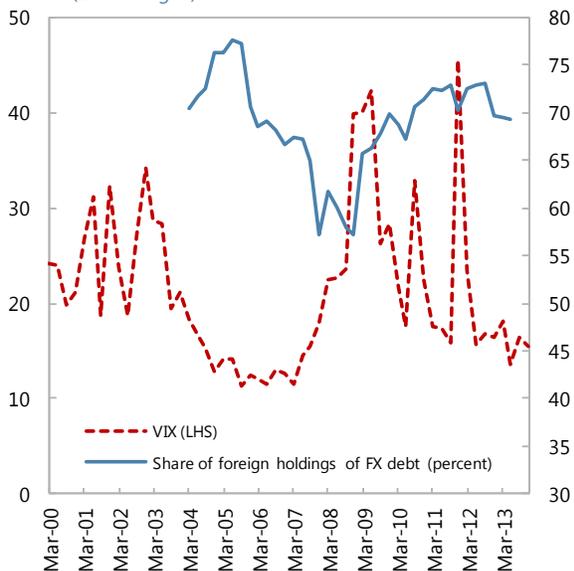
Global Risk Aversion and Foreign Participation in EM Government Local Currency Government Debt Markets
(EM averages)
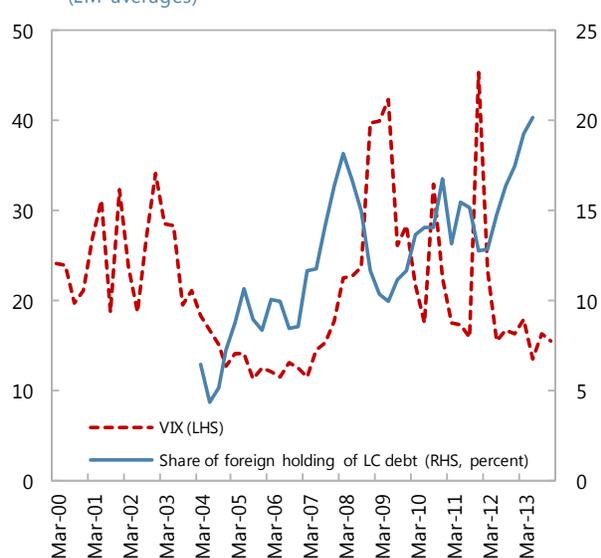
U.S. Long Term Yields and Foreign Participation in EM Government Debt Markets
(EM averages)
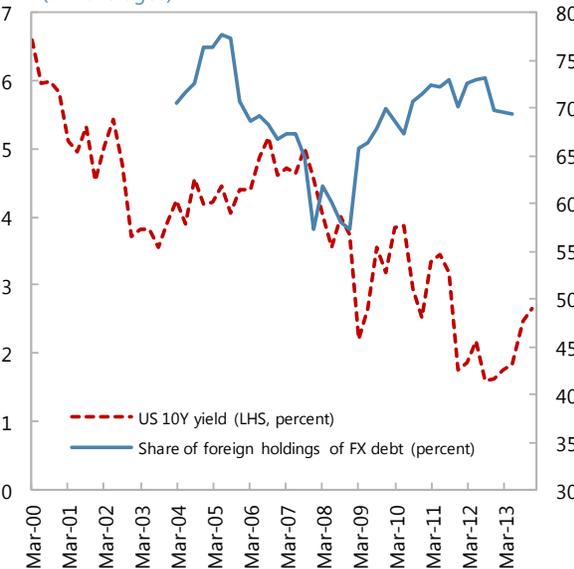
U.S. Long Term Yields and Foreign Participation in EM Local Currency Government Debt Markets
(EM averages)
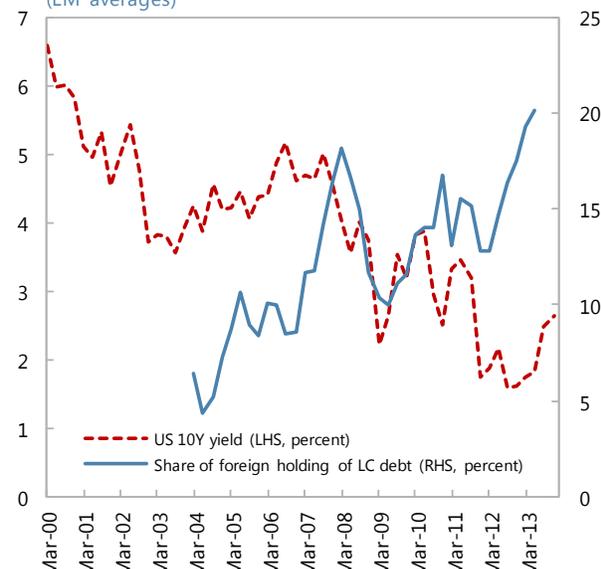
Sources: Country authorities; Datastream; Arslanalp and Tsuda (2014).

Figure 2. International Financial Spillovers into EMs
Additional increase in the yields (in bps) at various thresholds of conditional variables

Transmission of U.S. 10y Yield Shock into EM LC Yields: Non-linear Estimates
(Coefficient of the interaction term; in basis points)

Foreign participation ratios at least as great as values above
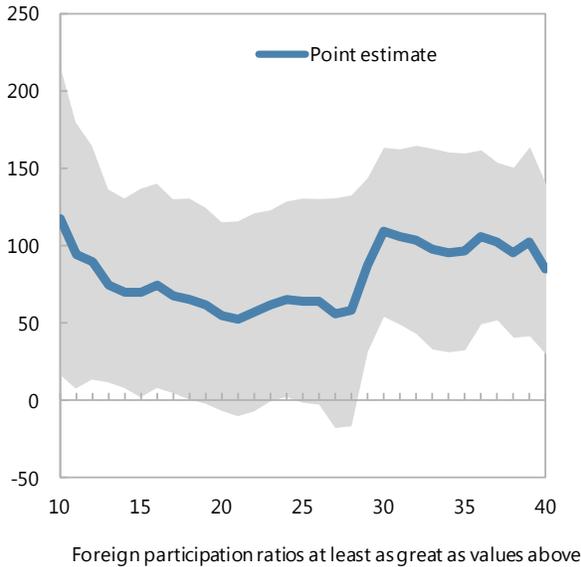
Transmission of U.S. 10y Yield Shock into EM Benchmark Yields: Non-linear Estimates
(Coefficient of the interaction term; in basis points)

Investor base concentration at least as great as values above
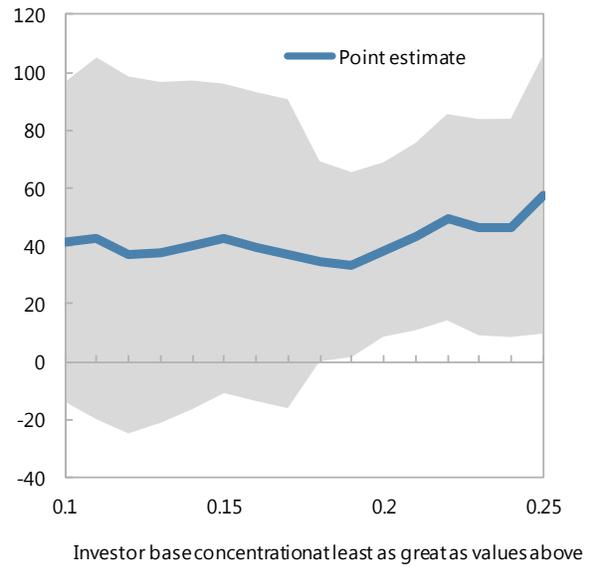
Transmission of U.S. Short Term rate (3-month) Shock into LC Yields: Non-linear Estimates
(Coefficient associated with the interaction term; in basis points)

Foreign participation ratios at least as great as values above
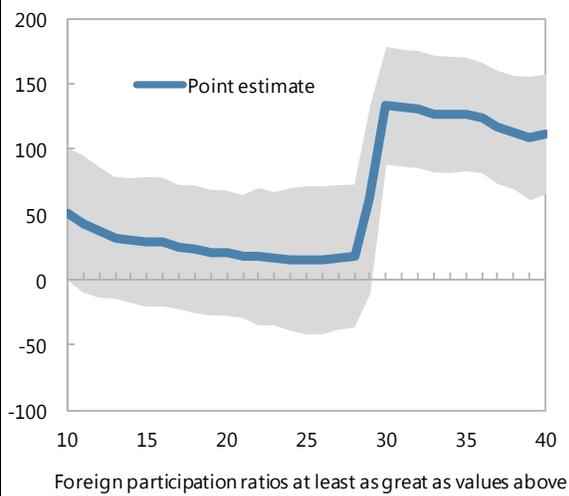
Transmission of VIX Shock into LC Yields: Non-linear Estimates
(Coefficient associated with the interaction term; in basis points)

Foreign participation ratios at least as great as values above
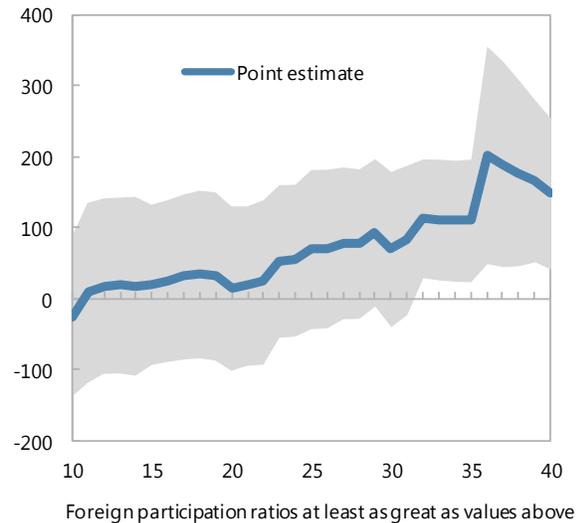
Source: IMF Staff calculations.

Table 1. Foreign Holdings of FX Debt and Yield Volatility. Period 2004:Q1–2013:Q2			
Dependent variable:	(1)	(2)	(3)
	Naïve	IV Remoteness	IV
FX yield volatility (in log)	OLS-FE		(1st and 2nd lags)
Foreign holdings ratio	-0.00123	-0.00406	-0.00226
	(-0.501)	(-0.573)	(-1.110)
Current account balance ratio	-0.00343	-0.00241	0.00431
	(-0.827)	(-0.351)	(1.107)
Real GDP growth	-0.0245**	-0.0239***	-0.0173**
	(-2.877)	(-3.698)	(-2.441)
Forward exchange rate volatility	0.0262	0.0280	0.0373***
	(1.419)	(0.999)	(2.700)
Public debt ratio (lagged)			0.00201
			(1.300)
Intercept	0.368**		
	(2.254)		
Country fixed-effects	Yes	Yes	Yes
Quarter specific effects	No	No	Yes
Observations	349	349	277
R-squared	0.140	0.135	0.700
Hansen OID test: *P*-value	..	..	..
Number of countries	15	15	13

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Dependent variable:	(1)	(2)	(3)
	Naïve	IV (Remoteness)	IV
LC yield volatility (in log)	OLS-FE		(1st and 2nd lags)
Foreign holdings ratio	0.00503	0.0233*	0.00779**
	(1.200)	(1.849)	(2.047)
Current account balance ratio	0.0193***	0.0175***	0.0168***
	(3.811)	(3.120)	(3.743)
Real GDP growth volatility	0.0688	0.0652*	0.0778**
	(0.991)	(1.657)	(2.009)
Forward exchange rate volatility	0.00336	-0.0378	0.00484
	(0.204)	(-1.206)	(0.319)
Inflation rate		-0.00439	
		(-0.564)	
Intercept	0.166		
	(1.231)		
Country fixed-effects	Yes	Yes	Yes
Quarter specific effects	No	Yes	Yes
Observations	362	362	344
R-squared	0.322	0.243	0.326
Hansen OID test: P-value	..	..	..
Number of countries	13	13	13

Table 2. Foreign Holdings of LC Debt and Yield Volatility. Period 2004:Q1–2013:Q2

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Foreign Holdings of FX Debt and FX Yield Level. Period 2004:Q1–2013:Q2			
Dependent variable:	(1)	(2)	(3)
	Naïve	IV (Remoteness)	IV
FX yield (in percent)	OLS-FE		(1st and 2nd lags)
Foreign holdings ratio	0.0172	0.0427	0.0129
	(0.292)	(0.482)	(0.379)
Current account balance ratio	-0.0974	-0.106	-0.0837
	(-0.795)	(-1.240)	(-0.883)
Real GDP growth	-0.234	-0.239**	-0.240**
	(-1.498)	(-2.115)	(-2.442)
Forward exchange rate	0.00108***	0.00108***	0.00116***
	(3.113)	(3.179)	(3.538)
External public debt ratio (lagged)	0.0334	0.0331**	0.0270*
	(0.904)	(2.003)	(1.717)
Intercept	3.151		
	(0.916)		
Country fixed-effects	Yes	Yes	Yes
Quarter specific effects	No	No	No
Observations	335	334	320
R-squared	0.080	0.079	0.079
Hansen OID test: *P*-value	..	..	..
Number of countries	15	14	14
Robust t-statistics in parentheses			
*** p<0.01, ** p<0.05, * p<0.1			

Table 4. Foreign Holdings of LC Debt and LC Yield Level. Period 2004:Q1–2013:Q2			
Dependent variable:	(1)	(2)	(3)
	Naïve	IV (Remoteness)	IV
LC yield (in percent)	OLS-FE		(1st and 2nd lags)
Foreign holdings ratio	-0.0648*	-0.0739***	-0.0810***
	(-2.143)	(-4.321)	(-2.924)
Current account balance ratio	0.00194	0.0224	0.0238
	(0.0290)	(0.441)	(0.482)
Real GDP growth	-0.144**	-0.146***	-0.184***
	(-2.649)	(-4.354)	(-4.744)
Forward exchange rate	0.00136***	0.00128***	0.00157***
	(4.187)	(3.730)	(5.854)
External public debt ratio (lagged)	-0.00279	-0.00181	0.00304
	(-0.818)	(-0.266)	(0.378)
Inflation rate	0.166**	0.160***	0.0823**
	(2.419)	(3.775)	(2.146)
Intercept	6.604***		
	(8.573)		
Country fixed-effects	Yes	Yes	Yes
Quarter specific effects	Yes	No	Yes
Observations	348	343	332
R-squared	0.291	0.313	0.425
Hansen OID test: *P*-value	..	..	..
Number of countries	13	13	13

Robust t-statistics in parentheses
*** p<0.01, **p<0.05, *p<0.1

	(1)	(2)	(3)	(4)
Table 5. Panel Non-Linear Estimates Dependent Variable: the Yield Associated with Local Currency Denominated Government Bonds (5-Year Maturity) (Columns 1–3) and the Country-Specific Benchmark Yield (Column 4)				
Interaction variable:	Foreign holdings (FH)	Foreign holdings (FH)	Foreign holdings (FH)	*Herfindahl* concentration
U.S. 10-year yield	0.418*			0.309*
	(2.086)			(1.932)
VIX		0.00797		
		(0.306)		
U.S. 3-month rate			0.0506	
			(0.337)	
U.S. 10-year yield * 1[FH>35]	0.958***			
	(3.277)			
VIX * 1[FH>32]		0.0692**		
		(2.947)		
U.S. 3-month * 1[FH>30]			1.332***	
			(6.431)	
U.S. 10-year yield * 1[*Herf*>0.2]				0.385**
				(2.896)
Relevant threshold dummy	-2.654***	-2.717***	-1.587***	-1.160**
	(-3.475)	(-3.536)	(-4.409)	(-2.308)
Current account balance-to-GDP	-0.0220	-0.0301	-0.00422	0.0261
	(-0.623)	(-0.896)	(-0.110)	(1.353)
Real GDP growth	-0.196***	-0.169**	-0.179***	-0.234***
	(-3.795)	(-2.921)	(-3.242)	(-3.450)
Forward exchange rate, log	0.00199***	0.00198***	0.00173***	
	(23.23)	(31.62)	(17.25)	
Inflation rate	0.370***	0.389**	0.330**	0.0982
	(3.902)	(2.813)	(2.873)	(1.044)
Public external debt-to-GDP, lagged				0.00691
				(0.885)
Constant	3.912***	5.110***	5.689***	5.456***
	(6.241)	(7.406)	(28.20)	(6.271)
Country fixed-effects	Yes	Yes	Yes	Yes
$\theta_2 + \theta_3$ [*P*-value]	1.4 [0.000]	0.08 [0.000]	1.4 [0.000]	0.7 [0.000]
Observations	367	367	367	317
R-squared	0.331	0.293	0.306	0.533
Number of countries	13	13	13	10
Robuts t-statistics in parentheses *** p<0.01, **p<0.05, p<0.1				

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CORPORATE SECTOR VULNERABILITIES[1]

This chapter assesses nonfinancial corporate (NFC) sector vulnerabilities in Poland both at the firm level and at the cross-country macro level. While the stock of NFC debt in Poland is high relative to its peers, there are mitigating factors. Intercompany debt accounts for more than half of NFC external debt and an increasing share of debt securities is denominated in local currency. To the extent that foreign currency debt is hedged, FX shocks may pose only a moderate risk. Nonetheless, as in many emerging markets, noninvestment grade issuance of debt securities has increased and large interest rate shocks could have adverse ramifications.

A.   Introduction

1.   The 2008–09 crisis led to a sharp worsening of corporate sector health. In 2007, the anticipation of high returns led to a worsening saving-investment balance in the NFC sector along with high fixed investment growth above 15 percent. However, as the crisis hit, investment contracted in light of the deteriorating economic outlook and firms' difficulty repaying debts. Nonperforming loans (NPLs) climbed, reaching around 12 percent of total loans by mid-2010 (and even higher for small- and medium-sized enterprises (SMEs)). Partly as a result, credit to NFCs contracted sharply, with year-on-year credit growth declining from more than 25 percent at end-2008 to close to -10 percent in the spring of 2010 and remaining negative for the remainder of the year. Bankruptcy cases in courts increased by about 60 percent during 2008–10 (Figure 1).

2.   The NFC sector appears to be gradually recovering. After a renewed deceleration in 2012, credit to NFCs is slowly picking up but remains low compared to other emerging markets (EMs) (Figure 2). Nonetheless, data on bankruptcies show encouraging developments with the 12-month sum down 6.8 percent year-on-year in March 2014 from growth of close to 20 percent a year earlier. While NPLs remain high, they have started to edge down.

3.   Recent turbulence in EMs has underlined how global financial flows can quickly reverse with implications for the NFC sector. While Poland weathered the unsettled financial markets at the onset of the U.S. Federal Reserve tapering talk in May 2013 as well as renewed volatility in early 2014, the events highlight the risks for EM economies as global interest rates rise on the back of monetary policy normalization. A potentially volatile adjustment path can have adverse consequences for corporate sector financing—in particular for companies with already strained balance sheets. In turn, a weakening corporate sector can quickly have macroeconomic implications through layoffs and increased unemployment.

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[1] Prepared by Lone Christiansen (EUR) and Annette Kyobe (SPR). We thank participants at the seminar in Warsaw (Poland) for the very useful discussion.

Figure 1. Poland: Corporate Sector Overview

Nonfinancial Corporate Saving -Investment Balance
(Percent of GDP)

Sources: Eurostat and IMF staff calculations.

NFCs: Nonperforming Loans
(Percent of total loans)
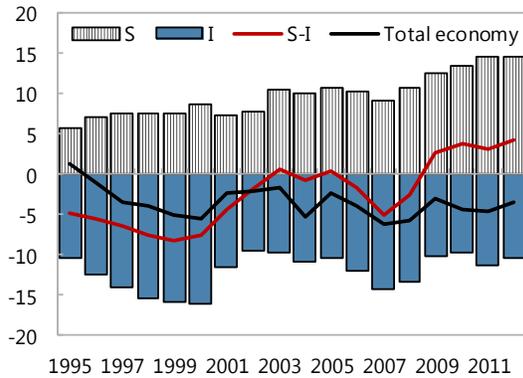
Sources: KNF and IMF staff calculations.
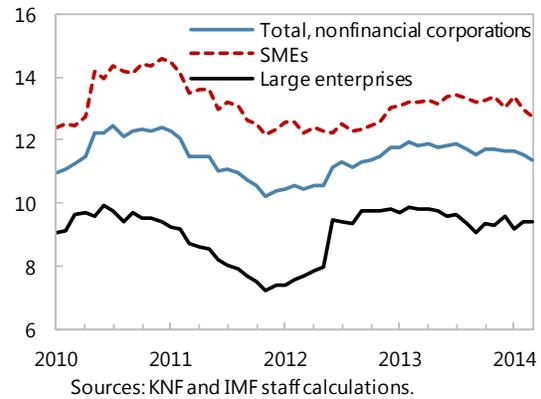
NFC Nonperforming Loans
(Percent of total loans, end of year)

Sources: KNF and IMF staff calculations.
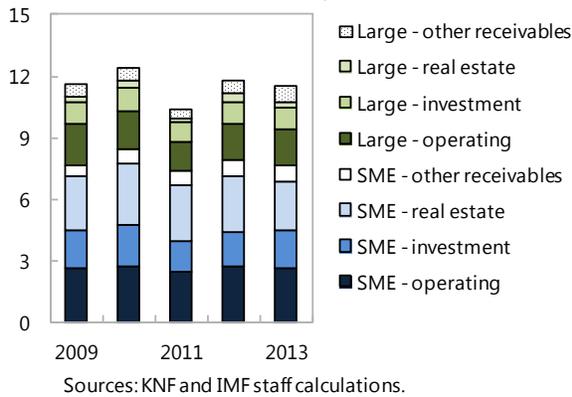
Private Sector Credit Growth
(Year-on-year percent change)

Sources: Haver Analytics, NBP, and IMF staff calculations.
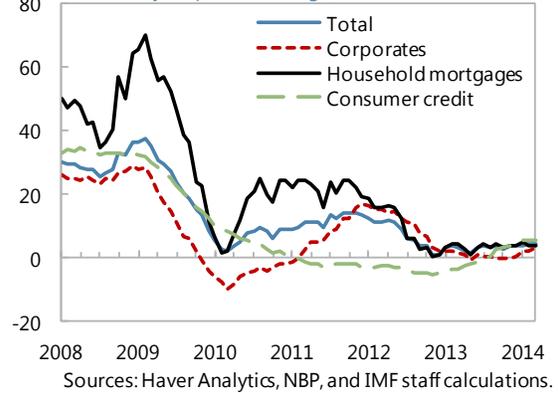
Cases in Courts
(Thousands)

Source: KPF.
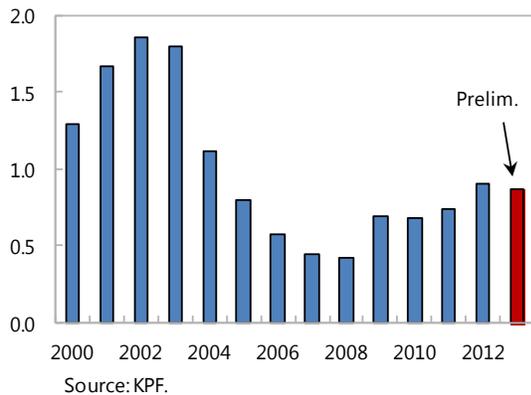
Bankruptcies
(12-month moving sum)

Sources: KUKE S.A.

Figure 2. Selected Countries: Credit to the Nonfinancial Sector

Credit to the Nonfinancial Sector
(Year-on-year growth, percent, end of period)

Sources: International Financial Statistics and IMF staff calculations. 1/ November 2013.
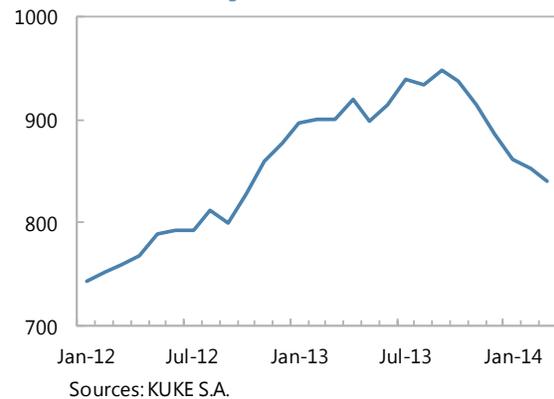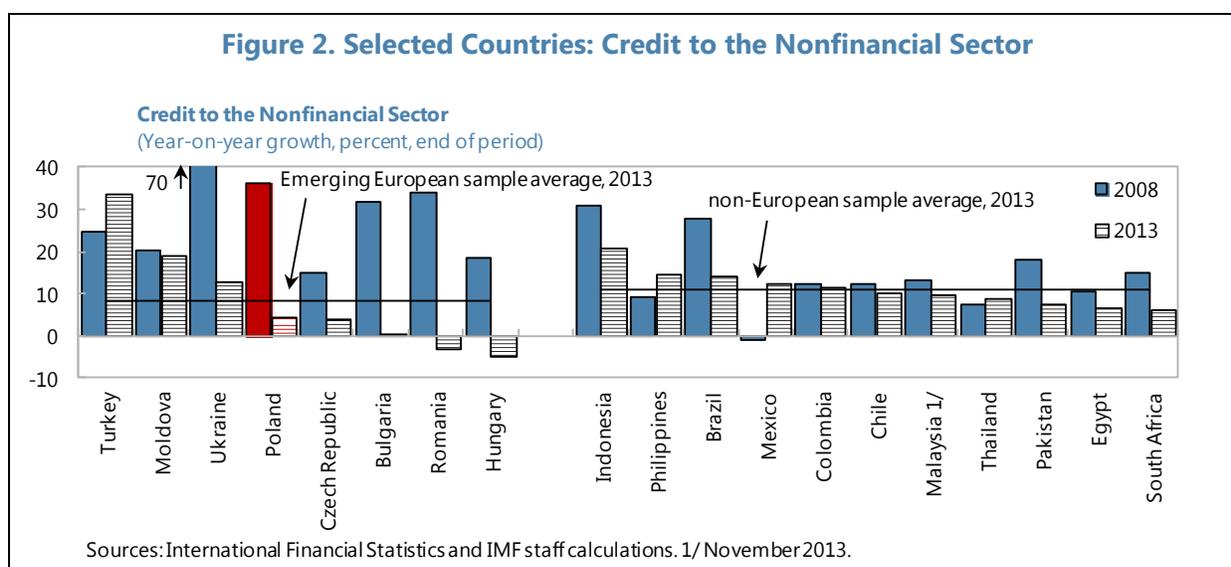
4.   Against this background, this chapter examines vulnerabilities of the Polish NFC sector. We first present stylized facts as a guide to potential vulnerabilities, examining stock and flow items to capture existing and building vulnerabilities. We then examine default risks and underlying weaknesses in the NFC sector associated with interest rate, profit, and exchange rate shocks. While stock indicators point to relatively stable sources of financing for Poland, flow indicators hint at emerging vulnerabilities. Nonetheless, the one-year ahead expected default frequency appears to be on an encouraging path.

B.   Stylized Facts

The Stock

5.   After increasing steadily since the mid-2000s, NFC debt declined in 2012.[2] Total nonconsolidated NFC debt in Poland (including domestic and external debt) increased by about 15 percentage points of GDP to 83 percent of GDP from 2005 to 2011, like in many other emerging European countries. The increase was mainly on account of a 10 percentage point of GDP increase in long-term loans, which in 2011 reached 35 percent of debt (Figure 3). The share of short-term loans had remained relatively stable at around 10 percent of debt. More recently, moderate deleveraging has taken place, with total nonconsolidated NFC debt declining by close to 5 percentage points of GDP from 2011 to 78 percent of GDP in 2012, as other accounts payable (excluding trade credit)

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[2] NFC debt is defined as the sum of liabilities associated with securities other than shares (excluding financial derivatives), loans, and other accounts receivable/payable based on Eurostat data. Nonconsolidated data include intercompany debt, which is excluded from consolidated data. Nonfinancial sector external debt is computed as the sum of liability debt components for "other sectors" in the IIP (direct investment debt instruments (intercompany debt), other debt instruments under other investment liabilities, and portfolio investment debt securities) based on IFS data.

Figure 3. Selected Countries: Composition of Total Nonfinancial Corporate Debt

Poland: Nonfinancial Corporate Nonconsolidated Debt 1/
(Percent of GDP)
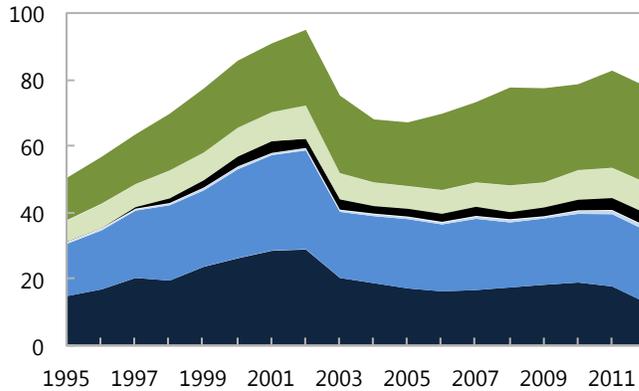
- Loans - long term
- Loans - short term
- Securiteis other than shares (excl. financial derivatives) - long term
- Securiteis other than shares (excl. financial derivatives) - short term
- Trade credit
- Other accounts payable (excl. trade credit)

Sources: Eurostat and IMF staff calculations.

