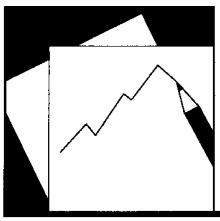
WP/05/184



IMF Working Paper

Post-Transition Investment Behavior in Poland: A Sectoral Panel Analysis

Zuzana Murgasova

INTERNATIONAL MONETARY FUND

 WP/05/184

IMF Working Paper

European Department

Post-Transition Investment Behavior in Poland: A Sectoral Panel Analysis

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Authorized for distribution by Susan Schadler

September 2005

Abstract

Analyzing and projecting the behavior of macroeconomic variables in new EU member states presents special challenges, owing to limited time series of the available data. This paper presents an analysis of investment in Poland based on an underexplored sectoral data set. The determinants of investment are found to include lagged investment, lead production, relative unit labor costs, EU demand, corporate profitability, and greenfield FDI (foreign direct investment) inflows. Dynamic in-sample simulations indicate some overinvestment in 1997 compared with what the model would suggest, and a substantial underinvestment during 2000-2004. The model is then used to project future investment: while rapid investment growth is likely, it remains uncertain whether investment as a share of GDP will reach its peak levels on the late 1990s.

JEL Classification Numbers: E22, E27.

Keywords: Poland, sectoral panel analysis, determinants of investment

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[1] An earlier version of this paper was presented at a seminar held at the Ministry of Finance in Warsaw on April 25, 2005. I would like to thank seminar participants and the Polish authorities for helpful comments. I am also grateful for useful comments and suggestions by Susan Schadler and Istvan Szekely, assistance with data collection by David Velazquez-Romero, and editorial comments by Thomas Walter.

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I. INTRODUCTION

Analyzing and projecting the behavior of macroeconomic variables in new EU member states presents special challenges, owing to limited time series of data since the transition. The short time series does not generally permit cointegration analysis that would establish long-run relationships between macroeconomic variables. Instead, analysis has tended to use panel-data approaches. For example, developments in investment in Poland have been recently analyzed by Gradzewicz (2005) in a firm-level analysis of investment decisions by industrial processing enterprises and by Dobrinsky (2005) in a cross-country panel analysis of investment/GDP ratios in Central and Eastern European countries.[2] While these studies identify a set of determinants of investment, neither of them lends itself naturally to conducting in-sample and out-of-sample simulations of aggregate investment in the economy.

This paper overcomes the shortcomings of data availability by analyzing investment in Poland on the basis of an underexplored sectoral data set for the past decade. There are several advantages to using this approach. Unlike studies based on cross-country panels, it allows one to develop a Poland-specific empirical model of determinants of investment. Because of an easy aggregation of sectoral variables into aggregate variables, this model can be used for in-sample and out-of sample simulations of aggregate investment.

The objective of this paper is to analyze the large fluctuations in investment over the past decade. The paper aims to address the following questions. (i) What factors were driving the broad movements of investment over the past decade? (ii) Did investment in the late 1990s exceed the amount suggested by fundamentals so that an investment overhang subsequently had to be worked out? (iii) What are the prospects for investment recovery in the medium term—that is, can investment relative to GDP be expected to return to its peak levels of the late 1990s?

The structure of the paper is as follows. Section II provides historical perspective on the evolution of economy-wide and sectoral investment in Poland and briefly summarizes possible determinants of investment. Section III analyzes the determinants of investment more systematically, using panel regressions based on sectoral data, and reports the results of in-sample and out-of-sample simulations. Section IV offers concluding remarks and policy recommendations.

[2] Owing to the nonexistence or methodological problems with the available data on capital stock in new member states, empirical papers tend to focus on investment flows instead.

II. HISTORICAL PERSPECTIVE

The early transition period saw a dramatic shakeup of the economy, followed by a rapid rise in investment during the second half of the 1990s (Figures 1 and 2). Prior to 1990, growth in Poland—a planned economy—had primarily taken place through fixed capital investment in heavy industry (Doyle, Kuijs, and Jiang, 2001). By the eve of the transition, the stock of capital was fundamentally misallocated. In the early phase of the transition, as the liberalization of prices and international trade exposed inefficiencies, a sizable part of the capital stock became obsolete overnight. The ratio of investment to GDP fell throughout 1993–94, before staging a strong revival in the second half of the 1990s. Between 1995 and 1999, investment increased substantially in most of the RAM-8 countries,[3] but was especially rapid in those with a low initial investment-to-GDP ratio, including Poland. Despite this relatively rapid increase, Poland's investment-to-GDP ratio remained substantially lower than in the other RAM-8 countries throughout this period—except in 1999 and 2000, when investment in the Baltics declined sharply in response to the Russia crisis.

After booming for half a decade, Poland's investment plummeted during 2001– 03 and has recovered only marginally since (Figures 1 and 3). This pattern has diverged considerably from those observed in the other RAM-8 countries, and has resembled more closely developments in investment in the EU-15 (Pelgrin, Schich, and de Serres, 2002).[4] The remainder of the paper focuses solely on investment in Poland.

Developments in Poland's total investment over the past decade were largely driven by changes in private sector investment (Figures 4 and 5). The sharp increase in the latter in the second half of the 1990s was to some extent accentuated by the privatization process, which led to the reclassification in the official statistics of a large number of public enterprises as private sector firms. This is consistent with the increasing share of the private sector in total output. Yet it is also likely that, once privatized, enterprises truly increased their investment activity.

Privatization significantly changed the sectoral composition of public sector investment (Figure 6). Public investment continued to be concentrated heavily in sectors providing public goods, such as public administration, education, health, utilities, and mining, with the last two reflecting delays in the privatization process. In other sectors with historically large public involvement, such as transportation and manufacturing, public investment fell to low levels.

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