1/ Debt computed as the sum of loans, securities other than shares (excluding financial derivatives), and accounts payable.

Poland: Nonfinancial Corporate Intercompany Debt 2/
(Percent of GDP)
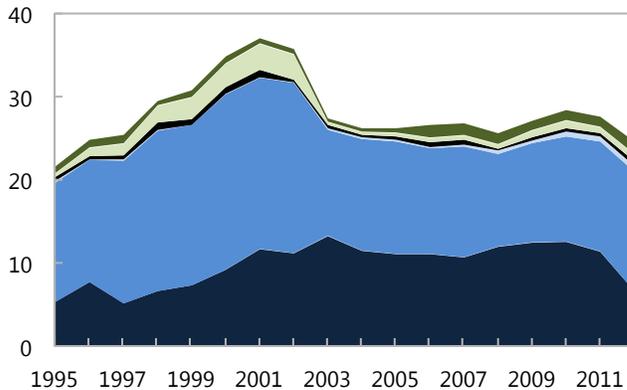
- Loans - long term
- Loans - short term
- Securiteis other than shares (excl. financial derivatives) - long term
- Securiteis other than shares (excl. financial derivatives) - short term
- Trade credit
- Other accounts payable (excl. trade credit)

Sources: Eurostat and IMF staff calculations.

2/ Intercompany debt is computed as the difference between nonconsolidated and consolidated debt.

Nonfinancial Corporate Debt
(Percent of GDP)
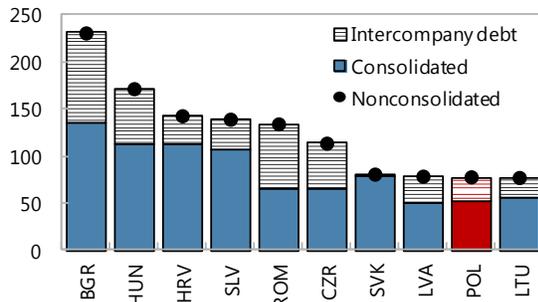
- Intercompany debt
- Consolidated
- Nonconsolidated

Sources: Eurostat and IMF staff calculations.
Note: Debt computed as loans, securities other than shares (excluding financial derivatives), and accounts payable.

Nonfinancial Corporate Intercompany Debt
(Percent of total nonconsolidated debt)
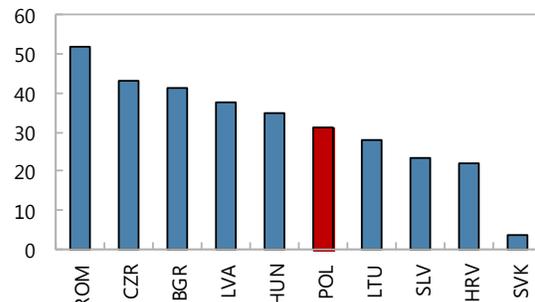
Sources: Eurostat and IMF staff calculations.
Note: Debt computed as loans, securities other than shares (excluding financial derivatives), and accounts payable.

contracted. While Poland's debt may appear high, next to relatively high NFC indebtedness in Europe, it does not stand out.

6.   **A large share of debt is associated with intercompany lending.** While total intercompany debt—defined as the difference between total nonconsolidated and consolidated debt—has declined recently, it remains high at around 25 percent of GDP in 2012, accounting for just above 30 percent of total nonconsolidated debt. This is mainly due to other accounts payable, including trade credits, which amount to 27 percent of nonconsolidated debt. However, even after subtracting intercompany debt (which is substantial also in other emerging European economies), Poland's NFC debt continues to look favorable relative to other countries in the region.

7.   **External debt is particularly important for assessing Poland's corporate sector vulnerabilities in a cross-country perspective.** Considering Poland's economic size and financial depth, comparisons with other major emerging economies outside Europe are also important. However, data limitations constrain comparisons across a wide range of countries (see Box 1). Thus, we focus cross-country comparisons on external nonfinancial sector debt (for which data on the International Investment Position (IIP) is available across countries).

External NFC debt is high…

8.   **NFC external debt liabilities have continued to rise.** While total nonconsolidated NFC debt in Poland (including domestic NFC debt) declined in 2012, external NFC debt continued its upward trend, reaching around 30 percent of GDP in 2012 from 17½ percent of GDP in 2000. However, most of the increase in external NFC debt took the form of intercompany debt, which grew from around 5 percent of GDP at end-2000 to around 17 percent of GDP at end-2012 (Figure 4).

9.   **Poland's external NFC debt surpasses that of many EMs, suggesting potential vulnerabilities.** While external NFC debt in Poland is below or on par with that of other European countries in the German supply-chain (Hungary, Slovak Republic, and Czech Republic), it is high relative to non-European EMs. NFC external debt in India, Indonesia, and Mexico in 2012 accounted for less than 15 percent of GDP (Figure 5). Hence, Poland's high external debt may present vulnerabilities, as large corporations with access to international capital markets may quickly face increasing financing costs if capital flows reverse, not least associated with Fed tapering or geopolitical turmoil in the region.

…but there are a number of mitigating factors.

10.   **Intercompany debt reduces vulnerabilities related to the external debt stock.** Intercompany debt is a more stable source of financing than borrowing from international wholesale markets. For example, in case of unknown maturity, the IMF's Balance of Payments Manual (IMF BPM6, 2009) allows for classification of intercompany lending as long-term lending given the nature of the relationship. As intercompany lending is less vulnerable to sudden stops linked to global

Box 1. Measuring Nonfinancial Corporate Debt

We explore nonfinancial sector vulnerabilities using several data sources to take advantage of their various strengths and mitigate their limitations. Our focus is on external NFC debt for cross-country comparisons, though to analyze Polish vulnerabilities we also use data on total NFC debt. While Polish data on NFC debt is available at a detailed level, external debt statistics for "other sectors" do not separate household and NFCs. However, the household share of nonfinancial sector external debt—which in turn accounted for about 40 percent of total external debt in 2013—is expected to be small.

Standard & Poor's Capital IQ. The database contains detailed firm-level income statement and balance sheet information for Polish public and private NFCs. However, data availability is limited in the early period of the sample. Overall, for 2012 we include 372 nonfinancial companies, including real estate companies, (365 public and 7 private companies) after excluding companies with negative interest coverage ratio for the shock scenarios (see section C). On the contrary, in 2001, the sample size is limited to 16 companies. In sum, assets for the sample of firms in 2012 correspond to PLN 516,444 million (32 percent of GDP), while debt corresponds to PLN 96,334 million (6 percent of GDP or 7½ percent of total NFC debt as determined with Eurostat data). The dataset does not include information on the share of foreign currency debt nor on intercompany debt.

Corporate Vulnerability Utility. The IMF utility (Brooks and Ueda, 2011) consists of several different default risk indicators based on publicly traded firms listed in Worldscope in a number of countries. Market capitalization-weighted averages are used for comparability across countries. The sample size increases over time with a limited sample size in the early 2000s.

Moody's KMV Credit Edge Plus. Moody's KMV contains expected default frequencies (EDFs) for publicly listed companies, where the EDF measures the probability that a firm will default within one year. Hence, a firm with an EDF of 10 percent has a 1 in 10 chance of defaulting during the next year. We extract information for 452 companies, including information on which industrial sector they operate in.

Dealogic Analytics. The database includes country-level aggregates of NFC bonds and syndicated loan and equity issuance. The data are broken down by maturity, sector, and currency across emerging market countries. The database does not include information on intercompany debt.

Eurostat. The country-level financial balance sheet data for aggregate European NFC sectors include a breakdown of financial liabilities. This allows us to compute debt liabilities for the nonfinancial corporate sector as the sum of (i) loans, (ii) securities other than shares (excluding financial derivatives), and (iii) accounts payable. As data are available at the nonconsolidated and consolidated levels, intercompany debt is deduced as the difference between the two. However, intercompany NFC debt with nonresident affiliates—an important component for Poland—is not accounted for (Cussen and O'Leary, 2013). Furthermore, to our knowledge, consistent, non-European cross-country comparable data on total NFC debt are not available, limiting us to an analysis of European countries.

International Financial Statistics (IFS). The International Investment Position (IIP) provides a breakdown of aggregate external liabilities. This allows computing nonfinancial sector external debt liabilities for "other sectors" as the sum of (i) direct investment debt instruments (intercompany debt), (ii) other debt instruments under other investment liabilities, and (iii) portfolio investment debt securities. While "other sectors" include NFCs as well as households, household external debt tends to be small, allowing for inference about the corporate sector.

Quarterly External Debt Statistics (QEDS). The external debt statistics provide a breakdown of nonfinancial sector external debt into short- and long-term debt as well as separate out intercompany debt. However, for many countries, data on intercompany debt are not available, and the maturity breakdown in many cases abstracts from the intercompany components or assumes intercompany debt is exclusively long-term debt.

Figure 4. Poland: Nonfinancial Sector International Investment Position and Debt

Nonfinancial Sector IIP
(Percent of GDP)

Sources: International Financial Statistics, and IMF staff calculations.

Nonfinancial Corporate Debt
(Percent of GDP)

Sources: Eurostat, International Financial Statistics, and IMF staff calculations.

Nonfinancial Sector External Debt
(Percent of GDP)

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

External Debt, end-2013
(Percent of GDP)

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

market turmoil and general investor sentiment, it substantially reduces external vulnerabilities related to the total external debt stock. In Poland, external intercompany debt (measured by FDI debt instrument liabilities) accounted for close to 60 percent of total nonfinancial sector external debt in 2012—well above that in many major EMs. Hungary and the Slovak Republic, which are also participants in the German supply chain, tell a similar story. Nonetheless, trade shocks—not least related to the German supply chain—will affect also companies with intercompany debt.

11.   The stock of external NFC debt, excluding intercompany debt, is not out of line with that of emerging market peers and debt securities are increasingly in domestic currency. At around 12 percent of GDP, the stock of overall nonfinancial sector external debt, excluding intercompany debt, is slightly below the median country in the sample (Figure 6). Similarly, from a global perspective, Poland's total stock (including domestic) of nonfinancial sector debt securities, at 10 percent of GDP, is lower than in many other EMs. In addition, an increasing share of NFC debt securities (38 percent in 2013 compared to 6 percent in 2000) is denominated in domestic currency, reducing balance sheet risks associated with exchange rate depreciation (Figure 7).

Figure 5. Selected Countries: Nonfinancial Sector External Debt and Intercompany Debt

Nonfinancial Sector External Debt, 2012
(Percent of GDP)
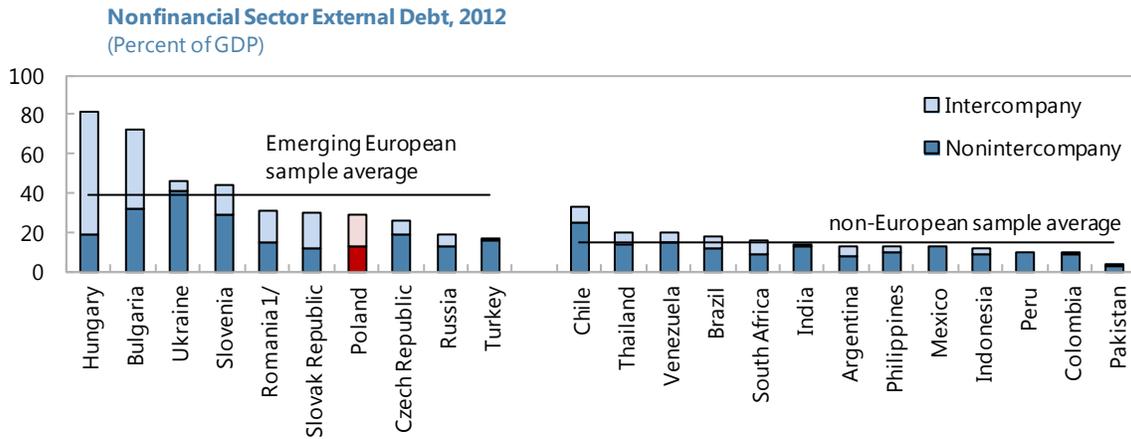
Sources: International Financial Statistics, World Economic Outlook database, IMF staff calculations.
1/ 2011.

Nonfinancial Sector External Intercompany Debt, 2012
(Percent of nonfinancial sector external debt)
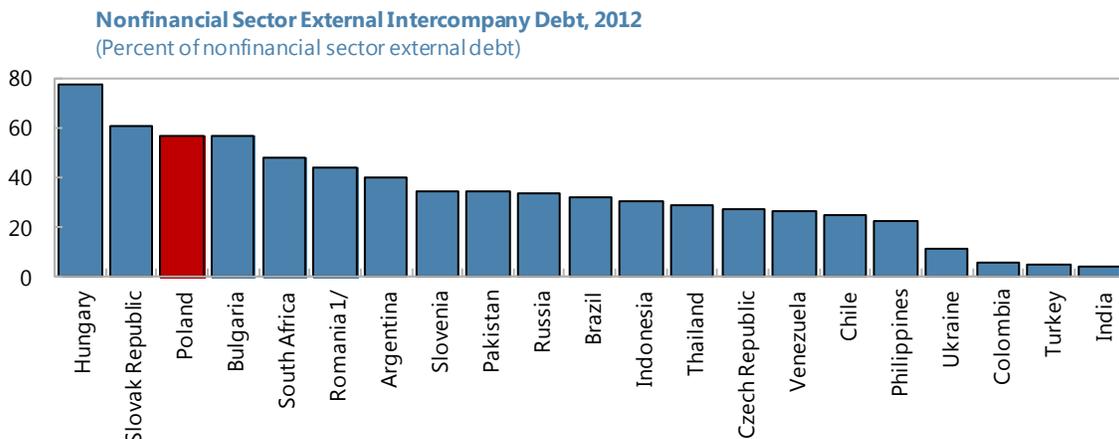
Sources: International Financial Statistics and IMF staff calculations.
1/ 2011.

12.   While the share of short-term external debt is high, the overall stock of short-term external debt is manageable. As of end-2013, short-term external debt accounted for about 33 percent of total nonfinancial sector external debt, excluding intercompany debt (though the share is close to unchanged when including intercompany debt), above the median country in the sample, as well as Mexico, South Africa, and Turkey. However, the stock of short-term debt, excluding intercompany debt, is manageable, at around 4 percent of GDP.

Figure 6. Selected Countries: Maturity Breakdown of Nonfinancial Sector External Debt

Nonfinancial Sector External Debt
(Percent of GDP, excludes intercompany debt unless otherwise indicated, 2013Q3)
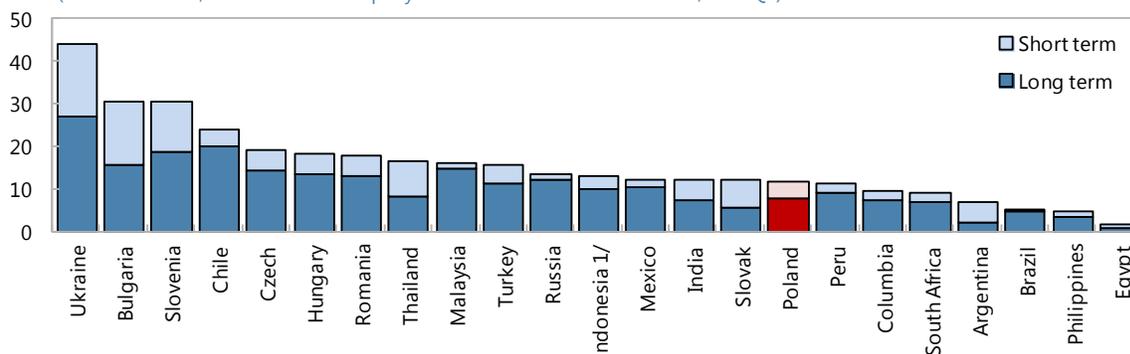
Sources: World Economic Outlook, QEDS, and IMF staff calculations. 1/ Incl. intercompany debt.

Nonfinancial Sector Short-Term External Debt
(Percent of total debt, excludes intercompany debt unless otherwise indicated, 2013Q3)
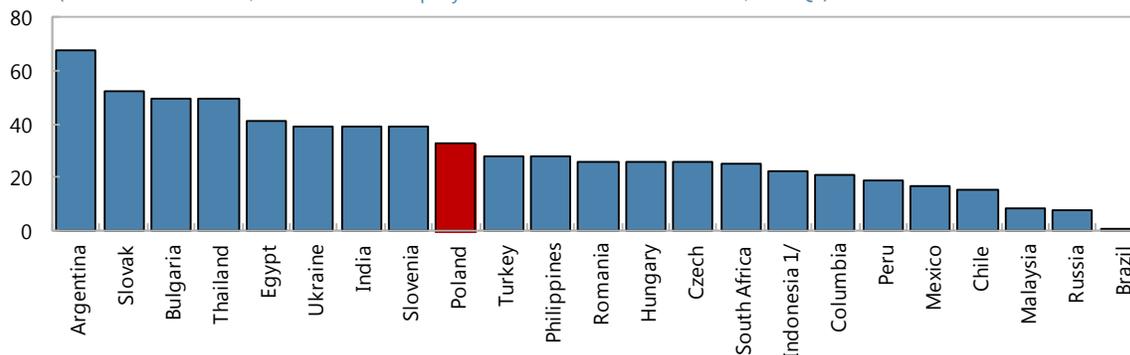
Sources: World Economic Outlook, QEDS, and IMF staff calculations. 1/ Incl. intercompany debt.

The Flow

While stock data do not present major concerns, flow data point to some vulnerabilities...

13.   Rollover needs are high. As of end-2013, overall external NFC debt, including loans, trade credits, and other types of debt, accounting for about 12 percent of GDP, had to be rolled over or paid off during the subsequent 12 months. Of this, close to 60 percent represented intercompany debt, which would presumably by easier to roll over than wholesale financing (Figure 8).

14.   The surge in global liquidity has given borrowers in Poland with lower credit ratings access to international finance. While the outstanding stock of non-investment grade[3] debt securities remains manageable at around 3 percent of GDP in Poland, the quality of NFC issuance

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[3] Non-investment grade issuance includes non-rated issuance.

has deteriorated rapidly. A similar trend is observed in other EMs. Non-investment grade issuance reached more than 80 percent of total NFC securities issuance in 2013 (50 percent in 2012) and is now above the median EM. However, given the global and European economic and financial crises, it is difficult to separate the effect of higher non-investment grade issuance (high-risk issuance) from potential generalized ratings downgrades globally (including of the sovereign) during that time.

Figure 7. Poland and EMs: Composition of Nonfinancial Sector External Debt

Poland: Nonfinancial Sector External Debt, 2013 (Percent of total)

Sources: SDDS, NBP, and IMF staff calculations.

Poland: Nonfinancial Corporate Debt Securities (Percent of GDP)

Sources: Dealogic and IMF staff calculations.

Poland: Currency Composition of Nonfinancial Sector External Debt (Billion zloty)

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

Poland: Nonfinancial Sector External Debt, 2013 (Percent of total nonfinancial sector external debt)

Sources: NBP and IMF staff calculations.

...though vulnerabilities remain contained.

15.   International corporate bond issuance is modest, and the currency and debt profiles of debt securities are sound. International corporate issuance has been moderate, below that in emerging Europe and other EMs, where global liquidity has supported foreign currency bond markets relative to equity and syndicated loan issuance (Figure 9). In addition, Poland's currency structure and debt profile compare favorably with other EMs. The foreign currency share in overall NFC debt issuance has started to decline as more borrowers are able to borrow in local currency, and foreign currency issuance is below that of many other EMs. Further, Poland has lower debt to equity issuance than other EMs, resulting in declining debt to equity ratios.

Figure 8. Selected Countries: Debt Outstanding, Rollover Needs, and Debt Issuance

Poland: Stock of Nonfinancial Sector External Debt, 2013
(Breakdown in percent of total)

- Loans — 69%
- Trade credits — 21%
- Currency and deposits — 0.3%
- Debt securities — 5%
- Other liabilities — 5%
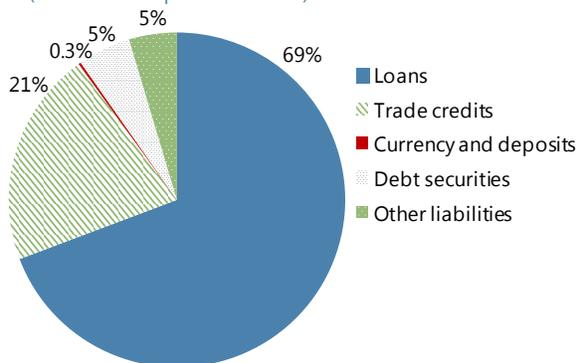
Poland: Total External Debt Outstanding (As of end-2013)

- Due to parents
- Due to others

Loans: 58% Due to parents, 42% Due to others

Trade Credit: 47% Due to parents, 53% Due to others
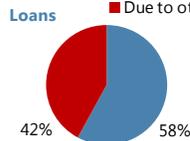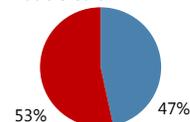
Poland: External Debt Due within 12 Months (As of end-2013)

44 percent of total NFC debt (12 percent of GDP) due

- ST (to parents) — 46%
- ST (to others) — 32%
- LT (to parents) — 14%
- LT (to others) — 8%
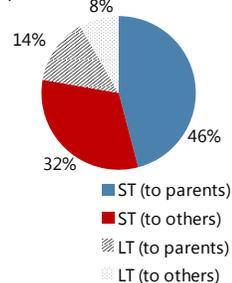
Sources: NBP, Statistics Poland, and IMF staff calculations.

Non-Investment Grade Nonfinancial Corporate Debt Securities
(Percent of GDP)

- Stock of non-investment grade debt securities
- Issuance of non-investment grade debt securities, 2010–13 (RHS)

Countries (x-axis): TUN, GTM, URY, LTU, MAR, UKR, EGY, VNM, ROM, ARG, COL, TUR, POL, CRI, PHL, IDN, ZAF, HRV, PER, PAN, BGR, HUN, JOR, RUS, IND, BRA, KAZ, CHN, MEX, THA, KOR, CHL, MYS
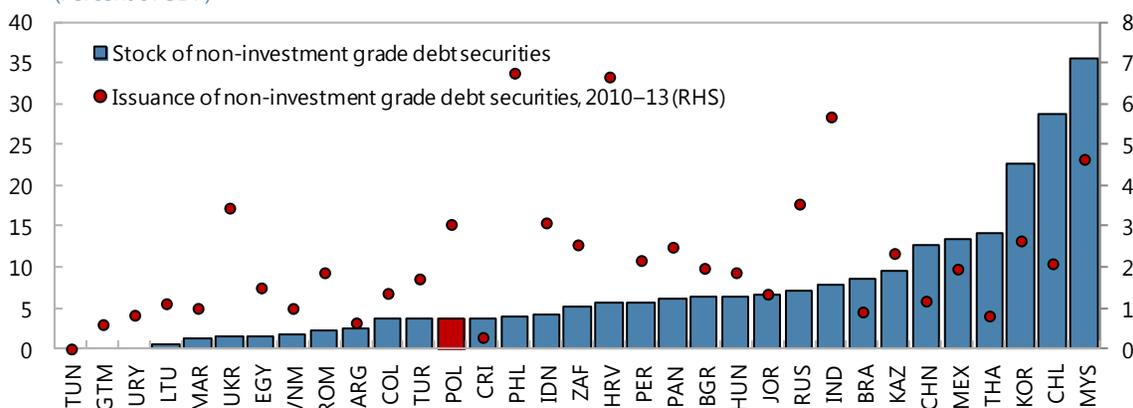
Sources: Dealogic and IMF staff calculations.

Non-Investment Grade NFC Debt Securities Issuance
(Percent of total NFC debt securities issuance in given year)

- 2010
- 2013

Countries (x-axis): JOR, EST, BIH, VNM, ARG, CHL, CRI, KOR, CHN, BRA, MEX, PER, COL, RUS, ZAF, MYS, TUN, THA, URY, KAZ, IDN, UKR, IND, TUR, POL, PHL, HRV, ROM, PAN, EGY
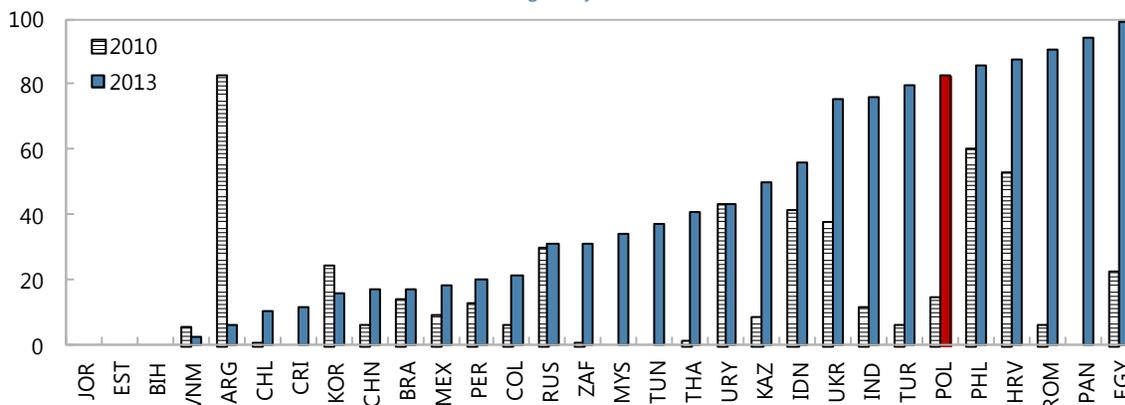
Sources: Dealogic and IMF staff calculations.

Figure 9. Poland and EMs: Nonfinancial Sector Securities Issuance

Poland: NFC Securities Issuance
(LHS: Billion USD, RHS: Percent of GDP)
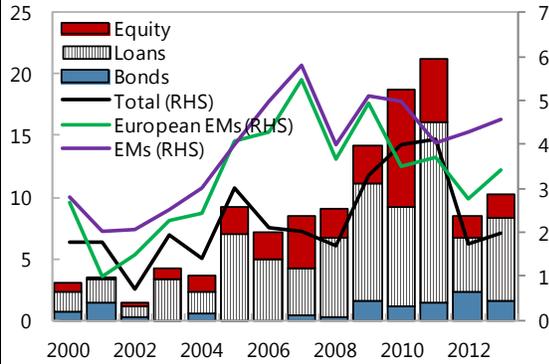
Sources: Dealogic and IMF staff calculations.

EMs: NFC Securities Issuance
(LHS: Billion USD, RHS: Percent of GDP)
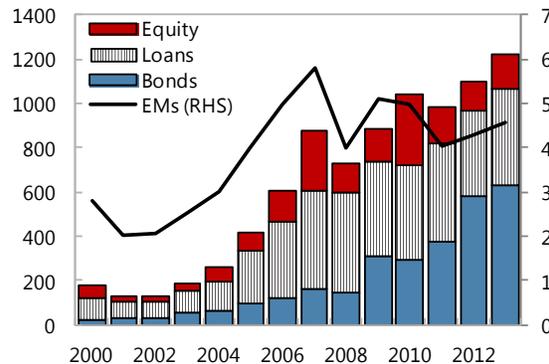
Sources: Dealogic and IMF staff calculations.

Poland: NFC Securities Issuance: Currency Structure
(Billion USD)
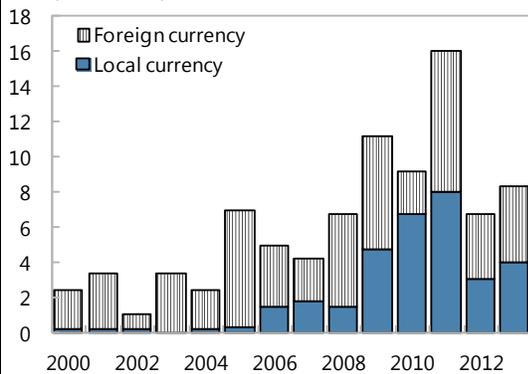
Sources: Dealogic and IMF staff calculations.

EMs: NFC Securities Issuance: Currency Structure
(Billion USD)
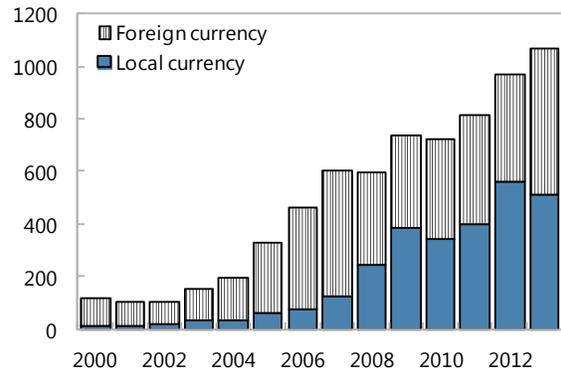
Sources: Dealogic and IMF staff calculations.

Poland and EMs: Issuance and Other Indicators
(2013)
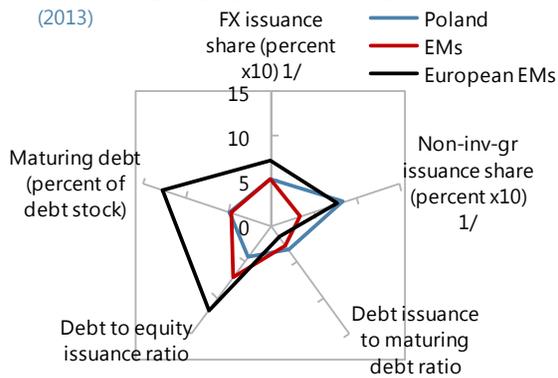
Sources: Dealogic and IMF staff calculations.
1/ Notation: 15 percent x10 corresponds to 1.5 percent.

Poland: Issuance and Other Indicators
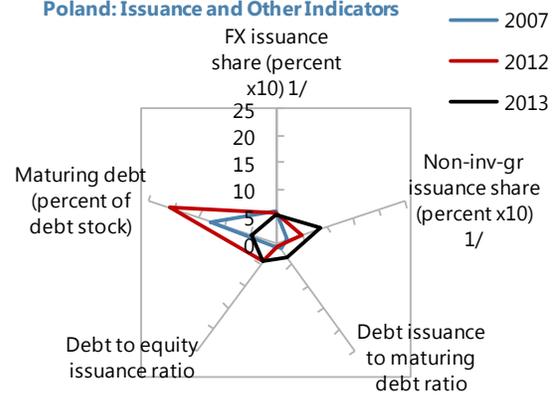
Sources: Dealogic and IMF staff calculations.
1/ Notation: 15 percent x10 corresponds to 1.5 percent.

Vulnerability Indicators

Firm-level balance sheet indicators point to some areas of vulnerability…

**16.   Balance sheet ratios and income statement items provide valuable insight into the
health of the corporate sector.** We assess corporate sector health and vulnerabilities in Poland in a
cross-country perspective, using information from the IMF's Corporate Vulnerability Utility (CVU)
(Brooks and Ueda, 2011). We consider indicators that capture accounting ratios, including leverage,
liquidity, profitability, and valuation, as well as other indicators, including external financing and
default risk.[4]

17.   Accounting ratios suggest moderate vulnerabilities in Poland's NFC sector (Figure 10).

- *Leverage.* After a decade of decline, ***total liabilities to total assets*** in Poland have
  stabilized at just above 40 percent. However, ***short-term debt to total debt*** picked up
  slightly in 2012. Nonetheless, ***Debt to equity*** and ***debt to assets*** are low relative to other
  emerging markets.

- *Liquidity.* The ***current ratio*** (current assets relative to current liabilities) and the ***quick ratio***
  (which nets out inventories from current assets) measure firms' ability to pay short-term
  obligations with easily convertible assets. These both deteriorated in Poland in 2012 as the
  economic environment worsened. As a result, these measures place Poland among
  emerging markets that are relatively vulnerable.

- *Profitability.* ***Return on assets*** (RoA) and ***return on equity*** (RoE) declined in 2012 in Poland,
  approaching levels last seen in 2008.

- *Valuation.* ***Tobin's Q*** captures the market value of debt and equity relative to the current
  replacement cost of assets. In the case of perfect markets and absent measurement error,
  Tobin's Q will equal 1 as there will otherwise be incentives to invest further (>1) or a merger
  and acquisition is advantageous (<1). In practice, however, Tobin's Q above 1 may occur
  when a company is facing financial constraints, for example for a promising start-up
  company that is valued by the stock market but is facing a binding borrowing constraint
  and operates with low total assets. In Poland, Tobin's Q was in 2012 only slightly above one,
  suggesting relatively efficient markets.

---

[4] Countries included from the CVU are: Argentina, Brazil, Bulgaria, Chile, China, Colombia, Czech Republic, Egypt,
Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russian Federation, Saudi
Arabia, Slovak Republic, Slovenia, South Africa, Thailand, Turkey, Ukraine, and Venezuela.

Figure 10. Selected Countries: Vulnerability Indicators

Poland: Nonfinancial Corporate Leverage
(Percent)

Source: IMF's Corporate Vulnerability Utility.
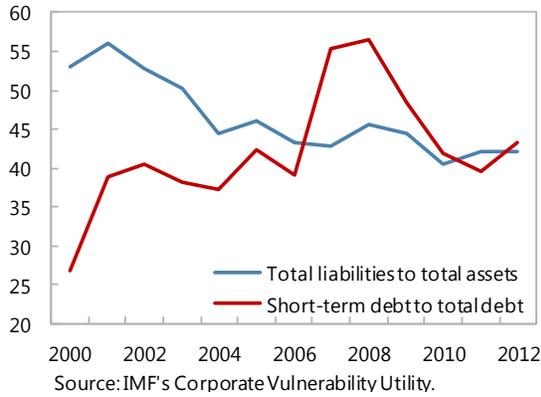
Selected Countries: Debt to Equity and Debt to Assets, 2012 (Percent)

$y = 0.1685x + 9.9138$
$R^2 = 0.6791$

Source: IMF's Corporate Vulnerability Utility.
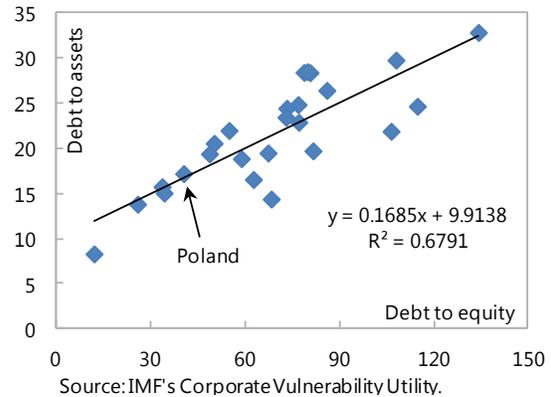
Current and Quick Ratios
(Current assets to current liabilities)

Quick ratio nets out inventories from current assets

Source: IMF's Corporate Vulnerability Utility.
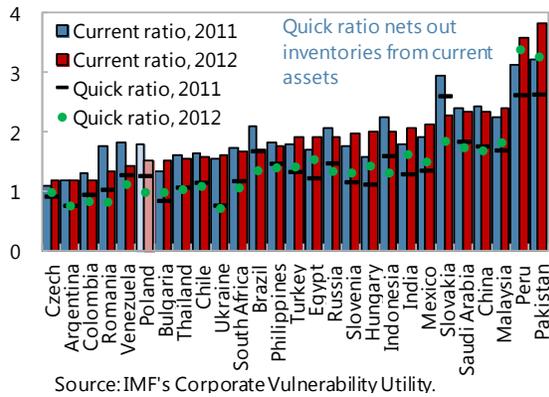
Poland: Nonfinancial Corporate Returns and Valuation
(Percent)

Source: IMF's Corporate Vulnerability Utility.
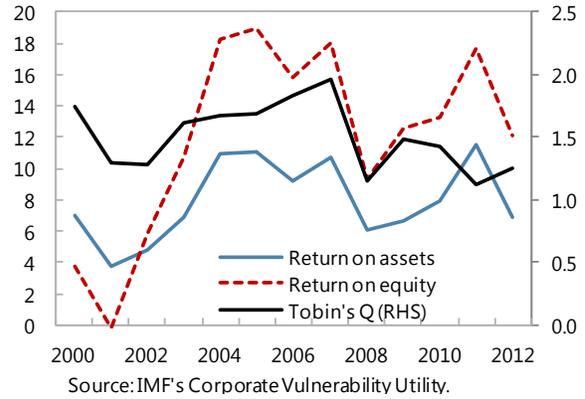
Poland: NFC Default Probabilities
(Percent; distance to default in st. dev. of asset returns)

Source: IMF's Corporate Vulnerability Utility.
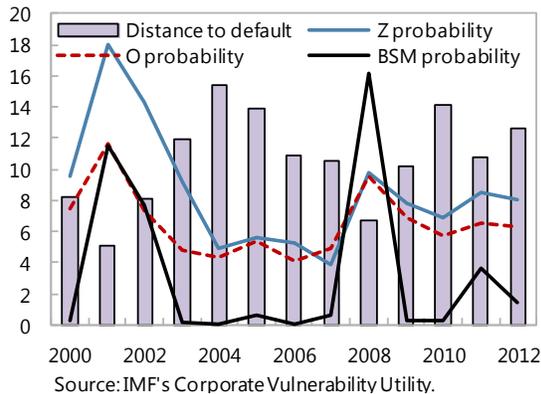
Selected Countries: Distance to Default and the Interest Rate, 2012 (Interest rate in percent)

$y = -0.6336x + 20.256$
$R^2 = 0.193$

Source: IMF's Corporate Vulnerability Utility.
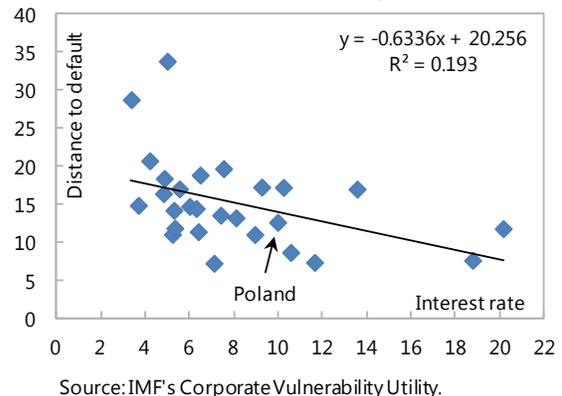
...but default risk has declined recently.

18.   Default probabilities are improving. The Altman Z-Score and Ohlson O-Score, converted into probabilities, as well as the Black-Scholes-Merton (BSM) Default Probability[5] all consistently show a slight decline in 2012 to between 1.5 percent (BSM probability) and 8 percent (Z probability), though the indicators remain above their 2010 levels. The distance-to-default (which also serves as an input to the default probability) measures how much the asset value must fall during the year for a firm to default based on the current balance sheet position. Corresponding to the decline in distress indicators, the distance to default increased in 2012.

19.   High-frequency data confirm that default risk is declining across several sectors. Moody's KMV computes the one-year-ahead probability of default at the firm level. While the 90th percentile of the companies in the sample remained high in early 2014 at above 15 percent, the median probability is low at less than 1 percent. Indeed, the improving conditions during 2013 occurred across a number of industries, in particular construction and real estate development. And relative to default probabilities above 10 percent for more than 50 percent of companies in the durable consumer products segment in early 2009, the median company in this segment recently recorded a default probability of only around ½ percent (Figure 11).[6]

Figure 11. Poland: High-Frequency Vulnerability Indicators

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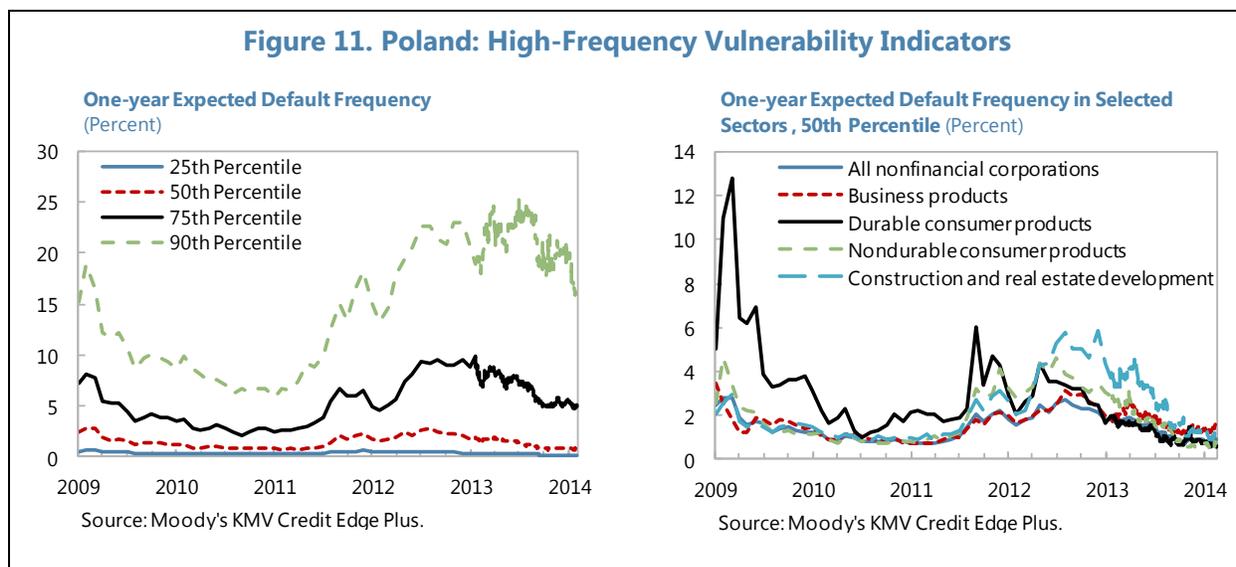
[5] The Altman Z-Score is a measure of distress, combining five accounting ratios into a single statistic. The Ohlson O-Score is a measure of the one-year-ahead default probability, combining nine accounting ratios into a single statistic. The BSM default probability is based on a theoretical asset-pricing model.

[6] The distribution of expected default frequencies may be affected by a varying sample size across time.

C. Resilience to Shocks

20.   In order to quantify corporate sector vulnerabilities, we explore the sensitivity of debt at risk to various shocks. Considering the high rollover needs, we assess which types of shocks may be associated with the most acute vulnerabilities. First, based on firm-level data, we compute the interest coverage ratio (ICR) as earnings before interest and taxes (EBIT) relative to interest expenses. ICR measures the debt-servicing capacity for a firm such that firms with ICR below 1 are classified as distressed or in theoretical default.[7] We then define debt at risk as the share of total corporate debt associated with an ICR below one, following the approach in IMF (2009 and 2011) and explore how the share of debt at risk changes when firms are subject to interest or profit shocks. Second, we estimate the FX loss on debt from 30 percent exchange rate depreciation.

Data

21.   We use firm-level data for the interest rate and profit shocks. We base the sample on public and private nonfinancial companies, including real estate companies, located in Poland, from Standard & Poor's Capital IQ database. However, as the share of private companies in the sample is relatively small, results could be sensitive to expanding the set of companies.

22.   After increasing sharply in 2008–09 as global financial conditions tightened, debt at risk worsened again in 2011–12. From less than 5 percent of debt in 2007, the share of debt at risk captured in the sample sharply deteriorated, reaching 25 percent of debt in 2009. While conditions improved markedly the following year along with somewhat calmer global financial markets and cost of borrowing around its 10-year low, renewed financial market turmoil in 2011 again started to worsen corporate sector conditions. By 2012, debt at risk had increased to above 10 percent of debt. This is similar to findings in IMF (2014a) for Poland, which put debt at risk on par with that in India and South Africa but above that in Colombia, Malaysia, and Mexico.[8] However, a substantial share is likely related to intercompany debt, though firm-level data limitations prevent a complete breakdown from this perspective.

Sensitivity to shocks

Stress tests indicate moderate vulnerabilities, though large shocks could cause strains…

23.   We consider four shocks: an interest rate increase, a decline in profits, a combined interest rate and profit shock, and an exchange rate shock. The interest rate and profit shocks are done at the firm level, while the exchange rate shock is done at an aggregate level due to data limitations.

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[7] While an alternative is to base the analysis on earnings before interest, tax, depreciation, and amortization (EBITDA), we choose to use EBIT, as the threshold of 1 is mainly established for this definition.

[8] IMF (2014a) defines ICR as EBITDA relative to interest expense; hence adjusting for depreciation and amortization.

- **Interest rate shock.** We define the baseline interest rate on debt as interest expense in year t relative to last year's debt. [9] We then apply a severe 500 basis point shock to the baseline rate. Hence, interest expense in the shock scenario can be computed as:

$$interest\ expense_{ishock,t} = \frac{i_{rate,t} + 5}{100} * debt_{t-1}$$

However, the interest rate shock could potentially increase the return on financial assets, defined as the sum of marketable securities, investment securities, and cash and bank balances. As the interest rate on domestic loans likely exceeds the return on equity and foreign currency-denominated assets, we assume the return on financial assets increases by 300 basis points (instead of 500 basis points). In the case of increased return on financial assets, the higher EBIT in the shock scenario is as follows:[10]

$$EBIT_{ishock,t} = EBIT_t + (financial\ assets_t) \cdot 3/100$$

We also explore the effects of abstracting from changes in the return on financial assets altogether, in which case EBIT is unaffected by the shock:[11]

$$EBIT_{ishock,t} = EBIT_t$$

ICR in the shock scenario is then given as:

$$ICR_{ishock,t} = \frac{EBIT_{ishock,t}}{interest\ expense_{ishock,t}}$$

- **Profit shock.** We shock operating income (equivalent to EBIT) directly by assuming a 25 percent decline:

$$ICR_{profitshock,t} = \frac{EBIT_t * (1 - 0.25)}{interest\ expense_t}$$

- **Combined interest rate and profit shock.** For completeness, we consider an adverse combined shock, consisting of an interest rate hike and a decline in profits as set out above. This allows examining risks associated with large, widespread shocks. In this scenario, we assume that returns on financial assets do not improve as the interest rate on debt increases.

- **Exchange rate shock.** As firm-level data on the currency composition of NFC debt is not available in the S&P Capital IQ database, the exchange rate shock is done at an aggregate level, following the approach in IMF (2014b). We employ the sum of individual firms' debt and combine it with the information that close to 40 percent of total NFC debt (including

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[9] Outliers where the baseline interest rate was above 50 percent or the baseline ICR was negative were removed.

[10] Missing observations for financial assets are set to zero.

[11] Abstracting from potential positive effects on financial assets did not materially change the results given their limited importance in the sample.

intercompany debt) is external debt and that 66 percent of external debt of the NFC sector is in foreign currency (FX).[12]

We consider the effect of 30 percent exchange rate depreciation. The FX loss on debt is then computed as the sum of the FX loss on the debt principal and the FX loss on foreign currency interest expense. To assess the impact of the shock, we assess the total FX loss relative to total EBIT for the firms in the sample. In addition, as intercompany debt may work as a stabilizing factor, we assess the FX loss both with and without adjusting aggregate shares (related to total external NFC debt) for intercompany debt. In turn, the FX loss on the debt principal and interest expense are approximated as:

$FX\ loss\ from\ valuation\ of\ principal$

$$= \left\{ \frac{External\ FX\ NFC\ debt\ outstanding}{External\ NFC\ debt\ outstanding} * \frac{External\ NFC\ debt\ outstanding}{Total\ NFC\ debt\ outstanding} \right.$$

$$\left. * \sum debt_{firm\ level} * (ER\ depreciation) * (1 - hedge\ ratio) \right\} / \sum EBIT_{firm\ level}$$

of which the FX loss associated with principal due in 2014 is:

$FX\ loss\ on\ principal\ due\ in\ 2014$

$$= \left\{ \frac{FX\ debt\ maturing\ in\ 2014}{Total\ FX\ debt\ outstanding} * \frac{External\ FX\ NFC\ debt\ outstanding}{External\ NFC\ debt\ outstanding} \right.$$

$$* \frac{External\ NFC\ debt\ outstanding}{Total\ NFC\ debt\ outstanding} * \sum debt_{firm\ level} * (ER\ depreciation) * (1$$

$$\left. - hedge\ ratio) \right\} / \sum EBIT_{firm\ level}$$

Here, maturing FX debt relative to total FX debt outstanding is proxied by the share of maturing FX denominated debt securities from the Dealogic database. The sum of debt at the firm level corresponds to aggregate debt from Capital IQ, corresponding to that employed in the interest and profit shocks above. ER depreciation denotes the 30 percent exchange rate depreciation, while the hedge ratio allows for varying degree of currency hedging of foreign currency debt, which can mitigate losses. As information on financial hedging is not easily available, we explore the results under different assumptions for the hedge ratio: no hedging, 50 percent hedge ratio, and 80 percent hedge ratio.

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[12] NBP, external debt statistics.

The FX loss on FX interest expense is approximated as:

$FX\ loss\ on\ interest$

$$= \left\{ \frac{External\ FX\ NFC\ debt\ outstanding}{External\ NFC\ debt\ outstanding} * \frac{External\ NFC\ debt\ outstanding}{Total\ NFC\ debt\ outstanding} \right.$$

$$\left. * \sum Interest\ expense_{firm\ level} * (ER\ depreciation) * (1 - hedge\ ratio) \right\}$$

$$/ \sum EBIT_{firm\ level}$$

Here, the sum of firm-level interest expense corresponds to aggregate interest expense from the sample of firms employed above from S&P Capital IQ.

24.   The results suggest that Poland's corporate sector is vulnerable to large interest rate shocks (Figure 12). A significant increase in interest rates, which is quickly translated into higher corporate borrowing costs, combined with a 25 percent adverse profit shock could more than double debt at risk to reach around 35 percent of debt. While the baseline debt-at-risk is on par with that for the United Kingdom in IMF (2011), the effect of shocks appears somewhat larger.[13] However, while the analysis here assumes debt is generally tied to variable interest rates, potential prevalence of fixed-rate debt would mitigate the impact of the shock. Moreover, intercompany debt may be less subject to interest-rate risk, depending on how they are priced and the type of shock (global vs. Poland-specific).

25.   To the extent that FX debt is hedged, FX shocks appear more manageable. The estimated loss on FX debt maturing in 2014 from 30 percent zloty depreciation is manageable (below 5 percent of EBIT). Nonetheless, in the absence of currency hedges, the total valuation effect (accounting for the full amount of outstanding FX debt) could be substantial (around 20 percent of EBIT)—though natural hedges, abstracted from here, may be a mitigating factor. In addition, intercompany debt could reduce the risk associated with FX shocks. While data are not available to abstract from intercompany debt at the firm level, it is possible to exclude intercompany debt from the total NFC aggregates in Poland. As such, in the extreme example of fully excluding intercompany debt from the aggregate shares, the estimated valuation loss related to 30 percent zloty depreciation could be substantially lower.

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[13] IMF (2011) found that debt at risk increases from around 10 percent of total corporate debt under the baseline to around 17 percent of debt following a 30 percent profit shock combined with a 300 basis point interest rate shock, though with substantial variation across sectors.

Figure 12. Poland: Responses to Shocks

Debt at Risk Under the Baseline and Cost of Borrowing
(LHS: percent of total debt, RHS: percent)

Legend: Debt at risk; Interest rate (simple avg., RHS); Interest rate (asset weighted, RHS)
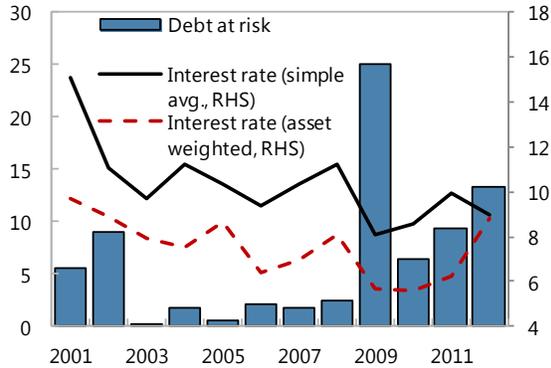
Sources: S&P Capital IQ and IMF staff calculations.

Share of Firms at Risk Under the Baseline
(Number of firms with ICR below 1, percent of total)
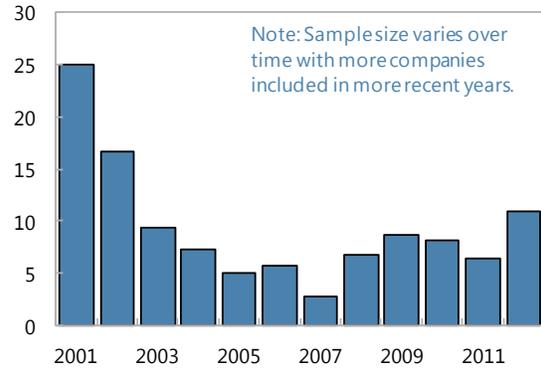
Note: Sample size varies over time with more companies included in more recent years.

Sources: S&P Capital IQ and IMF staff calculations.

Debt at Risk
(Debt with ICR < 1 in percent of total debt in the sample)

Legend: 2011 (371 firms); 2012 (372 firms)

Categories: Baseline; Profit shock; Interest rate shock; Combined shock
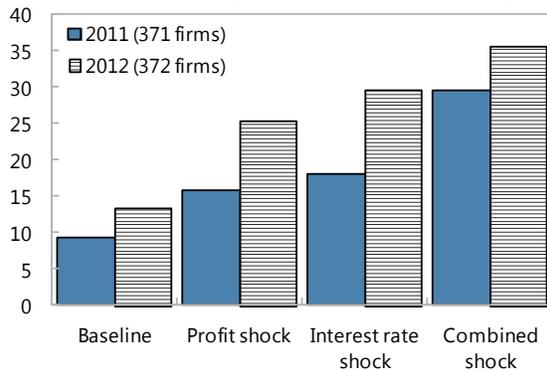
Sources: S&P Capital IQ and IMF staff calculations.

Distribution of ICR Below 1, 2012
(ICR for companies with baseline ICR between 0 and 1)

Max, Median, Min; Baseline, Combined shock
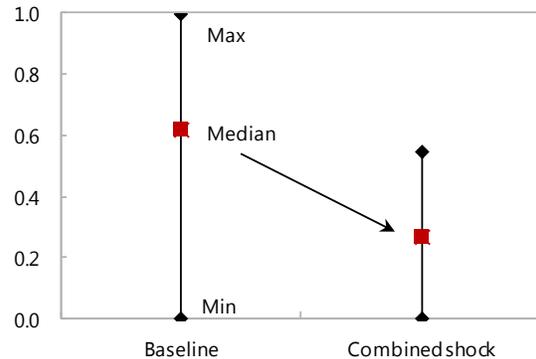
Sources: S&P Capital IQ and IMF staff calculations.

Estimated Valuation Loss From 30 Percent Depreciation (Percent of EBIT)
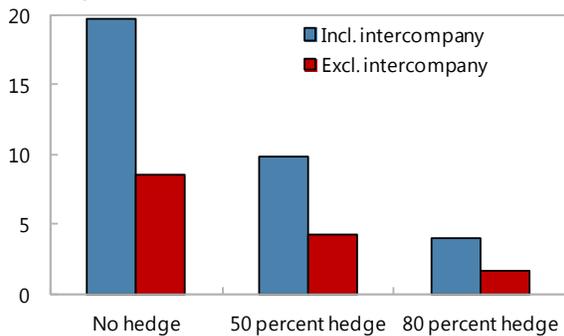
Legend: Incl. intercompany; Excl. intercompany

Categories: No hedge; 50 percent hedge; 80 percent hedge

Sources: Dealogic, Eurostat, NBP, International Financial Statistics, QEDS, and Fund staff calculations.

Estimated Loss on 2014 Maturing Debt From 30 Percent Depreciation (Percent of EBIT)
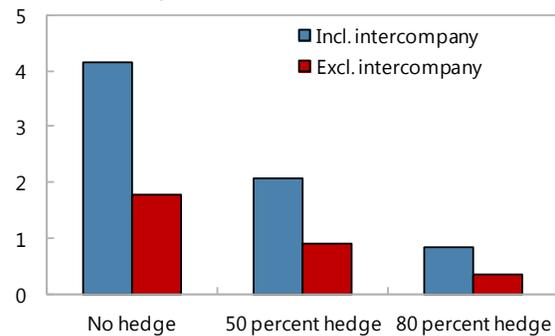
Legend: Incl. intercompany; Excl. intercompany

Categories: No hedge; 50 percent hedge; 80 percent hedge

Sources: Dealogic, Eurostat, NBP, International Financial Statistics, QEDS, and Fund staff calculations.

D. Conclusion

26.   NFC debt, and accompanying rollover needs, in Poland are high. While Poland's NFC debt does not stand out relative to that in other emerging European countries, external NFC debt is high when compared to non-European emerging markets. In addition, the stock of nonperforming loans is high in the corporate sector (particularly among SMEs), noninvestment grade bond issuance has increased recently, and rollover needs are substantial. Taken alone, this raises concerns.

27.   However, there are a number of mitigating factors. The share of intercompany debt in total NFC external debt is high. To the extent that intercompany debt is less vulnerable to sudden stops than wholesale funding, this should help alleviate rollover risks. In addition, default risk has declined across most sectors, debt–to-equity ratios are declining, and more borrowers are able to issue debt in local currency, moderating potential FX risks.

28.   Although overall vulnerabilities in Poland's nonfinancial sector appear manageable, large shocks could pose a concern. In the face of small to moderate shocks, debt at risk remains contained. The potential impact of FX shocks depends on the extent of hedging—little or no hedging could result in substantial valuation losses, while more significant hedging would lead to much lower losses. Similarly, severe interest rate shocks could pose a risk (though all debt may not be subject to variable interest rates). However, intercompany lending would likely mitigate potential default concerns.

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CYCLICAL BEHAVIOR OF VAT REVENUES IN EUROPE[1]

This chapter analyzes the cyclical properties and recent trends of VAT revenues in Poland and other EU countries. Econometric estimates uncover three main results. First, VAT revenues are strongly pro-cyclical in the short run. Second, the elasticity of VAT revenues is asymmetric over the business cycle: it tends to be higher during downturns and crisis episodes. The results also indicate that widespread increases in VAT rates in EU countries in the aftermath of the 2008 financial crisis have not translated into higher VAT revenues. In fact, recent declines in the effectiveness of VAT collections in several countries, including Poland, seem to be driven by structural factors, suggesting the need for a careful consideration of tax administration policies.

A.   Introduction

1.   **The performance of VAT collections in Poland has been lackluster since the 2008 financial crisis.** Despite an increase in VAT rates implemented in 2011, the share of VAT revenues in GDP declined from a peak of 8.2 percent of GDP in 2007 to 7.0 percent in 2013, signaling a drop in the effectiveness of VAT collections. In fact, the gap between theoretical and actual VAT revenues (i.e., the VAT compliance gap) widened from 0.2 percent of GDP in 2007 to 1.5 percent of GDP in 2011 (European Commission, 2013), and more recent data suggest that the VAT gap may have widened further during 2012–13. This trend has been prevalent in the EU, with most countries experiencing an increase in the VAT gap in the aftermath of the 2008 financial crisis. While the underlying causes of the erosion in VAT collections are not well understood, some studies point to increasing problems with tax compliance (Aizenman and Jinjarak, 2008; Reckon, 2009; European Commission, 2013). Yet, there are open questions about the role of cyclical factors, given the slowdown across the EU and the magnitude of the economic crisis in some countries.

2.   **This chapter studies the cyclical properties of VAT collections in Poland and other EU countries.** The study aims at disentangling the extent of cyclical versus structural factors in the behavior of VAT collections. More specifically, it uses co-integrating panel models to estimate the elasticity of VAT revenues to domestic demand in 21 EU countries between 1999:Q1–2013:Q4, and to test for systematic differences in the cyclical behavior of VAT collections before and after the 2008 financial crisis.[2] The analysis also explores potential asymmetries in the elasticity of VAT

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[2] The sample covers all EU countries with OECD membership. This encompasses 21 EU countries: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, and United Kingdom.

revenues between domestic demand expansions and downturns, and during protracted crisis episodes.

3.   Studying the cyclicality of VAT revenues is of interest for a number of reasons.
Understanding the cyclical behavior of VAT in EU countries and underlying recent trends is important for fiscal planning and policymaking, as VAT provides an important source of government revenue. From the theoretical perspective, the extent of pro-cyclicality of VAT revenues is unclear. On the one hand, VAT revenues should exhibit relatively low volatility, as consumption—the most important component of the VAT base—tends to be more stable than other GDP components. On the other hand, consumption smoothing mechanisms could fail to operate under certain conditions (for example, if households face cash constraints or if the economy undergoes a protracted slowdown). In addition, other components of the VAT tax base—particularly gross investment—tend to be highly volatile.[3] Therefore, assessing the cyclical behavior of VAT revenues in EU countries, including Poland, remains an open empirical question.

4.   The chapter provides several contributions to the literature. First, it uses high frequency data on VAT revenues and domestic demand to better differentiate short-run dynamics from the long-run relationship between these two variables. Second, it applies advanced cointegration panel data techniques to assess the cyclicality of tax revenues building from the aggregation of country-specific results. The estimations are robust and control for changes in nominal standard VAT rates and for common shocks affecting the countries in the sample. Robustness checks are also conducted by computing the VAT elasticities to GDP growth.

5.   The results indicate that VAT elasticities are strongly pro-cyclical and asymmetric throughout the cycle. Average point estimates range from 1.0 to 1.6 across estimation methodologies. More importantly, VAT elasticities tend to be substantially higher during cyclical downturns. This suggests that negative domestic demand shocks may have significant effects on VAT collections, especially during crisis episodes. This may have contributed to the observed increase in the elasticity of VAT revenues in EU countries in the aftermath of the 2008 financial crisis. However, cyclical dynamics seem insufficient to account for the observed downward trend in the efficiency of VAT collections, which suggests that other factors—such as problems with tax compliance—may also be at play.

6.   These results have both theoretical and policy implications. From the theoretical perspective, a larger VAT elasticity during the cyclical downturn implies that tax policy may be less counter-cyclical than suggested in the literature.[4] From the policy perspective, the results suggest

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[3] While in theory VAT should not apply to investment, in practice investment by exempted sectors pay VAT on intermediate inputs.

[4] The literature on the cyclicality of fiscal policy typically measures tax policy with the estimated non-cyclical components of tax revenues using constant tax elasticities. Neglecting pro-cyclical tax elasticities would tend to underestimate the drop in tax revenues during downturns, with the difference wrongly attributed to an easing in tax

(continued)

that forecasting models for VAT revenues need to take into account the cyclical position of the economy to reduce estimation bias (i.e., forecasted VAT revenues using an average and static elasticity would tend to overestimate revenues during the downturn and vice versa). The results also uncover a weakening trend in the effectiveness of VAT collections in Poland (and other EU countries) that calls for attention on tax administration issues. Furthermore, increases in VAT rates in Poland and other EU countries in the aftermath of the 2008 financial crisis did not lead to higher revenues.

7.   **The rest of the chapter is as follows.** Section B describes the sample and presents some stylized facts on the evolution of VAT revenues in Poland and other EU countries. Section C presents the empirical strategy. Section D discusses the baseline results and section E performs a series of statistical tests to assess potential asymmetries and non-linear effects in the cyclical behavior of VAT elasticities. Section F concludes.

B.   Stylized Facts

8.   **VAT represents an important source of fiscal revenues in Poland and other EU countries.** In 2012–13, VAT collections provided about 30 percent of tax revenues in EU countries, equivalent to 7½ percent of GDP and almost 8 percent of domestic demand. At the same time,

there were significant variations across countries: VAT revenues ranged from a minimum of 5½ percent of GDP (5½ percent of domestic demand) in Spain to almost 10 percent of GDP in Denmark (10¼ percent of domestic demand), partly due to differences in statutory rates. In Poland, VAT represented a relatively more important source of total fiscal revenues (35 percent) but a smaller share in terms of GDP (7 percent) and domestic demand (7 percent), alongside one of the highest rates in the EU.

Average VAT Revenues 1999-2013
(Percent)

Sources: Eurostat and IMF staff calculations.
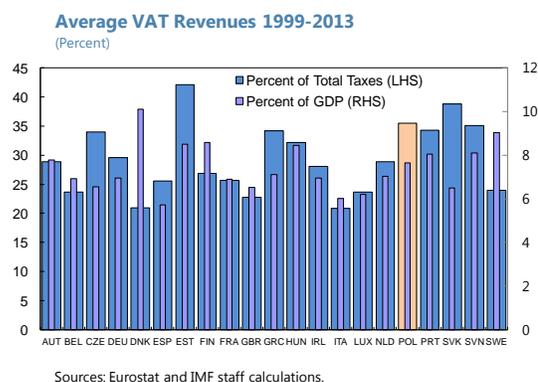
9.   **As in several other EU countries, VAT collection in Poland has declined since the 2008 crisis, in tandem with increasing statutory rates.** On average, the share of VAT revenues in GDP and domestic demand remained broadly stable in the EU during 1999–2013. But this general trend masked some concerning dynamics: more than half of the EU countries—including Poland— experienced a decline in VAT revenues to GDP (and domestic demand) since the 2008 financial crisis. Perhaps more worryingly, the decline in VAT revenues has been accompanied by increases in VAT rates—these were hiked in 12 out of the 21 countries under the analysis and cut in 4 countries, leading to an increase in unweighted average rates from 19.8 percent in 2007 to 21.5 percent in 2013.

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policy. The contrary applies to the upturn of the cycle. Thus, the use of average tax elasticities would tend to overstate the counter-cyclicality of tax policy.

10. **As a result, VAT effectiveness in the EU has dropped since the 2008 crisis.** A rough measure of VAT effectiveness can be computed as follows (Ebrill et al., 2001; Aizenman and Jinjarak, 2008):

$$VAT\ Effectiveness = \frac{VAT\ Revenues}{VAT\ Rate \times GDP} \qquad [1]$$

Thus, the change in VAT effectiveness over time (in percentage points) is given by:

$$\Delta\%\ VAT\ Effectiveness = \Delta\%VAT\ Revenues\ to\ GDP - \Delta\%VAT\ Rate \qquad [2]$$

11. **Using this measure, the effectiveness of VAT collection is estimated to have declined by about ½ percentage point of GDP since 2008.** The drop broadly matches the increase in VAT rates. In fact, the declines in VAT effectiveness have generally materialized in countries that increased their VAT rates. This descriptive result, however, does not imply causality, since the increases in VAT rates could reflect an endogenous policy response to deteriorating VAT revenue collection.

Change in Implied VAT Effectiveness
(Average 2008-13 minus Average 1999-2007)

Ch. in Average VAT Revenues to GDP = 0.1 pp.
Ch. in Average VAT Rate = 0.6 pp.
Ch. in Average Effectineess= 0.1 - 0.6 = -0.5 pp.
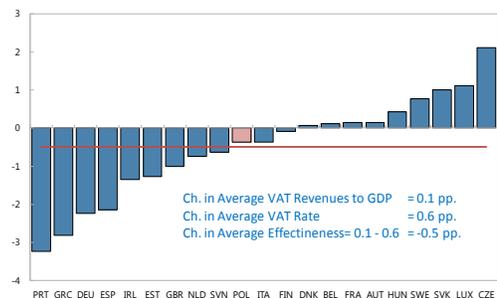
Sources: Eurostat and IMF staff calculations.

12. **VAT revenues in the EU have been highly pro-cyclical and on a downward trend since 2008.** In tandem with GDP and domestic demand growth, a slowdown in the growth of VAT revenues started to materialize in 2007, leading to a collapse during the 2008 financial crisis. Subsequently, VAT revenues rebounded strongly during 2010, helped by a base effect, but their growth has been lackluster in more recent years. The relative co-movement of VAT revenues and GDP/domestic demand growth also suggests that the VAT elasticity is relatively large.

Evolution of Average VAT, GDP Growth, and Domestic Demand Growth in the EU
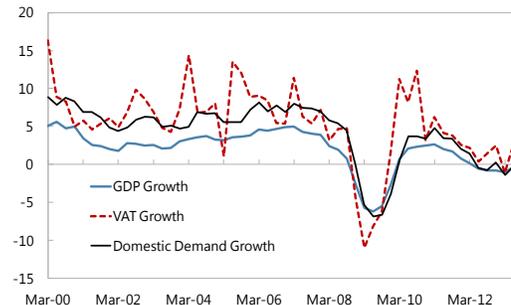
Sources: Eurostat and IMF staff calculations.

13. **VAT revenues seem to display higher sensitivity to domestic demand (and to GDP growth) during downturns.**[5] To further characterize the cyclical behavior of VAT revenues, we identify cyclical downturns as episodes of at least 8 consecutive quarters with a negative output gap (based on an HP-filter). According to this criterion, there were 29 downturn episodes in the sample, including 11 before the onset of the 2008

GDP, Domestic Demand, and VAT Around Downturns
(Percent, YoY)
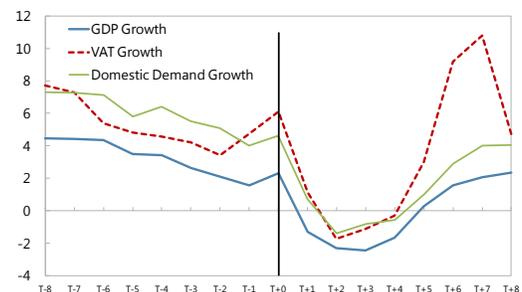
Sources: Eurostat and IMF staff estimates.

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[5] In this paper, the VAT base is proxied by domestic demand, but similar results were obtained using GDP and final consumption as alternative proxies.

financial crisis. Then, we look at the behavior of VAT revenues over a 16-quarter window centered at the start of the downturn (i.e., the first quarter with a negative output gap). The typical pattern, characterized by the simple average, suggests that VAT revenues collapse at the onset of an economic downturn (i.e., between quarters T+0 and T+2), and rebound strongly in the second year (i.e., in quarters T+4 and T+7).

14. **In Poland, the cyclical behavior of VAT revenues followed a similar pattern.** While Poland avoided recession during the sampled period, the growth of VAT revenues displayed a strong correlation with domestic demand and a marked pro-cyclical behavior. Also, the hike in the standard VAT rate in 2011 did not translate into a noticeable increase in VAT revenues. In addition, the VAT gap in Poland has increased sharply since 2007, albeit it remains below the EU average.

Poland, Cyclical Behavior of VAT
(in percent)

Sources: Eurostat and IMF staff calculations

Evolution of VAT Gaps in Poland and EU Countries
(In percent of GDP)

Sources: European Commission and IMF staff calculations.
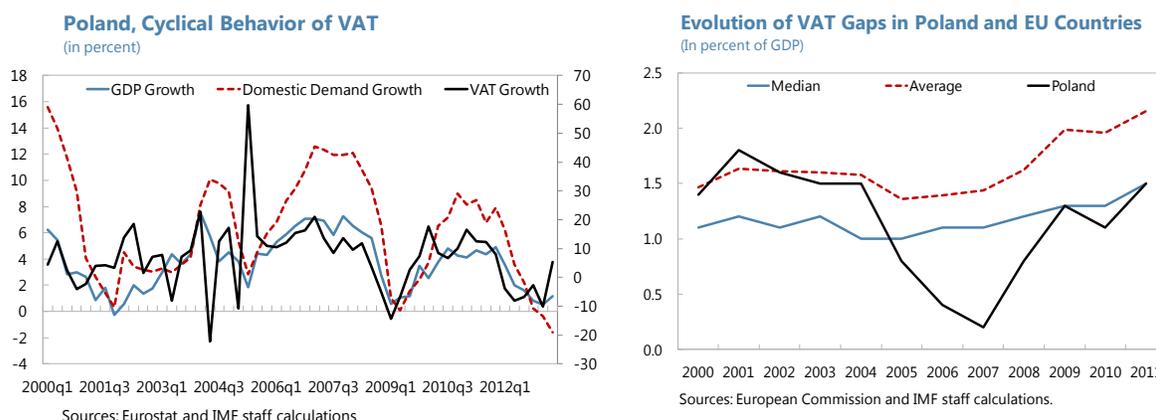
C. Empirical Design

15. **We set up a simple econometric model to identify the impact of domestic demand shocks on VAT revenues.** The model is fitted using quarterly panel data, which allows us to exploit both the time series and the cross sectional information in the data and, to fully account for country-specific heterogeneity, and to deal with cross-sectional dependence (i.e., common shocks). The panel cointegration specification also helps to address endogeneity concerns stemming from feedback effects between tax policy and domestic demand. The baseline model takes the following form:

$$\Delta T_{it} = c_i + \sigma_i t + \theta_i \Delta y_{it} + \beta_i \Delta v_{it} - \rho_i [T_{it-4} + \phi_i y_{it-4}] + \epsilon_{it} \qquad [1]$$

where Δ represents the year-on-year difference operator, T is the log of VAT tax revenues, y is the log of domestic demand, and v the standard VAT rate. The sub-index i stands for countries, and t for the time dimension. Thus, it is worth noting that the parameters in this model are country-specific, including the error correction term.[6]

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[6] Panel cointegration tests using the Westerlund (2007) methodology do not reject the hypothesis that VAT tax revenues and output are cointegrated, regardless of the specification of the test.

16. **There are several alternatives to estimate this model depending on the assumptions regarding the degree of cross-sectional heterogeneity.** One can for example assume that only the intercept differs across countries and estimate a version of model [1] with country dummies, using the dynamic panel GMM approach (Arellano and Bond, 1991; Blundell and Bond, 1998). But this specification ignores potential differences in the responsiveness of VAT revenues across countries, due for example to differences in institutional environments, degree of tax compliance, trust in government, and source of shocks. One alternative is to estimate model [1] by taking advantage of recent techniques on dynamic heterogeneous panel estimators: Pooled Mean Group (PMG) or Mean Group (MG) estimators. The focus is on the estimation of the average value of the parameters $(c_i; \sigma_i; \theta_i; \rho_i; \phi_i)$, namely: $(c; \sigma; \theta; \rho; \phi)$.

17. **PMG and MG estimators are robust to a number of biases and complement each other.** As opposed to the traditional cross-sectional and/or homogenous panel models, which rely on the finding of adequate proxies for unobserved factors, in the non-stationary panel approaches the country-specific deterministic, c_i, and $\sigma_i t$ capture a broad class of those variables. Moreover, any omitted variables that are either constant or smooth over time are also absorbed by the country-specific fixed effects and the heterogeneous trend components. The MG estimator (Pesaran and Smith, 1995) was the first to allow for complete cross-sectional parameter heterogeneity. Under heterogeneity of slope coefficients, the MG is consistent and can be obtained by averaging the country-specific time-series parameter estimates. This estimator, however, does not take into account that some economic conditions tend to be common across countries in the long-run. The efficiency gains of assuming common long run relationships while at the same time allowing for heterogeneous short-run dynamics are captured by the PMG estimator (Pesaran et al., 1999).

18. **We make use of the Common Correlated Effects (CCE) type estimators to control for cross-sectional dependence in the error terms.** Cross-sectional dependence (i.e., unobserved time-specific heterogeneity which makes error terms contemporaneously correlated) in our context is induced by the presence of common shocks affecting fiscal performance in the EU (as the economies are increasingly more integrated). This can lead to different country-specific responses to these covariant shocks. The Pesaran (2006) common correlated effects (pooled or mean group) estimators account for unobserved common factors with heterogeneous factor loadings by adding the cross-sectional averages of the dependent and independent variables as additional regressors in model [1]. This allows for more flexibility, as the impact of the unobserved common factors can differ across countries. The correction for cross-sectional dependence in the PMG is addressed using the methodology proposed by Binders and Offermanns (2007) whereas the adjustment to the MG estimator follows the Common Correlated Mean Group Estimator developed by Pesaran (2006).[7]

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[7] More specifically, the Binders and Offermanns (2007) and the Pesaran (2006) corrections consist in augmenting the PMG and the MG with the cross-sectional averages of all variables as proxies for the common factors. These procedures effectively deal with potential cross-sectional dependence, by explicitly accounting for the common factors in the most general form (i.e. by allowing the coefficients of the cross-sectional averages to differ across panel members).

19.   We use quarterly macroeconomic data obtained from the European Commission database. Level values of VAT revenues and domestic demand are in constant euro terms.[8] The models use year-on-year changes to the (log of) these two variables to deal with potential seasonal effects. The sample consists of 21 European countries observed over 1999:Q1 to 2013:Q4 (the time coverage reflects data availability).

D.   Results

20.   The econometric results show a strong pro-cyclicality of VAT revenues with respect to domestic demand. Using the baseline specification [1], the point estimate of the short-term elasticity of VAT revenues is high and relatively stable across estimation procedures (Table 1). The result implies that a one percentage point increase in domestic demand growth leads to a 1.0–1.6 percentage point increase of VAT revenues. The adjustment mechanism is relatively fast: a departure from the long-term equilibrium between VAT revenues and domestic demand growth will be reduced by about 42–63 percent in the next quarter. As expected, the hypothesis that the cointegrating coefficient between VAT revenues and domestic demand growth (i.e., φ_i) is equal to 1 cannot be rejected (not shown).

21.   The sensitivity of VAT revenues to domestic demand shocks has increased since the global financial crisis. A separate estimation of the baseline model using the pre- and post-crisis subsamples provides evidence of a marginal increase in the response of VAT revenues to domestic demand between 2008–13 (Table 2). This result could be driven by two possible factors. First, as the post-crisis years were characterized by disappointing domestic demand growth, a higher elasticity could reflect an asymmetry in the response of VAT revenues to the cycle. A second explanation relates to a potential reduction in VAT efficiency and tax compliance in response to the crisis (European Commission, 2013). We formally test for the existence of asymmetries in the response of VAT revenues to demand shocks in the next section.

E.   Exploring Asymmetries and Non-Linear Effects

22.   We propose a formal test of the asymmetric response of VAT revenue collection to negative and positive domestic demand shocks. The model specification follows earlier work on the existence of an asymmetric response of fiscal policy (mainly government expenditures) to output shocks (Hercowitz and Strawczynski, 2004). In particular, we formally test whether the pro-cyclicality of VAT revenues is statistically different between "bad" and "good" times, with the help of dummy variables:

$$(\Delta y_{it})^p = \Delta y_{it} \cdot d_{it},$$

$$(\Delta y_{it})^n = \Delta y_{it} \cdot (1 - d_{it}),$$

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[8] We use 2005 constant euro exchange rates.

where $d_{it} = 1$ if $(\Delta y_{it} - \overline{\Delta y_{i.}}) > 0$, and $d_{it} = 0$ if $(\Delta y_{it} - \overline{\Delta y_{i.}}) < 0$ and $\overline{\Delta y_{i.}}$ represents the country-specific domestic demand growth average.

Using this, the cyclical behavior of VAT revenues is specified as:

$$\Delta T_{it} = c_i + \sigma_i t + \theta_{1i}(\Delta y_{it})^p + \theta_{2i}(\Delta y_{it})^n + \beta_i \Delta v_{it} - \rho_i [T_{it-4} + \phi_i y_{it-4}] + \epsilon_{it} \qquad [2]$$

In this expression, the coefficients θ_1 and θ_2 capture the VAT elasticity during domestic demand expansions and contractions, respectively.[9]

23.   The estimation technique is modified to avoid introducing bias into the results. In principle, the estimation procedures could follow the ones applied to model [1], with the use of the PMG and the MG estimators to assess the robustness of the results. However, the fact that those estimators build from country-by-country results could introduce a bias in the estimation of the asymmetric equation. Indeed, for some countries, negative growth of domestic demand $(\Delta y_{it})^n$ is less represented in the sample than positive demand shocks. The skewness of the distribution of domestic demand growth within countries could therefore lead to unreliable estimates of the parameters θ_{1i} and θ_{2i} if, for example, only few negative domestic demand growth events are observed within countries. To account for this potential bias, the model is re-specified as a dynamic fixed-effect (DFE) panel in which the equation is estimated using the full sample of data while controlling for country-fixed effects. As the presence of fixed-effects in a dynamic panel specification could lead to the well-known Nickell bias, a version of the DFE is estimated using the Least Square Dummy Variable Corrected Estimator (LSDVCE), a method proposed by Bruno (2005).

24.   The econometric estimations reveal the existence of an asymmetric relationship between VAT revenues and domestic demand shocks. The elasticity of VAT revenues is significantly higher in "bad times" than during episodes of positive domestic demand shocks (Table 3). Regardless of the model and specification used (controlling or not for cross-sectional dependence, adding lags of cyclical variables, imposing homogeneity of coefficients), the results appear robust and similar: VAT revenues tend to decline more in "bad times" than they recover during "good times". This finding stands at odds with the intuition that VAT should prove more resilient during bad times, as private demand is stabilized by smoothing and risk-coping mechanisms. At the same time, a cyclically asymmetric VAT elasticity is in line with recent evidence of a pro-cyclical behavior of VAT inefficiency during recessions (Azeinman and Jinjarak, 2008) and the impact of recessions on the inefficiency of VAT collections in Europe (European Commission, 2013).[10] These results are therefore in line with a severe drop in VAT compliance during recessions.

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[9] Equation [2] can be generalized by controlling for lags of domestic demand shock variables as a way to account for potential lags between accrued and actual tax collections.

[10] The European Commission report on VAT gaps shows that the post-2008 difficult economic times faced by several Member States have strained VAT systems, particularly in the hardest-hit countries, led to increases in VAT Gaps even as rates were increased on several occasions.

The observed asymmetry could induce a declining long-term trend in VAT revenues to GDP, similar to the effects of cyclical ratcheting on government spending (Hercowitz and Strawczynski, 2004).

25.   The results differ somewhat when focusing only on episodes of protracted decline or increases in demand. The estimates show that VAT revenue cyclicality is not statistically different between protracted episodes of positive and negative domestic demand shocks (Table 4). Thus, when domestic demand shocks are protracted, they deliver the same revenue elasticity to VAT regardless of their nature (positive or negative shocks).

F.   Policy Implications

26.   The VAT elasticities reported in this chapter provide a sound basis for forecasting purposes. Overall, the econometric models produce satisfactory in-sample forecasts of VAT revenues. In particular, the model examining the existence of asymmetric effects in the elasticity of VAT revenue to domestic demand displays better forecasting properties than a simple linear specification. It also does a good job in tracking the dynamics of VAT revenues in Poland and other EU countries.

27.   The existence of asymmetric VAT elasticities is consistent with a worsening of tax compliance problems during the downturns. When domestic demand is very weak compared to historical averages (as was the case during Poland's recent economic slowdown), risks of deeper revenue underperformance become acute and issues of tax compliance could emerge more forcefully. As these behaviors are difficult to reverse, tax-to-GDP ratios may remain well below pre-shock levels, even after the recovery has taken place. This has implications for policies, notably the need to pursue policies aimed at strengthening revenue administration and safeguarding tax compliance.

G.   Conclusion

28.   This paper assesses the degree of pro-cyclicality of VAT revenues in EU countries, highlighting the existence of asymmetric effects. The paper innovates in a number of areas. First, it addresses potential endogeneity and heterogeneity across countries by using recent cointegrating panel techniques and by systematically controlling for statutory VAT rates. Since most European countries are exposed to common shocks (but certainly respond differently to those shocks), the econometric specifications factor in the issue of cross-sectional dependence. Second, the analysis

Poland: Goodness of Fit of the Model (Asymmetric Specification)
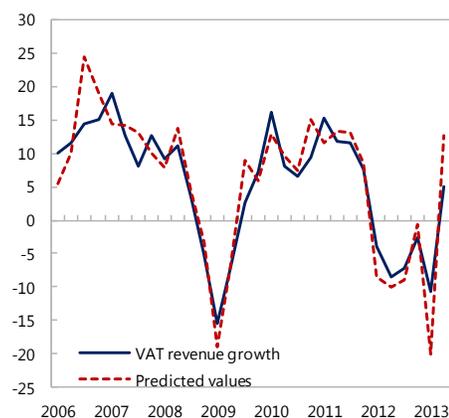
Sources: IMF staff calculations

EU sample: Goodness of Fit of the Model (Asymmetric Specification)
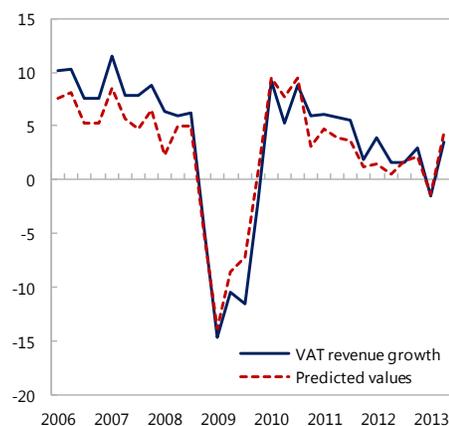
Sources: IMF staff calculations

reveals the existence of asymmetric effects. The results show that the pro-cyclicality of VAT revenues depends on the position of the business cycle, with downturns having stronger effects on VAT revenues than upturns. This is in line with recent findings of pro-cyclical VAT compliance and efficiency.

29.   The results indicate that increases in statutory VAT rates in EU countries have failed to translate into higher revenues. In fact, the descriptive evidence indicates a negative correlation between changes in VAT rates and VAT revenue performance. This result, however, does not imply that EU countries are operating on the "wrong side" of the Laffer curve, as the increases in VAT rates may have been endogenously adjusted to VAT performance. Exploring the causal relationship between these two variables is left for future work.

30.   The econometric results have practical implications for fiscal forecasting. First, the existence of state-dependent VAT elasticities suggests that any forecasting exercise of tax revenue collection and the implied structural fiscal stance should take into account potential shifts in revenue buoyancy, especially during downturns. Second, the existence of asymmetric VAT elasticities implies that VAT revenue losses during sharp economic slowdown episodes may be difficult to reverse when the economy recovers. In this regard, the ratio of VAT revenues to GDP in Poland and other EU countries could remain well below its pre-shock level for a protracted period of time, especially when concerns regarding trends in VAT gaps (or VAT inefficiencies) become acute.

31.   The econometric results have practical implications for Poland. First, the results suggest that pro-cyclical VAT elasticities should be used when forecasting VAT revenues and thus the fiscal balance. Second, given the increase in Poland's VAT gap since the global financial crisis, it appears that Poland is also experiencing an unfavorable trend in VAT collections. Thus, it is essential to determine the sources of VAT underperformance. To the extent that VAT compliance problems are consistent with the observed revenue collapse during periods of economic slack and the unfavorable trend in VAT performance, strengthening of tax administration, especially the VAT segment, should be one of Poland's key priorities.

Table 1. Linear Effect of Demand Shocks to VAT Revenues in Europe: Dynamic Heterogeneous Panel Estimates

Dependent variable: d. log VAT revenues	(1) PMG	(2) MG	(3) PMG-BO	(4) CMG
Error correction term	-0.424***	-0.488***	-0.496***	-0.627***
	(0.0475)	(0.0484)	(0.0511)	(0.0528)
Short term coefficients				
d. log Domestic demand	1.557***	1.644***	1.047***	0.998***
	(0.174)	(0.200)	(0.157)	(0.212)
d. VAT rate	1.565***	1.664***	1.126*	0.225
	(0.443)	(0.494)	(0.677)	(0.521)
Intercept				
Observations	1,050	1,050	1,050	1,050
Number of countries	21	21	21	21

Notes: Standard errors in parentheses. Changes to the variables are computed as year-on-year variations.
PMG: denotes the Pooled Mean Group estimator. MG: Mean Group estimator. PMG-BO: PMG estimator with Binders and Offermanns (2007) correction for cross-sectional dependence. CMG: Common correlated mean group estimator.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 2. Has the Crisis Led to a Shift in the Sensitivity of VAT Tax Receipts to Domestic Demand Shocks?

Dependent variable: d. log VAT revenues	(1) CMG: Before the crisis	(2) CMG: Since the crisis
Error correction term	-0.776***	-0.660***
	(0.0790)	(0.0660)
Short term coefficients		
d. log Domestic demand	0.862***	0.997***
	(0.327)	(0.323)
d. VAT rate	0.749	0.493
	(0.647)	(1.076)
Intercept	-3.180	-3.373
	(5.974)	(3.248)
Observations	504	546
Number of countries	21	21

Notes: Standard errors in parentheses. Changes to the variables are computed as year-on-year variations.
CMG: Common correlated mean group estimator.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3. Type of Demand Shocks and Cyclicality of VAT Revenues

Dependent variable: d. log VAT revenues	(1) PMG-BO	(2) CMG	(4) DFE	(5) LSDVC
Error correction term	-0.364*** (0.0411)	-0.631*** (0.0538)		
lag (d. log VAT revenues)			0.245*** (0.0572)	0.270*** (0.0313)
Short term coefficients				
Negative demand shock	1.425*** (0.322)	0.827*** (0.217)	1.599*** (0.279)	1.599*** (0.243)
Positive demand shock	0.583* (0.306)	0.727*** (0.257)	0.978 (0.774)	0.978*** (0.283)
d. VAT rate	1.572 (0.990)	0.721 (0.506)	0.656 (0.433)	0.650 (0.420)
lag Negative demand shock			-0.838*** (0.245)	-0.865*** (0.271)
lag Positive demand shock			-0.219 (0.570)	-0.240 (0.240)
Intercept	-1.696*** (0.197)	-1.366 (1.890)	0.0328*** (0.00519)	
Observations	1,029	1,050	1,029	1,029
Number of countries	21	21	21	21

Notes: Standard errors in parentheses. Changes to the variables are computed as year-on-year variations. Domestic demand shocks are measured as positive or negative quarterly deviations of domestic demand growth rates from country-specific sample averages.
PMG-BO: PMG estimator with Binders and Offermanns (2007) correction for cross-sectional dependence. CMG: Common correlated mean group estimator. DFE: Dynamic fixed effects. LSDVC: Least Square Dummy Variable Corrected.
*** p<0.01, ** p<0.05, * p<0.1.

Table 4. Role of *Protracted* Shocks				
Dependent variable: *d*. log VAT revenues	(1) PMG-BO	(2) CMG	(3) FE	(4) LSDVC
Error correction term	-0.495*** (0.0516)	-0.530*** (0.0485)		
Short term coefficients				
Protracted negative demand shock	1.318*** (0.264)	0.900*** (0.318)	1.133*** (0.304)	0.809*** (0.116)
Protracted positive demand shock	0.898*** (0.327)	0.778*** (0.271)	1.073** (0.428)	0.846*** (0.231)
d. VAT rate	1.423* (0.768)	0.953* (0.500)	1.151** (0.446)	0.806* (0.416)
lag (*d*. log VAT revenues)				0.259*** (0.0292)
Intercept	-1.003 (0.739)	-1.103 (0.686)	0.0430*** (0.00815)	
Observations	1,050	1,050	1,050	1,029
Number of countries	21	21	21	21

Notes: Standard errors in parentheses. Changes to the variables are computed as year-on-year variations. Protracted shocks are identified by sustained episodes (up to 4 quarters) of positive or negative deviations of domestic demand growth against country-specific sample average.

PMG-BO: PMG estimator with Binders and Offermanns (2007) correction for cross-sectional dependence. CMG: Common correlated mean group estimator. FE: Fixed effects. LSDVC: Least Square Dummy Variable Corrected.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

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THE POLISH PENSION SYSTEM: FISCAL IMPACT OF THE 2014 CHANGES AND REMAINING POLICY CHALLENGES[1]

This chapter presents an assessment of the long term fiscal impact of the 2014 pension changes and discusses key fiscal risks stemming from pre-existing flaws in the pension system. Under baseline macroeconomic and demographic projections over 2014–60, and assuming that half of the contributors switch to the first pillar, the 2014 pension changes will deliver an improvement in the fiscal accounts of about 30 percent of GDP in net present value terms. However, this improvement will be matched by an increase in implicit pension liabilities. More fundamentally, the 2014 pension changes do not address legacy flaws in the pension system, including old age poverty associated with low replacement rates; zero-floor indexation of first pillar notional accounts; a misalignment in the disability benefit formula; and pending reforms in special pension schemes. The chapter discusses policy alternatives to tackle these issues and highlights the need to ensure that fiscal policy remains prudent.

A.   Introduction

1.   The Polish pension system is based on three pillars. The 1999 pension reform entailed a move from a financially unsustainable defined benefit system to a defined contribution system, thus protecting its actuarial solvency. The reform also entailed the creation of a three-pillar system. The first operates as notional defined contribution (NDC), pay-as-you-go system (PAYGO), operated by the social security administration. The second entails a system of individual accounts managed by private pension funds (OFEs). Pension contributions to these two pillars are mandatory, with the largest part channeled to the first pillar and used to help pay current pensions. In addition, a third pillar of individual accounts is voluntary and not widely used.

2.   The pension system underwent significant changes in 2014. Following an official review, the second pillar was scaled-back with the transfer of about half of pension fund assets (and corresponding liabilities) to the first pillar. The changes also entailed, *inter alia*, a redirection of contributions to the first pillar and the centralization of the payout phase in the first pillar. These changes led to a sharp one-off drop in (explicit) public debt in early 2014 and are expected to further improve fiscal aggregates going forward. However, they would also entail an increase in long-term (implicit) fiscal liabilities.

3.   This paper presents an assessment of the long-term fiscal impact of the 2014 pension changes vis-à-vis the no policy change scenario. The assessment is based on projections of

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relevant fiscal flows over the period 2015–60, taking population trends as given and ignoring potential feedback effects between the pension system and the macroeconomy. Sensitivity analysis is carried out using four sets of adverse macroeconomic scenarios.

4.   Baseline results indicate that the 2014 pension changes would deliver an improvement in the fiscal accounts, vis-à-vis the no policy change scenario. The gain originates from the partial unwinding of the funded second pillar, which leads to the fiscal recapture of a fraction of incurred transition costs from the 1999 pension reform.[2] Moreover, the permanent drop in the size of the funded second pillar would also lead to a decrease in transition costs over the projected horizon. Given population projections, this would translate into positive cash flows to the fiscal sector until around 2050, followed by increasing negative flows in the outer years of the projection (and beyond). Overall, under the assumption that half of the contributors switch to the first pillar, the pension changes would generate fiscal cash flow gains of about 30 percent of GDP in net present value terms between 2014–60, compared with no policy change.

5.   However, the pension changes would be fiscally neutral if the increase in implicit liabilities is taken into account. Asset transfers and redirections of pension contributions to the first pillar would lead to improvements in the fiscal balance and to reductions in explicit public debt. However, these would be exactly matched by increases in pension liabilities since the system operates as NDC. Therefore, if implicit and explicit liabilities were treated equality, the pension changes would be fiscally neutral (Mackenzie, 2003).[3]

6.   Despite the improvements in the fiscal accounts, fiscal prudence remains essential. On impact, the pension changes will avert mandatory (and highly procyclical) fiscal consolidation, by reducing public debt below the 55 percent of GDP legal threshold.[4] However, the since the pension changes entail larger payments in the more distant future, there is a need to maintain fiscal prudence and continue the fiscal consolidation currently under way. The new permanent expenditure rule will be important in this regard.

7.   The pension changes do not address the fiscal risk of a sharp drop in replacement rates over time. The initial 1999 pension reform entailed a move towards a NDC scheme, protecting the actuarial solvency of the system through substantial declines in replacement rates (defined as the ratio of average pension benefits to wages) over time—from around 60 percent currently to 30 percent in the future according to the calculations presented in this chapter. Meanwhile, the

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[2] Transition costs reflect the partial redirection of pension contributions to fund second pillar assets.

[3] In practice, when assessing fiscal sustainability, financial markets and international institutions tend to focus on gross public debt.

[4] The Polish Constitution caps public debt (according to a national definition) at 60 percent of GDP, and the Public Finance Law requires mandatory fiscal consolidation if debt to GDP exceeds 55 percent of GDP. In addition, a recent law amendment established two preventive debt thresholds at 43 and 48 percent of GDP, in substitution for a previous threshold of 50 percent of GDP.

creation of a funded second pillar did not generate an increase in economy-wide savings, as the accumulation of assets in OFEs between 1999–2013 was almost perfectly matched by an increase in public sector debt. Together, these two factors give rise to risks of old-age poverty, which may result in pressure on public finances in the future.

8.   In the event of adverse economic developments, the fiscal sector would remain exposed to risks stemming from legacy issues in the pension system. In particular, non-negative indexation limits on the NDC accounts in the first pillar could lead to fiscal imbalances in a crisis scenario (as the growth of pension liabilities could exceed the growth of contributions). A misalignment of disability benefits with benefits in the core pension system could also increase incentives to claim retirement as disabled, weighing on fiscal resources. Unaddressed imbalances in special pension schemes for farmers, miners, and uniformed services could also lead to additional fiscal pressures over time.

9.   Fiscal risks could be also ameliorated by undertaking parametric changes in some components of the pension system:

- Addressing the drop in replacement rates. Options include expanding pension coverage to workers under special temporary contracts (who are also likely to be low-wage earners at greatest risk of old-age poverty), assessing alternatives to incentivize private savings in the voluntary third pillar, improving financial literacy.[5]

- Revising the indexation of the first-pillar NDC accounts to allow for negative coefficients. A second best option could entail setting the indexation of the main account to the five-year average growth of the wage bill to reduce the negative fiscal impact of adverse temporary shocks to labor market developments.

- Adjusting the disability formula. Disability benefits should be aligned to the largest extent possible with those of the core pension system to avoid adverse incentives and moral hazard problems.

- Tackling special pension schemes. Special pension schemes need to be subject to parametric reform and aligned with the core pension system to ensure their actuarial solvency. This is not likely to generate substantial fiscal impact in the short term, but would translate into fiscal savings in the long run, helping to balance the flows under the PAYGO system.

10.   The rest of the chapter is structured as follows. Section B presents a brief background of the 2014 pension changes and outlines the methodology and the main assumptions. Section C presents the baseline results and a sensitivity analysis, based on four adverse macroeconomic scenarios. Section D discusses legacy fiscal risks stemming from the pension system and presents

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[5] In Poland, some temporary contracts fall under the civil code (rather than the labor code) and therefore do not require employers and employees to contribute to the social security system.

some policy recommendations to help ameliorate them. Section E concludes, emphasizing the main policy recommendations.

B.   Background and Methodology

11.   Following the 1999 pension reform (Box 1), additional changes were implemented in 2011–2012. In the context of a fiscal consolidation strategy, pension contributions were partially redirected from the second to newly created subaccounts in the first pillar staring in 2011. These subaccounts were indexed to the average nominal GDP growth of the previous five years (Annex 1). Afterward, statutory retirement ages were increased starting in 2013, improving the financial footing of the pension system.

12.   A substantial downsizing of the second pillar was implemented in 2014. The changes entailed the transfer of pension fund holdings of government debt and government-guaranteed debt (about half of pension fund assets), together with the corresponding pension liabilities, to the social security administration. The transferred Treasury bonds were subsequently cancelled, and the corresponding pension liabilities were registered in individual NDC sub-accounts in the first pillar. Individuals were given the choice to maintain their accounts in the pension funds, and to contribute 2.92 percent of their salaries to these accounts which required filing an administrative request within a four-month window. Otherwise, all new contributions would be redirected to the first pillar (the default option). Pension funds were banned from investing in government bonds and previous benchmarking and penalty systems were removed to encourage a more active portfolio management. Limits on holdings of foreign securities are expected to be lifted over time, from 5 percent in 2013 to 30 percent by 2016.

13.   In addition, the payout phase will be centralized in the public system. The first cohort of men with private pension fund accounts begins retirement in 2014. The pension changes envisaged a centralized administration of the payout phase through the social security administration. All the contributions of individuals 10 years before retirement will be directed to the first pillar. In addition, assets in the second pillar will be gradually transferred to the first pillar starting 10 years before retirement (the so-called zipper).

14.   The assessment in this paper compares the fiscal impact of the 2014 pension changes to a no policy change scenario. The baseline projections assume that 50 percent of OFE members, and 50 percent of new labor market entrants decide to contribute to the second pillar. Sensitivity analyses were conducted assuming extreme switching and entry rates of zero and 100 percent to assess a full range of possible outcomes.

Box 1. The 1999 Pension Reform

In 1999, the Polish pension system was converted from defined-benefits to defined-contributions under a three-pillar structure. The first pillar entailed a public, NDC pay-as-you-go (PAYGO) system, operated by the social security fund (FUS). The second, a system of individual capitalization accounts managed by private pension funds. Contributions to these two pillars were compulsory for individuals below the age of 30 at the time of the reform. Those aged 30–49 were allowed contribute to the second pillar on a voluntary basis, while individuals aged 50 or more at the time of the reform were not allowed to open private pension fund accounts. In addition, a third pillar of individual investment accounts was offered as optional.

The creation of a funded second pillar, together with the recognition of inherited pension liabilities, entailed sizable transition costs. Pension contributions were maintained at 19½ percent of the wage bill. Between 1999 and 2011, 7.3 percent of the wage bill was transferred to the second pillar, and the remaining 12.2 was retained in the first pillar.

The reform ensured the actuarial solvency of the system but led to declining replacement rates. Individuals born before 1949 were grandfathered and allowed to receive pension benefits according to the previous system. For the younger cohorts, however, pension benefits were linked to their contributions, underpinning the actuarial solvency of the system. Contributions channeled to the first pillar helped pay current pensioners (as the first pillar operates as PAYGO) and were recorded in individual notional accounts indexed to the evolution of the nominal wage fund. In turn, contributions channeled to the second pillar earned market returns (net of fund management fees) based on the portfolios of pension funds. Upon retirement, pensions are determined by dividing the individual's capitalized accounts in the first and second pillars over life expectancy. Over time, pensions are indexed by CPI inflation plus 20 percent of the real wage growth. Under this system, replacement rates were projected to drop over time (from around 60 percent in 2014 to 30 percent by 2060).

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15.   **The exercise builds on a simplified static cohort model.** It uses information on the age and gender profiles of balances in first- and second-pillar accounts as of end-2012, and on data on cohort-specific participation rates, age-earning profiles (seniority) and social security contributions. Demographic projections for 2015–60 are taken from Eurostat. The model assumes no behavioral responses and no feedback effects from pension changes to macroeconomic and labor market conditions. In the projections, cohort-specific contributions and payments are conditional on projected macroeconomic scenarios (summarized by GDP growth and average wage dynamics), fixed age-earnings profiles, and demographic projections. The macroeconomic scenarios are assumed to homogeneously affect all cohorts and both genders and are identical under both policy scenarios. In terms of retirement probabilities, the model uses the simplifying assumption that all beneficiaries enter the system at the statutory retirement age. While this assumption is in variance with observed behavior, it implies a narrowing gap between effective and statutory retirement ages and has no tangible impact on the marginal fiscal effect of the 2014 reform.

16.   **The model also assumes equal returns between NDC and second pillar assets.** Financial returns on first pillar accounts are based on statutory indexation formulas, while returns on second pillar assets (net of fees) are assumed to evolve according to the average GDP growth of the

previous five years (these are in fact close to the effective average returns obtained by pension funds between 1999–2012).[6] The assumption of return equality entails a useful constraint to the analysis as it ensures that the results are not biased by imputed return differentials. All else equal, an increase in returns in the second pillar will generate higher pensions and also an increase in fiscal aggregates within the projection horizon due to the zipper (since the associated pension payments materialize later in time).

17.   The effects of the 2014 pension changes are measured by the net present value of the incremental cash flows vis-à-vis the no policy change scenario. The fiscal impact is computed by taking the difference of annual cash flows to the public sector under the 2014 pension changes and those under the no policy change scenario. The net present value of the difference, expressed in terms of GDP, is used as a summary measure of the net fiscal impact of the pension changes. The calculations use a discount rate equal to GDP growth, which implies that the opportunity cost of fiscal resources (and the productivity of fiscal expenditures) matches the growth rate.[7] Under this metric, a positive net present value implies that the 2014 pension changes produce a long-term improvement in the fiscal aggregates.

18.   The estimations leave outside some important risks that are difficult to model. Material risks (both positive and negative) stemming from age-specific employment probabilities, productivity changes, and underestimated life expectancies are not assessed in this paper. Periodic updates of the financial soundness of the pension system offer an alternative to track major trends and fill this gap, providing the ground to assess the need for corrective measures.

19.   The analysis focuses on cash flows and thus abstracts from differences in accounting criteria across various methodologies (Box 2). The one-off transfer of public debt and subsequent asset transfers in the context of the zipper are treated as positive fiscal cash flows (Annex 2).[8] Corresponding transfers of pension liabilities are registered in notional accounts and indexed over time according to statutory formulas. The associated pension payments, which materialize at a later stage, are computed by dividing the capitalized balances in the first-pillar accounts at retirement (properly adjusted by pre-retirement asset transfers) by life expectancy. The resulting annuities are also indexed according to legal provisions.

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[6] The ex-post returns of the second pillar between 1999–2012 were close to the indexation of the notional account in the first pillar during the same period: average real returns were about 3.4 percent in the second pillar, and 3.9 percent in the first pillar, compared with 3.9 percent GDP growth.

[7] In theory, the rate of return to compute the net present value should measure the opportunity cost of fiscal resources, or a risk-free return on assets with a maturity equaling liabilities. In the absence of such assets, GDP growth provides a reasonable and technically manageable discount rate.

[8] Alternatively, the cash flows associated with the one- off debt transfer could be measures by the drop in the associated debt service over time. The financial result will be equivalent to the one presented in this paper (under the assumption of equality between the interest rate on public debt and the rate of return used to compute the net present value).

Box 2. Accounting for the Fiscal Impact of Pension Changes

The 2014 pension system changes affect the government accounts through several channels:

* One-off asset transfer: in early 2014, pension funds transferred to the first pillar holdings of T-bonds (written-off immediately), government-guaranteed bonds, municipal bonds, and cash totaling at 51½ percent of their total assets.

* Opt-out from second pillar: insured could opt-out and redirect all their new contributions to the first pillar (their assets will remain in private pension funds until they are gradually transferred to the first pillar starting 10 years before their retirement).

* Lower contribution rate to second pillar: at 2.92 percent instead of 3.5 percent of income.

* Redirecting contributions of the elderly: all the contributions of workers close to retirement will go the first pillar starting 10 years before reaching the retirement age.

* Gradual transfer of assets: assets of persons 10 years before the retirement age will be gradually transferred to the first pillar.

The pension changes are registered differently by various fiscal methodologies. While there is a consensus to book additional contributions as revenues and pension payments as expenditures, there is no uniform treatment of asset transfers:

* Polish statistics: the one-off debt transfer is registered above-the-line (government-guaranteed securities, and cash are booked as first pillar revenue); the gradual transfer of assets of the elderly is also classified as first pillar revenue;

* ESA95: EU current methodology classifies both the one-off asset transfer and gradual pre-retirement transfers as revenues;

* ESA2010: EU new methodology (to be implemented in late 2014) will classify the one-off debt transfer as a below-the-line financing transaction. The accounting of subsequent asset transfers in the context of the zipper may also be registered as below-the-line financing, and gradually registered as revenue as pensions are paid out.

* IMF GFS: The IMF methodology also classifies the one-off debt transfer as a below-the-line transaction. Asset transfers in the context of the zipper would be registered as a financing item below-the-line, and gradually reversed when the corresponding pensions are paid out.

Methodological differences will lead to discrepancies in the fiscal accounts. Classifying asset transfers either as financing or revenues will affect the comparability of fiscal accounts. If asset transfers are registered below-the-line, as in ESA2010, there will be a downward pressure on public debt without matching entries on the fiscal balance (the latter will capture only a fraction due to lower interest costs). At the same time, asset transfers increase implicit liabilities, materializing in higher pension payments with matching fiscal revenues at a later stage.

C.   Assessing the Impact of the 2014 Pension Changes

Baseline Results

20.   The baseline scenario uses long-term official projections to facilitate the comparability of the results. Key macroeconomic variables (i.e., real GDP and real wage growth) follow MoF long-term projections (Text Figure 1). In the left panel, wage dynamics are stronger than GDP growth and compensate for a decreasing labor supply, leading to a stable labor share in GDP. In turn, the right

panel shows the evolution of contributors to notional accounts in the first pillar and the number of contributors under the notional defined contribution system. It also shows the evolution of contributors to OFEs. The sharp drop in 2014 follows from the assumption that half of the contributors opt out from the second pillar (there is no matching increase in the number of contributors to the first pillar since the switching changes their OFE affiliation but not their first pillar membership). The cash flows under the status quo and the pension changes are computed using these projections and applying the static cohort model. Thus, the estimated fiscal impact of the pension changes under the baseline scenario can be compared with the latest official results.

Text Figure 1. Poland: Model Assumptions

Note: "FUS contributors" refers to the number of contributors to the first pillar, "FUS sub-account contributors" to those that have a notional account in the first pillar, "OFEs contributors" refers to the number of contributors to OFEs; and "Reformed FUS pensioners" reflects the number of pensioners under the notional contribution system implemented in 1999.
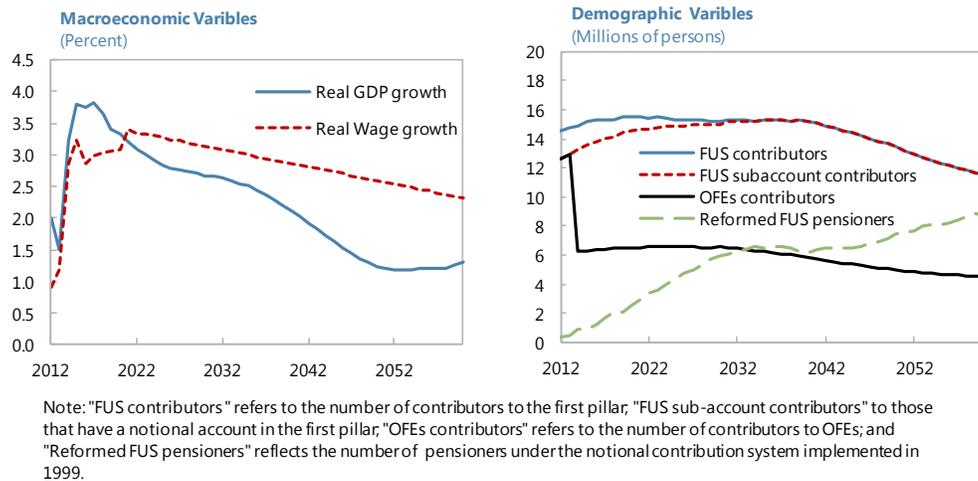
Sources: MoF, Eurostat and staff estimates.

21.   **The impact on fiscal cash flows is positive over the projection horizon, and broadly in line with official estimates.** As a result of the 2014 pension changes, cumulative cash flows build-up in the short- and medium-term and peak to about 31 percent of GDP by 2050. Afterward, the increase in pension payments starts to offset the incremental pension contributions and the interest savings, which causes a decline in the cumulative gains to around 29 percent of GDP by 2060 (Text Figure 2). This is broadly in line with official estimates.[9] The factors which affect the net cash flows are:

Text Figure 2. Cumulative Fiscal Gains of Pension Changes
(Percent of GDP)
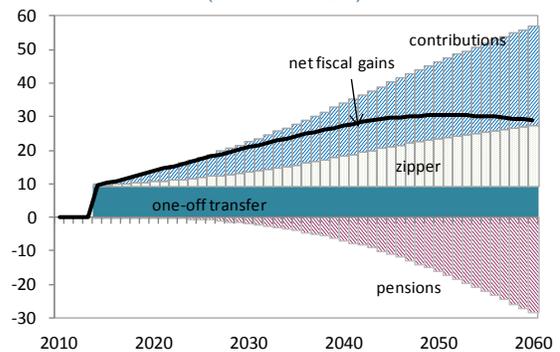
Source: IMF staff estimates based on ZUS, GUS, KNF and Eurostat.

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[9] According to calculations in the bill presented to Parliament, the gains of the FUS will accumulate to 19 percent of GDP. If adjusted by the one-off debt transfer totaling some 9 percent of GDP in 2014, cumulative gains would reach 28 percent, almost matching the outcome presented here.

- **Higher flow of contributions to the first pillar.** The additional stream of contributions to the first pillar vis-à-vis a no policy change scenario will cause a substantial drop in transition costs. The gains originate from: (i) individuals who are assumed to opt-out of the second pillar; (ii) a reduction in contributions to OFEs for individuals who chose to maintain their accounts in the second pillar; and (iii) individuals approaching retirement age, as their contributions will be entirely redirected to the first pillar starting 10 years before retirement. Overall, using a rate of return equal to GDP growth, these additional contributions generate an improvement in the fiscal accounts by some 30 percent of GDP in net present value terms between 2014–60.

- **Asset transfers.** Pension fund holdings of government debt and government-guaranteed debt transferred in 2014 represent 9 percent of GDP, resulting in lower debt service during the projected horizon. Additionally, assets in the second pillar transferred to the first pillar starting 10 years before retirement provide a cumulative 18 percent of GDP in cash flows to the fiscal by 2060.

- **Higher pension payments.** While pension benefits remain unaffected by the 2014 changes, the increase in contributions and asset transfers to the first pillar will lead to higher pension payments by the public sector by a cumulative 28 percent of GDP by 2060, partially offsetting previous cash flow gains.[10]

22.   The positive effect of the pension changes on fiscal aggregates is likely to be smaller under an infinite horizon. The improvement in cash flows as a result of the pension changes is exactly matched by an increase in implicit pension liabilities that have to be repaid beyond the projected horizon. Implicit pension liabilities will be covered by the stream of pension contributions under the PAYGO after the system reaches its long-term equilibrium. However, the fact that net fiscal gains are on a downward trajectory at the end of the projection suggests that this equilibrium is not yet reached by 2060. Thus, an assessment over an infinite horizon is likely to produce lower cash flow gains than those reported in this chapter.

Sensitivity Analysis on the Impact of the 2014 Pension Changes

23.   The results are broadly robust to alternative switching rates to the first pillar. Contributors' decisions to stay in private pension funds are not crucial for fiscal impact. The 2014 reforms envisage voluntary participation in the funded second pillar, with the insured having to decide in April-July 2014. These decisions could be then confirmed or reversed in 2016, and every four years afterward. In the case of no explicit choice, all new pension contributions will be redirected to the first pillar (i.e., the default). Under the assumption that all the contributors decide to stay in the second pillar, the net present value of the fiscal gains will represent 23 percent of GDP under the baseline scenario. At the other extreme, under the assumption that all the contributors

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[10] In particular, effect of one-off transfer will be largely wiped out by 2060, as 82 percent of the initial cash flow gain will have been paid out in pension benefits.

decide to opt-out of the second pillar, the net present value of the fiscal gain will increase to 35 percent of GDP. These results show that voluntary participation in the second pillar is not the key component in terms of the long-term fiscal impact, and other elements the pension changes (especially the gradual transfer of assets prior to retirement) will play a more significant role.

24.   **The robustness of the baseline results is also assessed using four macroeconomic scenarios.** The relative dynamics of the macroeconomic variables under each of these scenarios are based on historic correlations, calibrated with the help of Vector Autoregression (VAR) models. The scenarios are as follows:

- *Scenario 1: Historical Dynamics.* Macroeconomic variables are assumed to remain at their historical averages (i.e., levels observed during 200-13) (Table 1). In this scenario, real GDP growth averages 2.4 percent and, wage bill growth averages 2.5 percent. As a result, the ratio of the wage bill to GDP stabilizes at around 25 percent.

- *Scenario 2. Severe Downturn.* This scenario assumes a 3.8 percentage point drop in GDP growth (two standard deviations) relative to the baseline in years 2020–23, followed by a permanent drop in potential growth equivalent to one standard deviation over the rest of the projected horizon. The impact on inflation, wages, and employment is based on historic correlations. In this scenario, real GDP growth averages 1.7 percent, with a minimum of −3.2 percent and 7 years of negative performance.

- *Scenario 3: Sluggish Wages.* This scenario assumes that labor productivity slows down going forward, which materializes in slower wage and employment dynamics. GDP growth performance is comparable to the baseline scenario, but the growth of the wage bill averages 1.7 percent during the projection. As a result, the ratio of the wage bill to GDP drops from 26 ½ percent in 2014 to 22 percent at the end of the projection horizon.

- *Scenario 4. Protracted Crisis.* This scenario assumes a severe protracted crisis. The scenario implies a cumulative 23 percent and 20 percent drop in GDP growth and wages over 2020–25 relative to the baseline.

Table 1. Summary Statistics of Selected Variables Under Alternative Scenarios

	Actual 2001-13	Baseline	Historical Dynamics	Severe Downturn	Sluggish wages	Protracted Crisis
GDP Growth						
Average	3.6	2.3	2.4	1.7	2.4	1.3
Min	1.2	1.2	-0.7	-3.2	-0.3	-7.1
Max	6.8	4.3	6.8	6.8	6.8	3.8
St. Dev.	1.9	0.9	1.6	1.8	1.5	2.5
No. Years with Negative Dynamics	0	0	6	7	3	6
Wage Bill Growth						
Average	3.1	2.4	2.5	1.8	1.7	1.7
Min	-1.4	0.8	-0.8	-2.1	-0.6	-10.3
Max	10.8	5.5	4.4	4.4	4.4	5.5
St. Dev.	3.0	1.2	1.2	1.4	1.2	2.8
No. Years with Negative Dynamics	3	0	8	12	5	3

Source: IMF staff calculations.

25.   The baseline results are fairly robust to the sensitivity analysis. Overall, the fiscal impact of the pension changes under each of the distressed scenarios deviates from the baseline results by less than 6 percent of GDP (Text Figure 3). Consequently, the conclusion that the pension changes have a positive impact on fiscal aggregates appears fairly robust to changes in the macroeconomic assumptions. This robustness rests on the stability of the share of the wage bill to GDP. Since the indexation of the sub-accounts is linked to average GDP growth, a downturn scenario would translate into slower growth of pension liabilities, helping counteract the weaker pension contributions. Thus, the stream of cash flows would mainly depend on the relative dynamics of the wage bill and GDP. An eventual slowdown of the wage bill growth relative to GDP dynamics will tend to erode the net fiscal inflows, and vice-versa. This is why the sluggish wage growth scenario has the largest adverse impact.

Text Figure 3. Sensitivity of Baseline Results to Macroeconomic Shocks
(Cumulative percent of GDP)

Source: IMF staff estimates based on ZUS, KNF and Eurostat
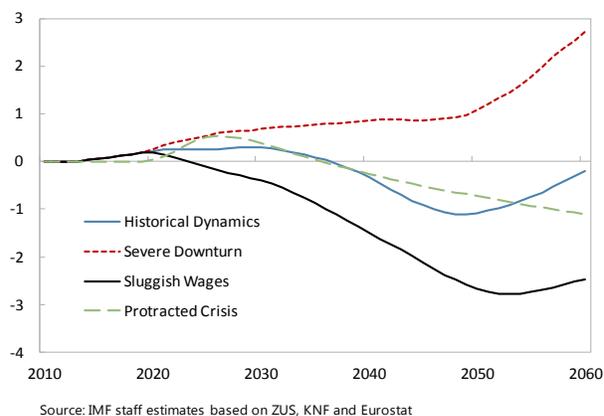
Impact of the 2014 Changes on the Second Pillar

26.   The 2014 pension changes entail a scaling back of the second pillar. The one-off debt transfer will lead to a sharp decline in the size of the second pillar (from around 18 percent of GDP in 2013 to around 9 percent of GDP in 2014). In addition, the subsequent drop in the assumed flow in contributions to the second pillar will add to the effect of asset transfers as a result of the zipper. Under the no policy change scenario, the assets of the second pillar would have reached 36 percent of GDP by 2060 (Text Figure 4). In contrast, projected second pillar assets under the 2014 pension changes are projected to stabilize at around 7 percent of GDP in 2060. Thus, the difference in the size of second pillar assets matches the estimated increase in cash flows to the fiscal and the increase in implicit pension liabilities for the government.

Text Figure 4. Projected Evolution of Second Pillar Assets
(Percent of GDP)

Source: IMF staff estimates based on ZUS, KNF and Eurostat.
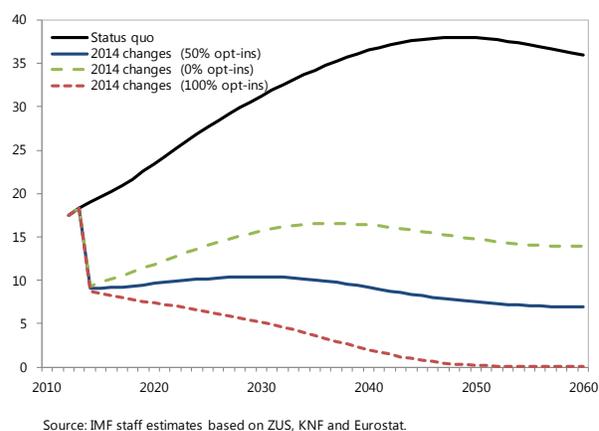
27.   The long term viability of the second pillar would depend on the share of contributors opting-in. The number of contributors that opt in to second pillar accounts is of crucial importance for its viability. Under the assumption that all contributors decide to shift their contributions to the first pillar, the second pillar will cease to exist before 2050, when remaining assets are transferred to the first pillar in line with new pension payout framework. Alternatively, if all current and future

contributors opt in, second pillar assets will increase to about 17 percent of GDP by 2030 and stabilize at around 14 percent of GDP by 2060.

D. Assessing Legacy Fiscal Risks

28.   Despite their positive fiscal effects, the pension changes do not eliminate the fiscal risks stemming from legacy flaws in the system. The larger first pillar following the 2014 pension changes will still require further reforms to mitigate fiscal contingencies. This section presents an assessment of fiscal risks stemming from indexation of notional pension accounts, inadequate replacement rates, special pension regimes, and disability benefits, together with some policy recommendations to address these risks.[11]

First-Pillar Indexation

29.   The indexation of notional accounts in the first pillar does not guarantee the long-term financial viability of the pension system. A defined-contribution pension scheme could be financially viable (including an unfunded PAYGO), providing that indexation of notional pension capital does not exceed the dynamics of pension contributions (Samuelson, 1958). The original 1999 pension reform aimed at achieving this outcome by setting indexation of the notional capital below the dynamics of the pension contribution base (also referred to as covered wage bill) and by allowing negative indexation coefficients. However, the rules were revised subsequently to fully reflect the growth of the covered wage bill and to impose a zero-floor limit on indexation. In turn, the indexation of the notional sub-accounts created in 2011 was set to the 5-year average nominal GDP growth and also restrained by a zero-floor limit. The analysis in this section estimates fiscal risks arising from such asymmetric indexation mechanisms in case of adverse macroeconomic shocks.

30.   Adverse economic shocks could undermine the solvency of the system. An episode of slow growth, or a crisis scenario, could activate the zero-floor indexation limit and lead to financial imbalances in the pension system (as the growth of revenues would fall behind indexation of the notional accounts). To assess the fiscal risks of asymmetric indexation, the projections under current rules are computed for the set of distressed macroeconomic scenarios discussed above, and then compared to a counterfactual policy that allows for negative indexation. This allows isolating risks related to asymmetric indexation and quantifying them in a long-term.

31.   Indexation of the main accounts may pose a large fiscal risk. Each of the shock scenarios would activate zero-floor indexation limit in the main account, with adverse fiscal consequences compared to a scenario allowing negative indexation. In the projections, this impact would range from 3 percent to 25 percent of GDP (Text Figure 5). Shocks heavily affecting the wage bill (as under

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[11] The calculations differ from those presented in the sensitivity analysis in two respects. First, the shocks are applied to all the notional accounts in the first pillar (including the main accounts and the full balances of the sub-accounts). Second, the calculations are compared with a counterfactual policy that allows for negative indexation in the first pillar.

the *Sluggish Wages* and the *Protracted Crisis* scenarios) could be particularly costly for public finances under the current indexation mechanism of the main account.

Text Figure 5. Shock Scenarios: Cost of Zero-Floor Indexation 1/
(Cumulative, in percent of GDP)
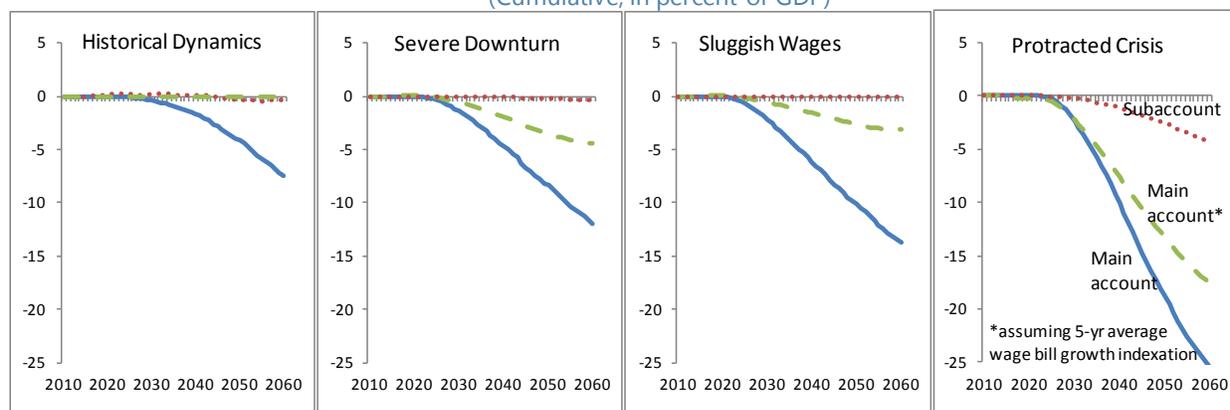
1/ Difference vs. system without zero-floor indexation constraint.

Source: Staff estimates based on ZUS, KNF and Eurostat

32.   Fiscal risks could be mitigated by changing the indexation mechanisms. The analysis suggests that the largest fiscal risk emanates from the indexation of the main account, while the sub-account could cause imbalances only in extreme cases. The most transparent way to address such risks would be to allow negative indexation of notional accounts, as envisaged by the original pension reform. Fiscal risks related to short-lived wage shocks could also be mitigated by making indexation of the main account dependent on multi-year instead of annual dynamics of covered wage bill. Such a change would suffice to eliminate the risks under the *Historical* scenario, and it would significantly mitigate risks under *Severe Downturn* and *Sluggish Wages* scenarios, all modeled as randomized scenarios based on VAR model. However, this would not suffice to reduce the substantially adverse fiscal impact of the *Protracted Crisis* scenario.

Replacement Rates and Old-Age Poverty Risk

33.   The pre-reform pension system was unsustainable. At the eve of 1999 pension reform, the system was characterized by low effective retirement age and high replacement rates (Text Figure 6). Given adverse demographic trends, growing deficits generated by such scheme would undermine public finances. The 1999 pension reform addressed this challenge by gradually moving from the old defined-benefit formula, only partly linked to contributions, to a defined-contribution, where pensions almost fully depend on contributions paid. Other things equal, decline in replacement rates would be the result of stabilizing the system by changing the pension formula.[12]

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[12] Replacement rates measure the size of pensions relative to wages. In this paper, replacement rates are defined as the ratio between average pensions and average wages (net of social contributions).

Text Figure 6. Unsustainable Pre-Reform Pension System

Source: ZUS, GUS, Eurostat.
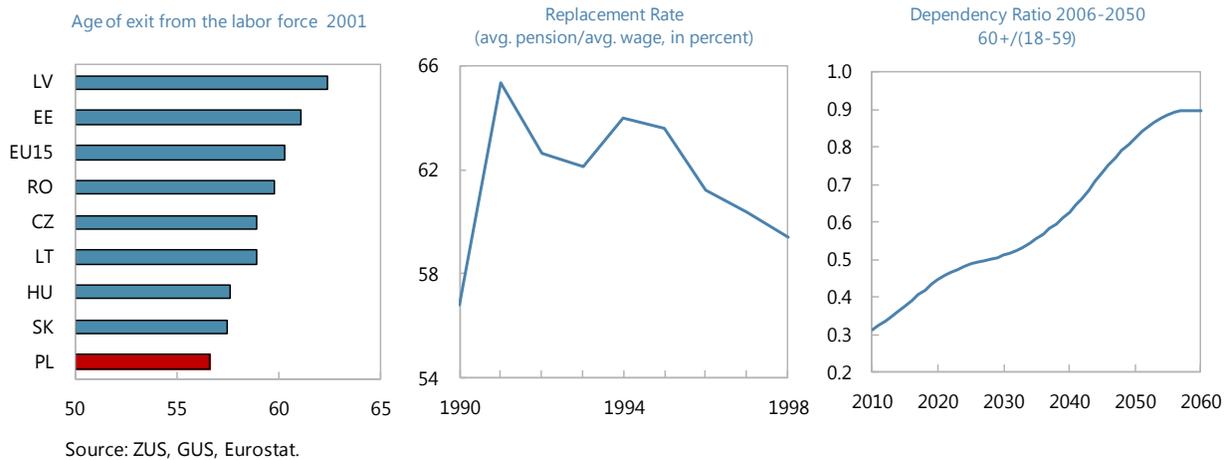
34. **The projections suggest a sharp decline of pensions relative to wages.** The model assumes that returns in the second pillar (net of fees) are equal to first pillar indexation, which is broadly in line with the experience so far. This implies that market returns follow GDP and wage bill dynamics, which makes pensions indifferent to the split of contributions between the two pillars, and the 2014 reforms neutral for replacement rates. On this basis, the replacement rate is projected to decline from around 60 percent currently to some 30 percent by 2060 (Text Figure 7). While different estimates of future benefits unavoidably vary, as they depend on modeling parameters, various projections point to a sharp decline in replacement rates. For example, the latest EU Commission Ageing Report (EC, 2012) suggests a 27 percentage point drop in replacement rates by 2060.

35. **The 2012 increase in statutory retirement ages prevented an even deeper drop in pensions.** The above estimates incorporate the gradual increase in retirement ages (from 65 to 67 for men and from 60 to 67 for women). This reform prevented a 7 percentage point deeper drop in replacement rates (Text Figure 8). Gender equalization of the retirement age also helped to reduce pension disparities between men and women.

Text Figure 7. Replacement Rates
(Percent of average wage)

1/ In contrast to projection, actal data covers legacy define benefit system and special pension schemes in ZUS.

Source: IMF staff estimates based on ZUS, GUS, Eurostat.

Text Figure 8. Estimated Replacement Rates, 2060
(Percent of average wage)

Source: IMF staff estimates based on ZUS, GUS, Eurostat.
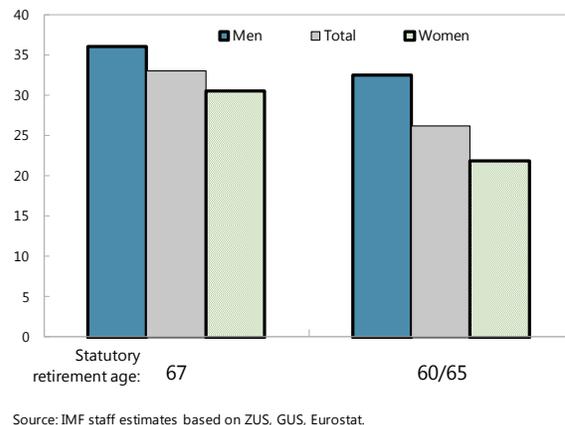
36.   But old-age poverty risk still stands out as an important long-term issue. The risk of poverty among Polish retirees is currently below EU average, but will likely become more pronounced along the projected decline in replacement rates. The estimates suggest that the share of pensioners at risk of poverty could increase substantially in the long-run (Text Figure 9).[13] The threat of old age poverty appears particularly high assuming that poverty thresholds remain unchanged relative to wages, as for social minimum and equivalised income, which may, however, overstate long-term risks. On the other hand, keeping partial indexation to wages, as for legal minimum pension, may not be sustainable in the long run.

Text Figure 9. Share of Pensioners Below Selected Income Thresholds
(Percent)
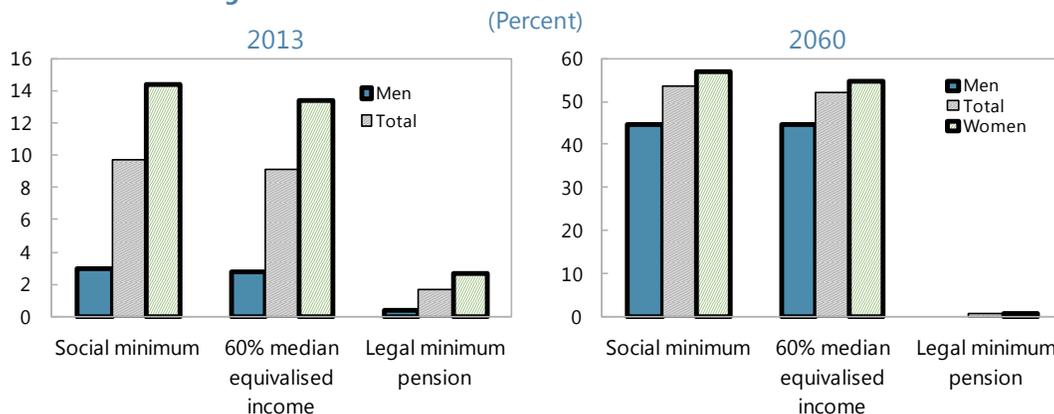
Source: IMF staff estimates based on ZUS, GUS, Eurostat.

37.   The minimum pension guarantee may not suffice to alleviate old age poverty. While there is a legally guaranteed minimum pension, its level relative to wages is bound to decline gradually since its indexation accounts only for only 20 percent of real wage growth (Text Figure 10).[14] By 2060, almost no retirees are projected to fall below the minimum pension, which will practically eliminate the fiscal risk of topping-up their benefits. However, this provides little comfort in terms of alleviating old-age poverty risk. Thus, developing efficient social assistance mechanisms for poor pensioners stands out as an important long-term policy challenge.

Text Figure 10. Legal Minimum Pension
(Percent of average wage)
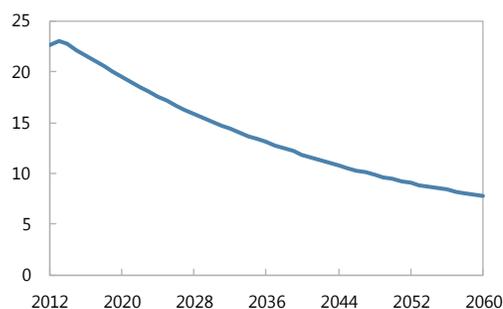
Source: IMF staff estimates based on ZUS, GUS and Eurostat

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[13] The three poverty measures under analysis include: (i) *social minimum* defines a threshold below which the household is considered to be in poverty; (ii) *legal minimum pension* refers the minimum old-age benefits guaranteed by the Law for those reaching retirement age with a contribution period of at least 25 years; and (iii) Eurostat *equivalised income*, which takes into account the impact of differences in household size and composition.

[14] Maintaining the partial indexation mechanism over an infinite horizon will imply that the ratio of minimum pension to average wage will asymptotically approach zero.

Special Pension Regimes

38.   In Poland, special occupational pension schemes have a broad coverage and pose a fiscal burden. Beyond the core pension system, there are several occupational schemes for miners, "uniformed services" (police, military, border guards, etc.), and farmers. Together, these sub-systems covered 2.1 million beneficiaries in 2010, equivalent to 29 percent of those in the regular system. Outlays on special pensions were 2.7 percent of GDP or 29½ percent of regular pensions (Text Figure 11). The ratio of contributions to pension outlays in occupational schemes tends to be low, with the uniformed personnel scheme fully paid by the state budget (Text Figure 11). In 2010, the gap between contributions paid by farmers and miners and pension spending under their retirement schemes was around 1½ percent of GDP. This gap would increase to 2.4 percent of GDP if uniformed personnel pensions are also included.

Text Figure 11. Special Pension Schemes in Poland, 2010 1/
(Percent)

Number of Beneficiaries — Structure of pension spending — Contributions to Expenditures
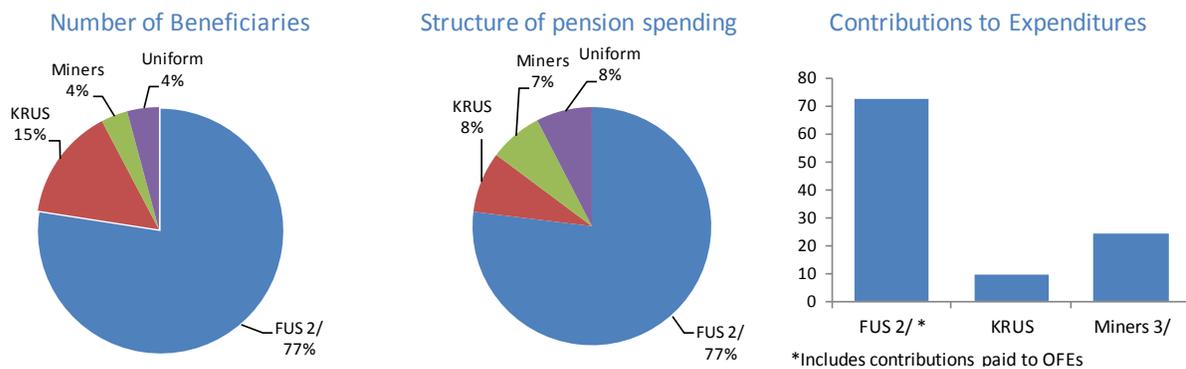
1/ Figures include old-age, disability, and survivor beneficiaries.
2/ Regular system only.
3/ Estimated from mining sactor wages and employment data.
Source: IMF Staff estimates based on ZUS, KRUS and Wiktorow (2011).

39.   Occupational pension schemes are more generous than the regular system. While the ratio of contributions to pension spending in the core system should increase as it moves to defined contribution basis, this is unlikely to happen in the special schemes, which continue to be based on a defined-benefit formula. Also, pensions of uniformed services and miners are significantly higher than regular old-age pensions whereas their effective retirement age is lower (Text Figure 12). Uniformed retirees have an unlimited possibility to work regardless of age, while benefits of early retirees in the core system are reduced or suspended above certain thresholds. Farmer benefits are well below the average, but also the contributions are very low (covering only 10 percent of outlays).

Text Figure 12. Generosity of Special Pensions Schemes, 2010

Average Pensions in Special Pension Schemes (Percent of FUS pensions)

Effective Retirement Age
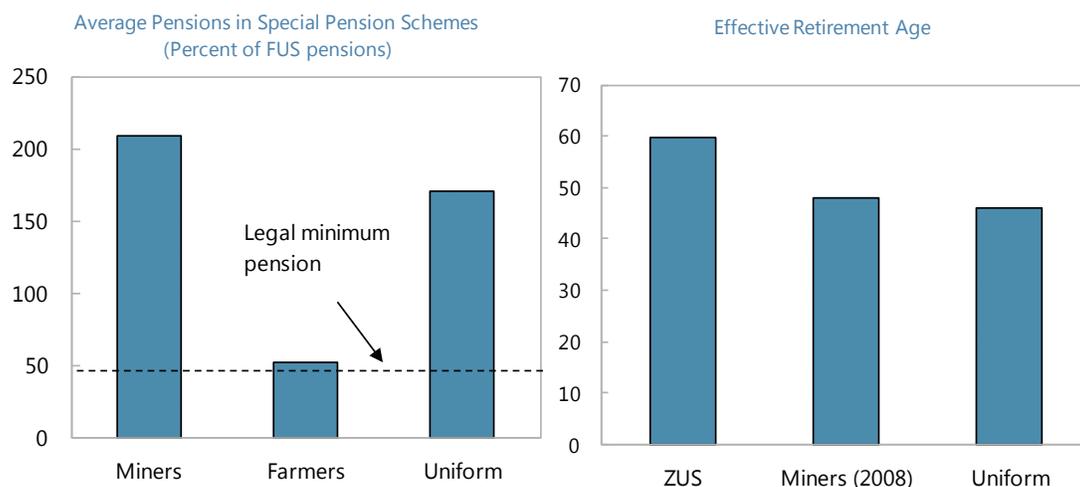
Sources: ZUS, KRUS and and Wiktorow (2011).

40.   Against this background, there are possible alternatives to reform the special schemes. Separate pension schemes stand against the principles of the original pension reform, which envisaged the universal coverage of the regular system.[15] Given the need to recognize the accrued pension rights, reforming the special schemes is unlikely to yield fiscal gains in the medium-term. However, it would make the system more coherent, with the potential to deliver long-term gains and improve fiscal sustainability. The issues and policy alternatives for each sub-sector are slightly different:

- While there may be merits to have uniformed services outside the regular scheme, the system could be rationalized with parametric changes. Some important changes were implemented in 2013, when the work period to obtain pension rights was lengthened from 15 to 25 years, and a minimum retirement age was set at 55 years. These rules, however, are still milder than in the regular system. Thus, consideration may be given to further changes to link pensions more closely to the nature of work.

- The system for miners may be seen as a hidden subsidy for the mining sector. A possible option, considered also by the authorities, would be to keep privileges only for those truly working under hardship conditions. A more transparent solution, however, would be merging miners with the main system and paying for their privileges by explicit budget subsidy or higher employer contributions.

- Official plans for farmers assume gradually covering them with personal income tax and making their pension contributions and benefits dependent on income. While this appears

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[15] In fact, miners and new entrants to uniformed services were covered by the regular scheme at the time of the 1999 reform, but subsequently moved out.

to be the right direction for reforms, specific legal initiatives for implementation have yet to be articulated. Additionally, enrollment in the farmers' social security scheme depends on land ownership regardless of whether agriculture provides the main source of income. This creates incentives to misuse the system. Therefore, revision of the enrollment criteria should be considered.

Disability Benefits

41.   Maintaining the current disability formula implies growing incentives for misuse. The incidence of disability was very high in the early 1990s, when the number of disabled pensioners almost matched old-age beneficiaries (Chlon-Dominczak, Agnieszka, 2009). This reflected lenient disability assessments (to mask open unemployment), leading to widespread abuse of the pension system. Subsequent tightening of disability regulations radically reduced this problem, but there

may nonetheless be incentives to seek disability rather than a retirement pension. As retirement pensions are projected to decline over time relative to wages, disability benefits will become increasingly appealing: under current rules, disability benefits could exceed projected pensions some 10–15 years before the statutory retirement age for the lower income groups and among workers with shorter contribution periods (Text Figure 13). While the disability formula should retain an insurance component, there is room to seek better alignment with old-age pensions to ameliorate adverse incentives.

Text Figure 13. Attractiveness of Disability Benefits vs. Old-Age Pensions

Years before retirement age when disability benefit equalize old-age pension
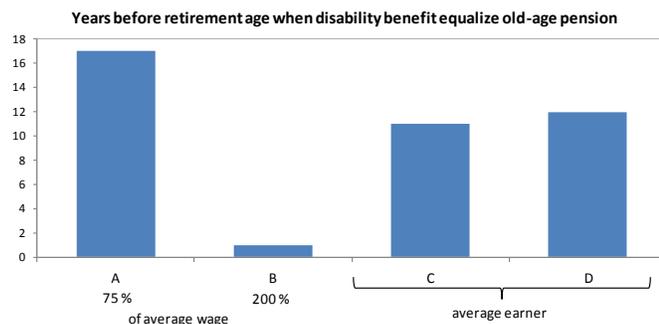
Stylized person:
A, B, C - 42 years of work (25-67 years old)
D - 42 yers in the system (25-67), o/w 10 years of non-contributing period

Source: Staff estimates.

E.   Conclusion

42.   The analysis presented in this paper indicates that the pension changes undertaken by Poland in 2014 would deliver an improvement in the fiscal accounts. The partial unwinding of the second pillar will generate an increase in contributions to the first pillar and a sustained drop in (explicit) public debt (and associated interest payments). At the same time, the public sector will take on larger pension payments in the future. Since statutory indexation clauses in the notional accounts in the first pillar are indexed to the evolution of the nominal wage bill and GDP, they tend to provide a link—under normal conditions—between the growth of implicit pension liabilities and the flow of pension contributions under the PAYG scheme. Furthermore, the fact that pensions are based on capitalized contributions (through the NDC system) also tends to support the actuarial balance of the system.

43.   The pension changes do not address legacy issues in the pension system:

- Excessively low replacement rates (associated with the original 1999 pension reform) may increase the incidence of old-age poverty, possibly leading to higher fiscal contingencies not assessed in this paper. To ameliorate this risk, it is important to promote awareness of the insufficiency of projected pensions and explore alternatives to stimulate additional private savings.

- The indexation mechanism of the main account merits revision. The non-negative indexation in the first pillar (particularly in the main account) may jeopardize the financial soundness of the system and translate into fiscal contingencies in the event of adverse macroeconomic developments. These risks could be mitigated by relaxing the non-negative indexation clauses or by linking the indexation of the main account to multi-year wage bill dynamics.

- The relatively generous disability formula should be aligned to the extent possible with old pension benefits to reduce adverse incentives as replacement rates drop over time.

- Longstanding reforms to the special pension schemes for farmers, miners, and uniformed services also need to be tackled.

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Annex I. Major Reforms and Modifications to the Polish Pension System

The 1999 Reform

1.   **The 1999 reform of the pension system helped improve its long-term sustainability but entailed sizable transition costs.** With the reform, the single public scheme was replaced with a two-pillar mandatory system: a public pay-as-you-go (PAYGO) first pillar, and a funded second pillar (OFEs). Pension rights accrued under the old (and actuarially insolvent) defined-benefit scheme were recognized, but the benefit formula under the new system was changed to defined-contributions (Box 1). Thus, pensions under the new system would depend on contributions paid to the first pillar (booked in individual notional accounts and indexed by the growth of the contribution base) and to OFEs (invested in market assets, yielding market returns). The reform implied an immediate fiscal cost due to the partial diversion of pension contributions to the OFEs. Official estimates (Ministry of Labor and Social Policy, 2013) suggest that fiscal cost of the original reform would be around 80 percent of GDP by 2060, which is also consistent with the estimates presented in this chapter.

2.   **The financing of the transition gap led to growing fiscal constraints.** Since the launch of pension reform, the accumulation of assets in the second pillar led to fiscal costs and was broadly matched by growing public debt. Over time, public debt approached legal limits, leading to fiscal constraints and exposing clear trade-offs on the allocation of scarce fiscal resources.[1] Meanwhile, risk diversification in the second pillar was also limited by regulations and incentives facing pension funds, which led to the prevalence of public debt in pension fund portfolios.

The 2011 and 2012 Reforms

3.   **Transfers to the second pillar were reduced in 2011.** As part of a fiscal consolidation program, transfers to the second pillar were cut to 2.3 percent of the wage bill starting in May 2011, and the remaining 5 percent was redirected to subaccounts in the first pillar, boosting fiscal revenues. These sub-accounts would be indexed at the average nominal GDP growth of the previous five years. The authorities planned a partial reversion of pension contributions back to the second pillar, starting from 2.8 percent of the wage bill in 2013 to 3.5 percent of the wage bill by 2017.

4.   **Statutory retirement ages were increased starting in 2013, improving the financial footing of the pension system.** A decision to gradually increase the statutory retirement age to 67 and equalize for men and women is expected to increase activity rates among the older age

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[1] The Polish Constitution caps public debt (according to a national definition) at 60 percent of GDP, and the Public Finance Law requires mandatory fiscal consolidation if debt to GDP exceeds 55 percent of GDP. In addition, a recent law amendment established two preventive debt thresholds at 43 and 48 percent of GDP, in substitution for a previous threshold of 50 percent of GDP.

groups and improve replacement rates. In parallel, an increase in the retirement age for new entrants to uniformed services implemented in 2013 would also contribute to improve the financial soundness of the pension system.

5.   Long-term demographic trends, however, pose substantial challenges going forward. The combined effect of declining fertility rates and increases in life expectancy would lead to adverse population dynamics. In fact, the pace of the aging process in Poland is projected to exceed that of other European countries. As a result, the old-age dependency ratio (defined as the number of persons aged 65 and older, relative to those between 15 and 64) is projected to increase from about 20 percent in 2012 to 70 percent by 2060 (Jabłonowski, and Müller, 2014). If continued, these population dynamics are likely to exert substantial pressures on the PAYG system, with adverse fiscal implications.

REPUBLIC OF POLAND

Annex II. A Stylized Example

1.   The pension changes create a gap between the fiscal deficit and (explicit) public debt dynamics. Increased contributions from the second- to the first-pillar generate an improvement in the fiscal deficit, particularly in the short- and medium-term (since the corresponding pension payments materialize later in time). On impact, the fiscal deficit (and its financing) also improves with the transfer of public debt from the second to the first pillar, as it leads to lower interest expenditure. Similarly, asset transfers associated with the zipper reduce public debt and the associated interest bill. In contrast, the implicit fiscal cost associated with indexation of the (new) notional account is not captured above the line on an accrual basis, and only resurfaces over time when higher pension payments are made from the first pillar.

2.   A stylized example of the fiscal impact of pension changes serves to illustrate the accounting and the methodology used in the assessment. Let W_t be the economy-wide nominal wage bill at time t, and α the share of wages that collected as pension contributions in the first pillar under the status quo policies. As a result of the pension changes, the share of social security contributions collected in the first pillar will increase to $\alpha_R > \alpha$, where the increase reflects the redirection of pension contributions from the second to the first pillar and also depends on the number of workers choosing to switch back to the first pillar (the default option). Pension contributions from workers that participate in the reformed defined-contribution pension system are registered in three types of accounts:

- Individual notional accounts in the first pillar (A_1) which are indexed to the evolution of the nominal contribution base, and subject to a zero-floor.

- Individual sub-accounts created in 2011, after the redirection of pension contributions from the second to the first pillar (A_2), which are indexed at the average GDP growth of the previous five years. The sub-accounts are also subject to a zero-floor indexation. Between 2011–13, these sub-accounts have accumulated the partial redirection of pension contributions to the first pillar that is included the status quo policies.

- Individual sub-accounts after the pension changes (A_{R2}), which reflect the additional balances resulting from the additional redirection of pension contributions to the first pillar and the gradual transfer of assets under the zipper (i.e., $A_{R2} > A_2$).

- Individual accounts in the second pillar (A_3), which growth in line with market returns net of management fees.

Let P_{st} denote the economy-wide pension payments that result from the different accounts in the pension system, denoted by the sub-index $s=0, 1, 2, 3$. Where $s=0$ refers to the yearly pension payments of the grandfathered pensioners and workers at the time of the 1999 pension reform; $s=1$ refers to pension payments that correspond to balances in the A_1 notional accounts in the first pillar; $i=2$ refers to the pension payments that correspond to the A_2 accounts in the first pillar; and $s=3$, which correspond to pension payments associated with the A_3 capitalized balances in the third pillar.

3.   **The relevant cash flows for the fiscal sector are as follows.** For the status quo policies, the cash flows comprise: (i) pension contributions, minus (ii) pension payments, and (iii) interest payments on pension-related public debt:

$$\alpha W_t - iD_{t-1} - (P_{0t} + P_{1t} + P_{2t}) \tag{1}$$

where P_{2t} captures the portion of pensions associated with contributions registered in the first pillar sub-account under the status quo policies. In turn, the corresponding flows for the pension changes are given by:

$$\alpha_R W_t - iD_{Rt-1} - (P_{0t} + P_{1t} + P_{R2t}) \tag{2}$$

where P_{R2t} captures the portion of the pensions associated with contributions registered in the first pillar sub-account under the pension changes, which includes the additional contributions and the asset transfers (i.e., $P_{R2t} > P_{2t}$). The impact of the pension changes on fiscal flows is given by subtracting [2]–[1]:

$$(\alpha_R - \alpha)W_t - i(D_{Rt-1} - D_{t-1}) - (P_{R2t} - P_{2t}) \tag{3}$$

The first two terms are positive as a result of the pension changes. The first one reflects the higher pension contributions to the first pillar, and the second the interest savings on public debt (which is positive since public debt associated with status quo is larger than that under the pension changes. These two terms initially dominate the fiscal dynamics. The third term, which grows over time as current contributors retire, reflects the larger pension payments by the public sector.

4.   **The pension changes also have an effect on public debt.** In the computations, public debt is restricted to explicit public liabilities associated with pension reforms. The initial stock of debt for the purposes of the analysis reflects the capitalized cost of financing the transition gap since the 1999 pension reform until end-2013. Explicit government debt associated with status quo pension reforms is denoted by D_t. In turn, $D_{R,t}$ denotes the evolution of public debt as a result of the 2014 pension changes. The latter is lower than the status quo debt starting in 2014: the transfer of public bonds from pension funds to the first pillar in 2014 causes a one-off drop in public debt of about 9 percent of GDP. Since asset transfers under the zipper, T_t, represent a positive cash flow, they also affect the evolution of explicit debt. Using i to denote the interest rate, public debt under status quo policies evolves as:

$$D_t = (1 + i)D_{t-1} + P_{0t} + P_{1t} + P_{2t} - \alpha W_t \tag{4}$$

While public debt under the pension changes is given by:

$$D_{Rt} = (1 + i)D_{Rt-1} + P_{0t} + P_{1t} + P_{R2t} - \alpha_R W_t - T_t \tag{5}$$

Thus, the incremental impact of pension reform on explicit public debt is given by [5]–[4]:

$$(D_{Rt} - D_t) = (1 + i)(D_{Rt-1} - D_{t-1}) - (\alpha_R - \alpha)W_t - T_t + (P_{R2t} - P_{2t}) \tag{6}$$

This expression implicitly assumes that the interest rate is the same under the status quo and the pension changes (since i is not modeled endogenously, this assumption ensures that any interest

rate path is neutral on the results). Equation [6] is equation [3] augmented by debt amortization and the zipper. As noted above, the first term of the right-hand side is negative on impact, as the pension changes cause a sharp one-off drop in explicit public debt. Furthermore, public debt under the pension changes keeps dropping for several years relative to the status, as the second and third terms of the right-hand side are also negative. In the long-term, however, the last term of the right-hand side, grows in relative terms as capitalized pension payments from the notional account A_2 are repaid to pensioners. Population projections imply that the latter term will not overcome the effect of the pension changes within the period under analysis.

5.   **Beyond the effects on explicit public debt, the pension changes also affect implicit fiscal liabilities.** The later are accumulated in the notional accounts in the first pillar. The evolution of the main account (A_1) is the same under the status quo and the pension changes. These balances are indexed at the nominal growth of the contribution base ω_t, and evolve according to the following:

$$A_{1t} = A_{1t-1}(1 + \omega_t) + \alpha W_t - P_{1t} \tag{7}$$

In turn, the incremental impact of the pension changes on the notional sub-accounts is given by:

$$A_{2Rt} - A_{2t} = (A_{2Rt-1} - A_{2t-1})(1 + y_t) + (\alpha_R - \alpha)W_t + T_t - (P_{R2t} - P_{2t}) \tag{8}$$

Where the indexation y_t reflects the average GDP growth of the previous five years. The net increase in implicit liabilities associated with the active policy is given only by [8], as notional account A_1 is common to the two policy alternatives.

6.   **The net effect on overall fiscal liabilities—which also reflects the accrual impact of the pension changes—tends to be neutral.** Adding together the net increase in explicit public debt [6] and the net increase in implicit public liabilities [8] gives the net impact of the active policy in a generic year t, which collapses to:

$$(1 + y_t)(A_{2Rt-1} - A_{2t-1}) - (1 + i)(D_{t-1} - D_{Rt-1}) \tag{9}$$

The first term reflects the evolution of the change in implicit liabilities stemming from the pension changes and the second term the savings on public debt service. Thus, the net effect on overall fiscal liabilities will depend on the relationship between interests on public debt and the indexation rate of the notional account. Since redirected contributions and asset transfers from the second to the first pillar are exactly matched with an increase in the notional account balances, the net effect of the pension changes on overall public debt will be zero under the assumption of equality between the interest rate on public debt and average GDP growth. In an alternative scenario, if interests on public debt were higher than the indexation rate, the impact of the active policy on public liabilities would be positive, as savings on public debt service exceed notional account indexation.

ARE PRIVATE SAVING ACCELERATIONS PREDICTABLE?[1]

Poland's domestic private saving rate has been on a declining trend, raising questions about the country's ability to generate sufficient domestic resources to finance investment. Given the expected decline in the replacement rate associated with future pensions, the low saving rate also gives rise to concerns about the adequacy of future retirement income. This paper examines how other countries have managed to achieve increases in the private saving rate, and draws some specific implications for Poland. The results show that episodes of sustained accelerations of private savings are mostly the result of very strong macroeconomic performance. Supporting sustained increases in private sector savings in Poland would therefore require addressing elevated levels of unemployment and further reducing the fiscal deficit.

A. Introduction

1.   Saving and investment rates remain low in many emerging economies (EMs). Higher investment rates supported by higher savings are needed in some countries to increase growth and avoid large current account deficits, which can leave them vulnerable to shocks. Some EMs have been able to raise significantly private saving rates. Others have mostly experienced large (short-term) capital inflows which in many occasions fueled consumption and real-estate booms, rising macroeconomic imbalances (currency mismatches), and painful adjustments. Private sector savings are also important to ensure a decent retirement income for older members of society.

Private Saving Dynamics in Selected EMs
(Percent of GDP)
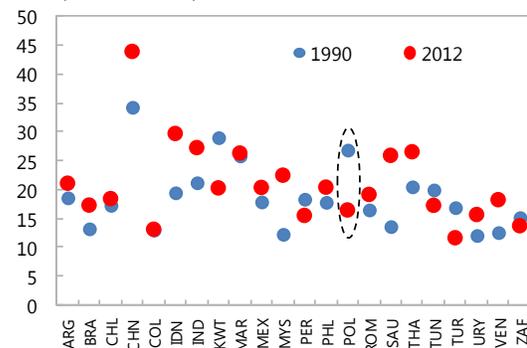
Source: IMF World Economic Outlook database.

2.   The need to develop appropriate policies and create the conditions to boost domestic saving are particularly important for an emerging economy such as Poland. The private saving-to-GDP ratio (of which the household saving rate is a key part) has been on a continuous declining trend in Poland over the past decades despite significant efforts to stabilize the economy and promote economic growth. Partly as a result, the country continued to run persistent current account deficits (though these were comfortably financed by substantial inflows of foreign direct investment and EU structural funds). Nonetheless, boosting domestic saving is also particularly important in Poland to ensure a decent retirement income for older members of society. Recent staff calculations indicate that given current demographic trends and reforms to improve the

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solvency of the public pension system, pension replacement rates are converging towards low levels which may prove socially unsustainable. Moreover, persistent high levels of unemployment and labor market duality (which effectively removes a sizeable share of the labor force from the social security system) also have implications for the saving behavior of households (Figure 1).

Figure 1. The Case for Higher Saving Rates in Poland

Household Gross Saving Rates
(percent of disposable income)

Replacement Rates
(Percent of average wage)

1/ In contrast to projection, actal data covers legacy define benefit system and special pension schemes in ZUS.

Share of Temporary Employment
(percent of total employment)

Structural Unemployment in Poland and Euro Area
(percent of total labor force)
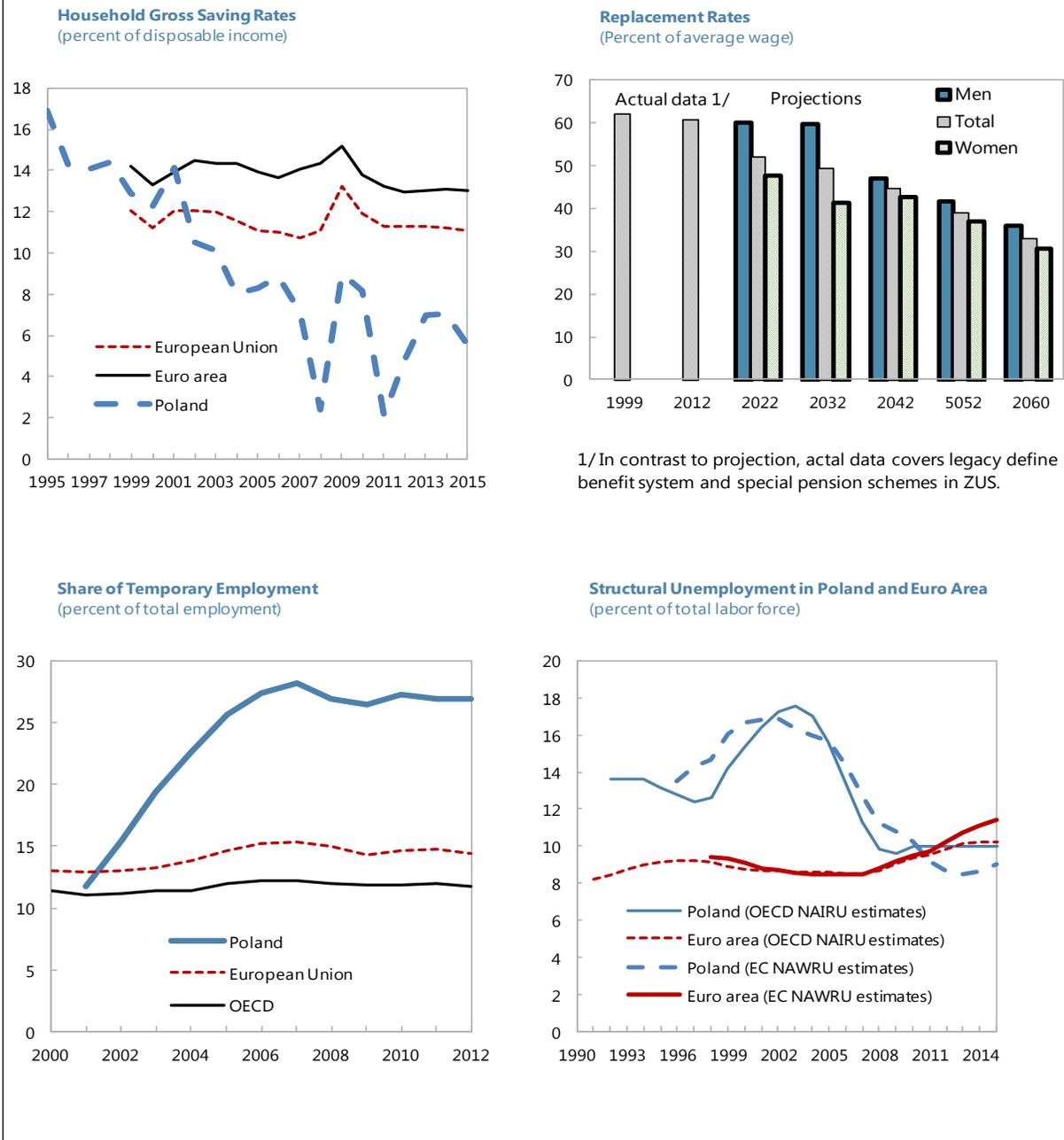
Sources: OECD statistics; European Commission AMECO database; ZUS; GUS; Eurostat; IMF staff estimates.

3.   This paper provides a cross-country analysis of the experience of countries that have succeeded in boosting domestic private saving in a sustained way and draws possible implications for Poland. What can Poland learn from peers? How were saving surges engineered in other countries? The paper examines these important questions by reviewing the existing literature and attempting to provide a robust statistical analysis on the economic conditions that are necessary to experience saving transitions.

4.   While several papers have analyzed the determinants of the level of the private saving ratio, very few have focused on episodes of sustained high private saving rates. The literature on the determinants of the level of the private saving ratio is vast and has broadly identified demographic variables and good macroeconomic performance as the main correlates (Edwards, 1996; Loayza et al., 2000). A curious aspect of this literature is that it does not focus on what is perhaps the most telling source of variation in the underlying data. Rodrik (2000) proposes a framework to identify episodes of private saving transitions/accelerations and found that these episodes are preceded by high levels of GDP growth.[2] Methodologically, Rodrik's work is similar to the literature on the accelerations of other macroeconomic variables such as real GDP growth (Hausmann et al., 2005; Berg et al., 2012).

5.   This paper adds to the literature on saving accelerations initiated by Rodrik (2000) and examines the phenomenon using the largest possible sample of countries. We focus on the dynamics of the private sector saving-to-GDP ratio within countries, and econometrically investigate the determinants of saving accelerations. The paper contributes to the existing literature on several fronts. First, it uses comprehensive data on private sector saving ratios produced by the IMF. Second, it uses various econometric models and subsets of the data to isolate the main contributors to private saving accelerations. Third, it tests a wide range of possible correlates (natural resource discoveries, globalization, fiscal performance, macroeconomic volatility, persistent high unemployment rate, etc.) of saving transitions and derives some policy recommendations. Fourth, it uses matching techniques to investigate the effects of saving accelerations on overall economic performance approximated by real per capita GDP growth.

6.   The paper finds that saving transitions are not unusual worldwide and tend to be predictable. First, we have identified 86 episodes of rapid and sustained accelerations in domestic private saving ratios. The unconditional probability that a country will experience a private saving acceleration sometime during a decade is around 25 percent. Second, these private saving transitions tend to be preceded by superior economic performance: high and stable GDP per capita growth, a low unemployment rate, and sustained strong fiscal positions. They also tend to be

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[2] Throughout the text, we will be using the terms saving transitions or saving accelerations interchangeably. Saving transitions refer to episodes of protracted increase in the saving rate by more than 4 percentage points of GDP. More details on the exact identification of these transitions will be provided in the next section. Also, the word "saving" will in some occasions refer to private saving-to-GDP ratio for convenience.

determined by "luck": large natural resource discoveries are strong predictors of saving accelerations.

7.   The results also suggest that factors preventing Poland from experiencing a private saving acceleration are low public savings and elevated unemployment rate. Based on the econometric models, the predicted propensity for Poland to experience a saving acceleration is relatively low at around 6 percent (this is not surprising given that Poland has not experienced any saving transitions yet). There is therefore important to preserve the gains in the areas where Poland has achieved successes (macroeconomic stability) while taking further steps to address the high level of unemployment and the fiscal deficit.

8.   The paper then asks whether saving accelerations are accompanied by increases in domestic investment and commensurate real GDP growth. Using matching techniques borrowed from micro-econometric evaluation literature (to address the endogeneity of saving accelerations), we compare real per capita GDP growth and private investment ratios between countries that have experienced private saving accelerations and countries that did not, during and after the acceleration episode. The results are striking: increases in private saving are fueled by higher growth realizations but are not necessarily a cause of stronger GDP growth. The results show that episodes of sustained acceleration of private sector savings are mostly the result of stronger GDP growth performance and not necessarily their cause.

B. Empirical Design: Identifying Private Saving Transitions

9.   Following Rodrik (2000), private saving transitions are defined as episodes characterized by a *sustained* increase in the private saving rate. More formally, a country is said to undergo a private saving transition in year *T* if:

- The three-year moving average of its saving rate over a nine-year period starting at *T* exceeds *by more than 4 percentage points* the five-year average of its private saving rate prior to *T*.

- The private saving rate after the transition is higher than 10 percent of GDP.

More precisely, we define S_T^f as the three-year moving average of the saving rate with year *T* as the first year of the average and S_T^b the five-year moving average with year *T* as the terminal year. For example, S_{2001}^f corresponds to the average for the years 2001–03, while S_{2001}^b the average for the years 1997—2001. Applying the filter amounts to searching through the data for occurrences of any *T* such that the following are true:

$$S_{T+i}^f > S_{T-1}^b + x, \quad \text{for all i = 0, 1, ... , n} \qquad [1]$$

$$S_{T+i}^f > 10 \text{ percent of GDP, for all i = 0, 1, ... , n} \qquad [2]$$

where the parameter *x* stands for the threshold increase in the saving rate (set to 4 percent of GDP), and *n* captures the length of the horizon over which the transition is expected to be sustained. With a nine-year horizon starting at year 0, *n* = 6. The first of these conditions checks that the (moving average of the) private saving rate after year *T* exceeds the average prior to *T* by more than 4

percentage points of GDP. The second condition ensures that the average private saving rate after the candidate transition year exceeds 10 percent of GDP. If these conditions are satisfied for more than a single year in any country, we check to see whether 10 years or more separate the dates. If not, we assume that there is a single transition and designate the earliest year in the sequence as the transition year.[3]

10. **We find a surprisingly large number of saving accelerations—86 episodes in all.[4]** Table 1 shows the distribution of these accelerations across countries and years. Aside from the sheer number of accelerations, the magnitude of the typical acceleration is also striking. The average private saving rate acceleration was 13.6 percentage points of GDP when comparing private saving rates before and after the acceleration (and the median was 10.3 percentage points of GDP).

Table 1. Distribution of Saving Accelerations Across Countries							
Angola	1989	Croatia	1998	Morocco	1972	Paraguay	1971
Angola	2003	Haiti	1985	Morocco	2000	Rwanda	2000
Albania	1992	India	1988	Mexico	1978	Saudi Arabia	1992
Armenia	2002	India	1999	Mexico	1993	Sudan	1998
Azerbaijan	1999	Ireland	1973	Macedonia, FYR	1995	Senegal	2003
Burundi	1999	Iran, Islamic Rep.	1990	Mali	2000	Singapore	1979
Bangladesh	1979	Israel	1980	Mozambique	1980	Singapore	2005
Bangladesh	2005	Jordan	1992	Mauritius	1998	Slovenia	1994
Bolivia	1970	Kazakhstan	1993	Malawi	1981	Sweden	1978
Chile	1986	Kenya	1981	Malaysia	1978	Chad	2005
China	1986	Kenya	2000	Malaysia	2004	Thailand	1984
China	2002	Kyrgyz Republic	1999	Nigeria	1971	Trinidad and Tobago	1982
Congo, Rep.	1988	Cambodia	1990	Nigeria	2004	Trinidad and Tobago	2001
Algeria	1991	Korea, Rep.	1971	Norway	1976	Tunisia	1989
Egypt, Arab Rep.	1987	Korea, Rep.	1985	Norway	1996	Turkey	1986
Egypt, Arab Rep.	2001	Kuwait	1980	Nepal	1993	Uganda	1972
Eritrea	1994	Kuwait	2003	New Zealand	1983	Uganda	2002
Ethiopia	1998	Libya	1999	Pakistan	1976	Uzbekistan	1997
Finland	1993	Sri Lanka	1976	Peru	1978	Venezuela, RB	1972
Guinea	1990	Sri Lanka	1990	Philippines	1998	Vietnam	1993
Gambia, The	2002	Lesotho	1991	Portugal	1972	South Africa	1971
						Congo, Dem. Rep.	1983
						Zambia	2002

Source: IMF staff calculations.

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[3] One could have examined changes in private saving rates by a similar search over possible breaks in trend and then examine all and only "statistically significant" changes in private saving rate. However, as discussed in Hausmann et al. (2005), this is not appropriate for our interest because this will identify saving transitions of very different nature because of the differing statistical power caused by the underlying variability of the private saving-to-GDP series. The filter that we use allows us to discard instances of simple volatility in the private saving-to-GDP rate which are not economically meaningful.

[4] To identify saving transitions, we use a sample including the largest possible number of countries, irrespective of their income groups. The beginning of the sample is 1960, but the sample if obviously unbalanced due to data availability issues.

11.   The (unconditional) probability of private saving acceleration is estimated at 25 percent in any given decade for a typical country. The calculation is done by dividing the number of episodes by the number of country-years in which an episode could have occurred. The latter is calculated by summing up all the country-years in our sample and eliminating the 9-year window after the occurrence of each episode, since our filter takes this period as belonging to the same episode. We also remove the first 2 years for each country since by construction the acceleration could not take place at this period. Applying this rule we obtain 3517 possible occasions in which an episode could have occurred. Dividing our 86 episodes by this number, we obtain the average probability of a growth transition taking place in any given year—in this case it is 2.5 percent. This means that a typical country would have about a 25 percent chance of experiencing a growth transition at some point in any given decade.

12.   Saving accelerations are predominantly observed in emerging and developing countries (Figure 2). The peak of saving transitions occurred during the past decades (upper left figure), a period which has seen rising incomes in many emerging and developing countries. It is therefore reassuring that the bulk of saving transitions is concentrated in countries that are qualified today as emerging economies (according to the IMF classification, bottom left figure). The regional distribution of these accelerations is also worth analyzing. Most of these saving accelerations took place in mainly 4 regions: Sub-Saharan Africa, Latin America; MENA; and not surprisingly Asia (upper right figure). Of these 86 private saving transitions, 34 percent have experienced only one transition, and 12 percent have experienced two accelerations (bottom right figure).

13.   The usual pattern of a saving transition involves a significant increase in the private saving rate. The typical jump in the private saving rate around the year 0 (the transition year) is about 11 percentage points of GDP. The median saving rate in our sample goes from 10 percent in the years before the transition, to about 21 percent of GDP percent in the five to ten years following the transition (Text Figure 1).

Text Figure 1: Pattern of Private Saving Ratio Around the Acceleration Year
(median values; in percent of GDP)
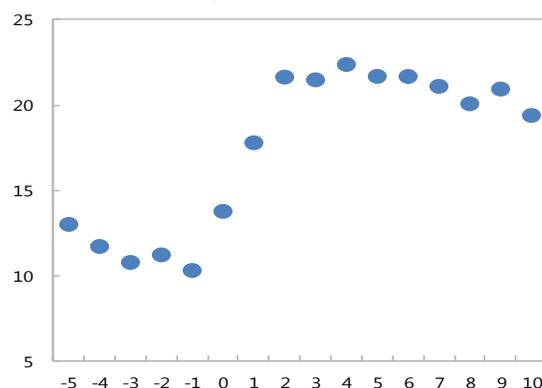
Source: IMF staff calculations.

Figure 2. Distribution of Private Saving Accelerations

Number of Accelerations by Decade
(Full sample of countries)
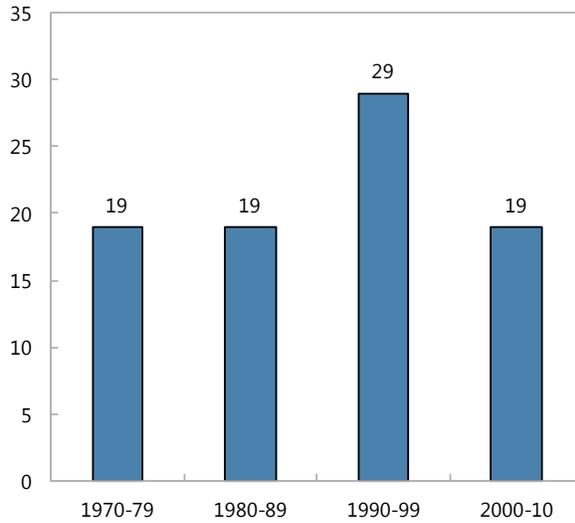
Distribution of Saving Accelerations by Regions
(Period covered: 1960-2012)
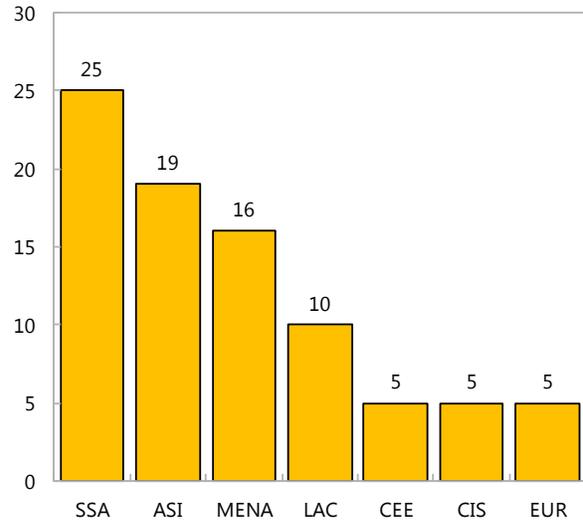
Notes: SSA: Sub-Saharan Africa; ASI: Asia; MENA: Middle East & North Africa; LAC: Latin America & Caribbean; CEE: Central & Eastern Europe; CIS: Commonwealth Independent States; EUR: Advanced European Economies.

Distribution of Accelerations by Income Groups
(Period covered: 1960-2012)
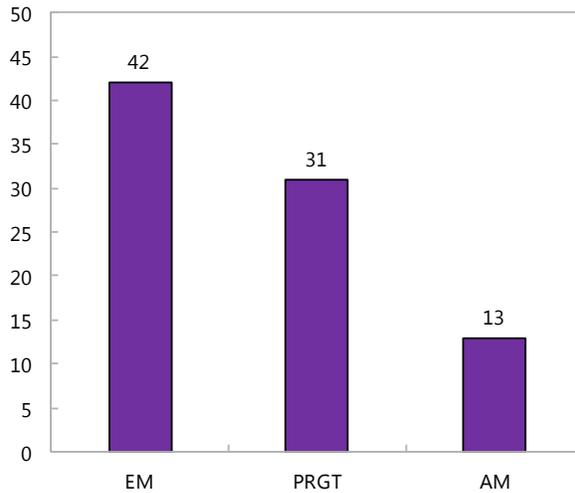
Notes: EM: Emerging Markets; PRGT: Poverty Reduction & Growth Trust countries; AM: Advanced Markets.

Proportion of Accelerations
(percent; 1960-2012)

Number of accelerations
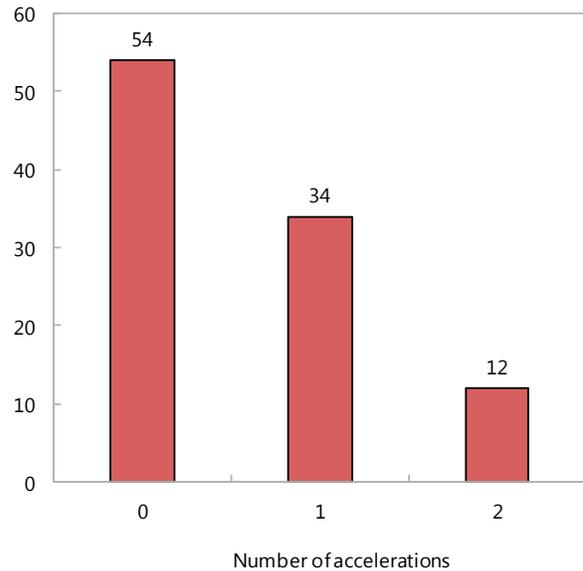
Source: IMF staff calculations.

C. The Econometric Model: What Makes Increases in Private Saving Sustained?

14.   This section examines the factors that could contribute to private saving accelerations. We estimate econometric models where the dependent variable is a dummy taking the value 1 in the years around the time of private saving acceleration (and 0 otherwise). More specifically, the model takes the following representation:

$$P[d_{it} = 1| X_{it}] = X'_{it-6,t-1}\Gamma + \epsilon_{it} \qquad [3]$$

where *d* is the dummy taking the value 1 the 3 years centered on the first year of the private saving acceleration episode (i.e., the dummy equals 1 for $t-1$, t, and $t+1$). A 3-year window reduces the probability that we will narrowly miss the timing of an acceleration through quirks in the data or in our method. Our comparison group consists of countries that have not had a saving episode.[5] The matrix *X* denotes the control variables.[6] To ensure consistent estimates of the parameters and to avoid reverse *causality* issues, these control variables are measured as averages over the 5 years before the saving acceleration window. Setting up the model that way implies that we are interested in the "initial" macroeconomic conditions that make saving accelerations more likely.

15.   We use a range of limited-dependent variable models while controlling for a number of macroeconomic variables. Since the focus of the paper is on aggregate private sector saving (this is mainly explained by the difficulty to obtain sufficient cross-country data on household and corporate sectors saving rates over a sufficiently long time horizon), the choice of explanatory variables is dictated by the objective of covering both the traditional determinants of household and corporate saving rates. We therefore test a large number of potential factors that would be relevant to private saving transitions. It is worth noting that the proposed specifications attempt to shed light on the *pre-conditions* that make the occurrence of private saving accelerations more likely. The variables are therefore taken as averages over the period preceding the occurrence of the acceleration. We group the potential candidates as follows:[7]

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[5] We also make the following adjustments to the sample. First, for each country, we drop the first four and last two years of data, since saving acceleration episodes could not have been calculated for those years based on the filter presented in the previous section. Second, we drop all data pertaining to years $t+2$, … $t+10$ of an episode, since we are interested in predicting the timing of accelerations and given that we ensure that the minimum distance between two accelerations should be 10 years.

[6] Country-specific effects are not controlled for, since a very limited number of countries, experienced more than one acceleration (see Figure 2).

[7] All *probit* specifications control for year-specific effects (year dummies) to account for unobservable shocks that are common to all countries in the sample.

- *GDP growth and volatility*: We expect higher GDP growth rates and lower GDP growth volatility to be associated with sustained increases in private saving.[8] We use data from the IMF WEO.

- *Unemployment rate*: High and persistent unemployment should be negatively associated with private saving accelerations ex-post. In such an environment, workers would be unlikely to generate high and sustained voluntary or precautionary savings. As domestic demand is compressed, firms also do not necessarily make higher profits despite wage moderation. We use data from the IMF WEO.

- *Public sector saving rate*: The effect of the public sector saving rate is ambiguous and is therefore an empirical question.

  ➢ On the one hand, public sector saving may lead to a drop in private saving according to the *Ricardian equivalence*.[9] But this should be short lived and crucially depends on a number of prerequisites. As discussed in Seater (1993) and Lopez et al. (2000), stringent assumptions are required for *Ricardian* equivalence to hold: full intergenerational caring, perfect capital markets, far-sighted rational consumers, absence of uncertainty and, nondistortionary taxes. In practice, these conditions are rarely met leading to rejection of full Ricardian equivalence by some papers (Lopez et al., 2000 provides a good summary of these works). It is therefore possible that high public sector savings are associated with increases in private sector saving.

  ➢ As discussed in Lopez et al. (2000), *Ricardian* equivalence would fail (even in the absence of liquidity constraints and finite horizons) if the government were to engage in the provision of insurance to private agents against future income shocks. In this case, accumulated public sector savings will co-move with the private sector saving. Building fiscal buffers and thereby fiscal space allows for more effective countercyclical fiscal policy in periods of shocks what prevents the private sector from dissaving and helps make private sector saving accelerations more sustainable. Alternatively, higher public saving may be associated with lower public service delivery which makes the accumulation of precautionary private saving more likely. The association between public and private savings is therefore an empirical issue. Public sector savings data are drawn from the IMF WEO.

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[8] Income growth volatility is computed as the standard deviation of annual real per capita GDP growth rate over the past five years.

[9] Some clarifications are worth mentioning. First, we are not assessing the contemporaneous relationship between public and private savings as the former enters the model with sufficient lags. We assess whether accumulated public savings before the private saving acceleration eventually takes place explains the likelihood of observing sustained increases in private savings ex-post. Second, the effect we measure if more the contribution of ex ante public sector savings to the magnitude but also the durability of private saving increases.

- *Economic globalization*: Are countries that are highly integrated into the global economy, either through trade or financial links, more likely to experience sustained increases in private saving rates? The answer is ambiguous.

  ➢ On the one hand, globalization leads to economic gains (diversification and productivity shocks) which can translate into episodes of sharp improvements in private sector balance sheets.

  ➢ On the other hand, high integration into the global economy can be associated with episodes of increased volatility which can be harmful for growth and private saving. Finally, financial openness may operate as a risk-sharing mechanism which relaxes the need to maintain elevated levels of savings, thus reducing the correlation between domestic saving and investment (Feldstein and Horioka, 1980, type of story).

  ➢ To answer this question empirically, we control for trade and financial openness. The financial openness variable is from the updated version of Chinn and Ito (2008) whereas trade openness (measured as exports and imports normalized by GDP) are drawn from the IMF WEO.

- *Financial development*: We also control for the depth of the domestic financial system. As pointed out by Ferrucci and Miralles (2007), the impact of domestic financial system deepening could go both ways. On the one hand, it reduces constraints on borrowing, thereby increasing current consumption and reducing saving. On the other hand, it increases the availability of diverse saving instruments, as well as expected returns. The ratio of M2-to-GDP is used as the proxy for financial deepening. Bank deposits (in percent of GDP) are also tested. Series are drawn from the World Bank's Financial Development and Structure Database.

- *Natural resource discoveries*: Major natural resource discoveries in a given country are potentially correlated with structural breaks in saving rate dynamics. We include in the model the values of oil discoveries drawn from the recent work by Cotet and Tsui (2013). We expect natural resource discoveries to translate into accelerations in private saving.

D. Correlates of Saving Accelerations: Econometric Results

Baseline estimates

16.   A good macroeconomic environment is found to be a key factor behind private saving accelerations (Table 2).

- The results indicate that public saving and output growth volatility are among the main determinants of saving accelerations. The negative effect of output volatility (a sensible measure of macroeconomic uncertainty) on saving accelerations suggests that persistent macroeconomic instability erodes existing buffers and makes it harder to sustain precautionary saving over the long term. Both household and corporate sector saving rates are negatively affected.

• In contrast to the *Ricardian equivalence* prediction, our econometric results show that higher public savings are positively correlated with the probability of private saving accelerations.

• Three other important results are worth flagging. First, countries that suffer from elevated and protracted unemployment are less likely to experience a private saving acceleration for the reasons described above (columns 2 and 5). Second, financial openness is negatively correlated with private saving accelerations (columns 1, 2 and, 5). In other words, countries that have access to foreign capital are less likely to experience large and sustained increases in domestic private savings, all else equal. Third, "luck" also has its own contribution to private saving successes. Indeed, the results show that large natural resource discoveries precede episodes of private saving accelerations (columns 6 and 7).

Table 2. Determinants of Private Saving Accelerations in Emerging and Advanced Economies

Dependent variable:							
Saving acceleration dummy	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Real per capita GDP growth	0.00813***						
	(0.00214)						
Per capita growth volatility, log	-0.00312	-0.0177*	-0.0129*	-0.0192**	-0.00385	-0.0244***	-0.0256***
	(0.00771)	(0.00957)	(0.00754)	(0.00752)	(0.00645)	(0.00864)	(0.00866)
Public saving-to-GDP	0.00589***	0.00631***	0.00676***	0.00682***	0.00459***	0.00582***	0.00596***
	(0.000859)	(0.00131)	(0.000964)	(0.00102)	(0.000881)	(0.00128)	(0.00122)
Trade openness	-6.92e-05	0.000152	4.01e-05	9.43e-05	3.76e-05	2.50e-05	4.13e-06
	(0.000140)	(0.000128)	(0.000129)	(0.000121)	(8.54e-05)	(0.000169)	(0.000165)
Financial openness	-0.00929**	-0.0154***	-0.00161	0.00314	-0.00780**		
	(0.00451)	(0.00476)	(0.00534)	(0.00515)	(0.00328)		
M2-to-GDP	3.25e-05	-6.37e-05	0.000354*				
	(0.000176)	(0.000176)	(0.000183)				
Bank deposits-to-GDP				0.000163	-0.000138		
				(0.000196)	(0.000134)		
Unemployment rate		-0.00233*			-0.00266**		
		(0.00134)			(0.00120)		
Oil discoveries per capita, log						0.217**	0.213**
						(0.0989)	(0.0965)
Real per capita GDP, log			-0.0740*	-0.0989***	-0.103*	-0.0386	-0.0523
			(0.0389)	(0.0384)	(0.0596)	(0.0480)	(0.0481)
(Real per capita GDP, log)^2			0.00349	0.00483*	0.00569	0.000719	0.00171
			(0.00254)	(0.00247)	(0.00347)	(0.00301)	(0.00300)
Intercept	-0.244***	-0.104*	0.113	0.344**	0.355	0.0871	0.173
	(0.0513)	(0.0561)	(0.157)	(0.146)	(0.242)	(0.187)	(0.191)
Year-specific effects	Yes	Yes	Yes	Yes	No	No	Yes
Number of accelerations	51	19	50	45	18	44	44
Countries	126	80	125	113	78	99	99
Observations	1,901	821	1,901	1,733	1,198	1,618	1,568

Note: Coefficients reported are marginal effects evaluated at the average of the control variable. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff estimates.

Robustness checks

17.   Robustness checks do not alter the main finding that a good macroeconomic environment is the critical factor behind private saving accelerations. We start by showing the results of the modified *logit* framework suggested by King and Zeng (2001) that is designed to better handle rare-occurrence bias (Table 3). This method is particularly useful to the modeling of relatively rare event data such as the saving acceleration episodes. In presence of rare binary events,

standard statistical procedures, such as *logit* or *probit* regressions can underestimate the probability of occurrence of the event due to the high concentration of nonevents in the data.[10] They appear broadly similar to the estimates using the *probit* model. Saving accelerations tend to be preceded by high economic growth and low growth volatility, higher public savings, and lower unemployment. Saving accelerations are also strongly correlated with large discoveries of natural resources.

Table 3. Correction for Rare Occurrence Bias: ReLogit Specifications

Dependent variable:

Private saving acceleration dummy	(1)	(2)	(3)	(4)	(5)	(6)
Real per capita GDP growth	0.0987***		0.121***			
	(0.0292)		(0.0307)			
Per capita growth volatility, log	-0.00352	-0.216		-0.112	-0.401***	-0.356***
	(0.114)	(0.201)		(0.223)	(0.127)	(0.124)
Public saving-to-GDP	0.0761***	0.130***	0.0835***	0.138***	0.0937***	0.0815***
	(0.0121)	(0.0216)	(0.0160)	(0.0220)	(0.0203)	(0.0200)
Trade openness	-0.00225	0.00131	-0.00199	0.000953	-0.000689	0.000857
	(0.00294)	(0.00272)	(0.00267)	(0.00282)	(0.00293)	(0.00260)
Financial openness	-0.120	-0.304***	0.0341	-0.274**	0.0352	
	(0.0838)	(0.106)	(0.0998)	(0.113)	(0.106)	
Bank deposits-to-GDP	-0.00164	-0.00396	0.00511	-0.00225		
	(0.00332)	(0.00364)	(0.00330)	(0.00429)		
Unemployment rate		-0.0979**		-0.0890*		
		(0.0433)		(0.0483)		
Real per capita GDP, log			-1.552**	-3.327	-0.552	-0.657
			(0.654)	(2.071)	(0.791)	(0.754)
(Real per capita GDP, log) ^{2}			0.0748*	0.185	0.0115	0.0169
			(0.0437)	(0.121)	(0.0509)	(0.0477)
Oil discoveries per capita, log					2.608*	3.387**
					(1.556)	(1.547)
Intercept	-2.987***	-2.505***	3.971*	11.90	1.439	1.884
	(0.282)	(0.505)	(2.357)	(8.334)	(3.002)	(2.910)
Number of accelerations	46	18	45	18	42	44
Countries	122	79	121	78	97	99
Observations	2,106	1,200	2,101	1,198	1,521	1,618

Notes: Relogit is a *logit* model corrected for rare occurrence bias as suggested by King and Zeng (2001). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

18.   Using the sub-sample of EMs and low-income countries (LICs) only does not materially alter the results. The estimation results discussed so far used the entire sample of countries, including developed countries. As another robustness check, we present the analogous results for a sample that includes only developing countries (Table 4). In most aspects, the findings are quite similar, except for the financial development variable which now turns out to be statistically (and positively) correlated with the probability of saving accelerations. This result can be explained by the fact that the marginal benefit associated with further financial deepening is stronger in the sub-sample of EMs and LICs.

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[10] Simple regression coefficients are reported instead of marginal effects.

Table 4. Correlates of Private Saving Accelerations (Emerging Market Sample)

Dependent variable: Private saving acceleration dummy	(1)	(2)	(3)	(4)	(5)
Real per capita GDP growth	0.0118***				
	(0.00317)				
Per capita growth volatility, log	-0.0145	-0.0340**	-0.0252**	-0.00965	-0.0479***
	(0.0108)	(0.0147)	(0.0109)	(0.00784)	(0.0128)
Public saving-to-GDP	0.00424**	0.00498	0.00424***	0.00269**	0.00356**
	(0.00171)	(0.00327)	(0.00163)	(0.00128)	(0.00171)
Trade openness	-0.000698**	-0.000637**	-0.000384	-0.000400**	
	(0.000277)	(0.000324)	(0.000269)	(0.000157)	
Financial openness	-0.00106	-0.0166**	0.00588	-0.00848**	0.0125*
	(0.00678)	(0.00746)	(0.00703)	(0.00349)	(0.00743)
Bank deposits-to-GDP	0.00132***	0.00167**	0.00199***	0.00103***	
	(0.000435)	(0.000666)	(0.000454)	(0.000298)	
Unemployment rate		-0.00454**		-0.00204**	
		(0.00187)		(0.00100)	
Real per capita GDP, log			-0.111	-0.323**	-0.0893
			(0.120)	(0.148)	(0.143)
(Real per capita GDP, log)^2			0.00448	0.0204**	0.00315
			(0.00873)	(0.00973)	(0.0102)
Oil discoveries per capita, log					0.379***
					(0.124)
Intercept	-0.237***	-0.0535	0.327	1.177**	0.304
	(0.0694)	(0.0723)	(0.417)	(0.556)	(0.512)
Year-specific effects	Yes	Yes	Yes	No	Yes
Number of accelerations	35	9	35	9	35
Countries	85	45	84	47	77
Observations	1,137	322	1,137	590	1,031

Note: *Probit* estimates. Coefficients reported are marginal effects evaluated at the average of the control variable. Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.
Source: IMF staff estimates.

Is Poland ready to experience an acceleration in its private saving ratio?

19.   The analysis identifies challenges that may make it more difficult for Poland to experience a significant acceleration of private savings. Setting the basis to support sustained increases in private sector savings in Poland would require addressing elevated levels of unemployment and fiscal imbalances. This result is derived from two main exercises. First, we compute the (unconditional) average performance of the pool of countries that experienced private saving accelerations and compare it with Poland (Table 5). For most of the key variables, Poland crossed the "threshold" but did not do so for the public saving ratio and the average unemployment rate. Second, we computed propensity scores to experience private saving accelerations and found that at the current juncture, it is very unlikely that such acceleration takes place. Although the Poland's propensity scores have increased recently, they continue to undershoot critical thresholds due to the elevated unemployment rate and fiscal imbalances. The econometric calculations indicate that Poland has around 6 percent chance of undergoing a private saving acceleration (Text Figure 2).

Text Figure 2 Poland: Dynamic Propensity Scores
(Predicted probability of private saving acceleration; in percent)
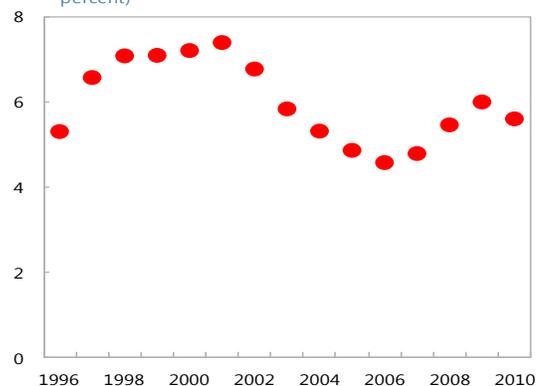
Source: IMF staff calculations.

Table 5: Poland and the Countries with at Least One Acceleration During the 2000s			
	Median among the accelerations post 1995	Median among the accelerations post 1995: Non-resource rich sample	Poland: Average over 2000–10
Real GDP growth volatility	3.0	2.3	1.7
Unemployment rate	**9.3**	**9.5**	**12.2**
Real per capita GDP growth	3.3	2.03	4.7
Public saving-to-GDP	**2.4**	**1.6**	**-0.5**
Financial development (M2-to-GDP)	33.0	30.7	48.6
Financial development (bank deposits-to-GDP)	28.9	28.0	40.2
Trade openness (Exports and Imports-to-GDP)	68.7	59.5	81.1
Financial openness (KAOPEN index)	-0.54	-0.6	0.1
Foreign direct investment-to-GDP	2.1	2.3	4.4

Source: IMF staff estimates.

E. Causality Between Saving Accelerations and GDP Growth

20.   A key question is whether saving accelerations increase economic growth, or whether they are purely a consequence of strong economic growth. We examine the association between private saving accelerations and macroeconomic performance during the acceleration and post-acceleration episodes. The task is complicated by the endogeneity of saving accelerations. As an example, we found in earlier *probit* estimations that high GDP growth precedes private saving accelerations. As long as GDP growth is sustained, it is difficult to disentangle whether the direction of the causality between saving accelerations and GDP growth is bidirectional.

21.   We differentiate between the role of output growth during the saving acceleration phase and after the acceleration takes place. We proceed in three steps:

- First, we measure the association between the acceleration dummy variable and the average growth during the following nine years. This exercise would reveal the supplementary real per capita growth which is needed to fuel the saving accelerations.

- Second, we ask whether growth and private investment ratios are significantly higher in the long run, well after the acceleration was initiated (approximately after 10 years after). The question is whether the "pool" of resources generated during the saving acceleration phase leads to higher growth. If not, the results will indicate that growth matters the most for saving accelerations than the opposite. Armed with forward looking outcome variables help reduce the direct reverse causality issues and is similar (in spirit) to Granger—causality type of tests, where precedence defines the statistical causality.

- Third, we estimate the effects of saving accelerations using propensity score matching techniques which help reduce the endogeneity bias in the occurrence of saving accelerations. Under this approach, each saving acceleration country-observation is matched to a counterfactual non-acceleration country-observation with a similar predicted probability of having experienced a saving acceleration (propensity scores), and their macroeconomic outcomes (growth and private investment ratio) are then compared using various matching algorithms.[11]

22.   We find that the supplementary increase in GDP during the acceleration phase is around 1 percentage point per year while saving accelerations do not seem to significantly increase GDP growth afterwards (Table 6). They do not also seem to reduce it either. The direction of causality therefore runs from higher and stable growth to private saving accelerations. Medium-term policies that promote a sustainable macroeconomic environment and which address structural issues such as long term unemployment and job quality are therefore those that generate growth and commensurate protracted increases in private saving. The results in Table 6 also demonstrate that saving acceleration are also good for capital accumulation in the long run, despite their limited effects on overall growth. In term of magnitude, the results indicate that 10 years after the acceleration took place private investment tends to be higher by about 2.5–3 percentage points of GDP.

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[11] The propensity score matching technique introduced by Rosenbaum and Rubin (1983) has recently been popularized in the macroeconomic literature by various works by Lin and Ye (2007; 2009), and Lin (2010).

	(1) Nearest-neighbor matching	(2) 3 Nearest-neighbor matching	(3) Radius matching	(4) Kernel matching
Table 6. Saving Accelerations and Macroeconomic Performance During and After the Accelerations				
Change to growth during	1.321***	0.995***	1.118***	1.123***
the acceleration episode	(3.058)	(2.783)	(3.814)	(3.823)
Observations	1,136	1,136	1,136	1,136
Change to growth	0.523	0.520	0.464	0.457
post-acceleration episode	(1.054)	(1.174)	(1.296)	(1.280)
Observations	1,059	1,059	1,059	1,059
Change to private investment ratio	2.689**	3.215***	2.576***	2.592***
post-acceleration episode	(2.414)	(3.511)	(4.130)	(4.138)
Observations	810	810	810	810

Notes: Bootstrapped z-statistics for average treatment effect on the treated (ATT) are reported in parenthesis. They are based on 100 replications of the data. *, **, and *** indicate the significance level of 10 percent, 5 percent, and 1 percent, respectively. *Probit*-selection equations include the full set of determinants of saving transitions as discussed in previous section, except the unemployment rate to maximize sample size. Estimations are based on the common-support sample.
Source: IMF staff calculations.

F.   Conclusion

23.   We find that private saving accelerations are relatively frequent, mostly occurring in emerging and developing countries. Of the 135 countries studied, 69 have had, at least, one private saving acceleration between 1960 and 2012. These accelerations tend to be concentrated in the group of economies still in converging towards high income and living standards. Emerging and developing countries have experienced 78 percent of world's overall saving accelerations.

24.   Strong economic performance is found to be associated with private saving accelerations. The econometric framework and the results demonstrate that superior economic performance precedes surges in private saving. This includes factors such as higher rates of GDP growth, lower GDP growth volatility, lower unemployment, and healthy public finances. We found that financial development also matters in the sub-sample of developing countries, while strong fiscal positions tend to be one of the most robust determinants of private saving transitions. "Luck" does matter as well: large discoveries of natural resources lead to a surge in private saving rate, a result which has not been discussed in the literature so far.

25.   We also find that private saving accelerations are mostly the consequence of higher growth rather than a cause of growth *per se*. However, we found a positive and significant

association between private saving accelerations and private investment in the long run, suggesting that funds were intermediated to some extent by the financial system into the real economy. The results are robust to endogeneity concerns regarding the timing of saving accelerations.

26.   These results have important economic implications for Poland.

- First, efforts to promote voluntary private savings will deliver both macroeconomic and social gains. They will help reinforce external sustainability and contribute to a decent retirement income for older member of society.

- Second, there seems to exist a "virtuous package" depending on some specific policies. For Poland, the most germane are related to the fiscal situation and the labor market. Thus, policies aimed at addressing the labor market problems (persistent high unemployment and labor market duality) and those re-equilibrating public sector finances are the most important challenges for Poland.

- The agenda for Poland is therefore to:

  ➢ Advance structural reforms including labor market reforms to increase potential growth and reduce persistent high unemployment;

  ➢ Continue with fiscal consolidation to reduce public debt;

  ➢ Preserve banking and financial stability to safeguard the confidence in the domestic financial sector as a mean to increase formal and voluntary saving.

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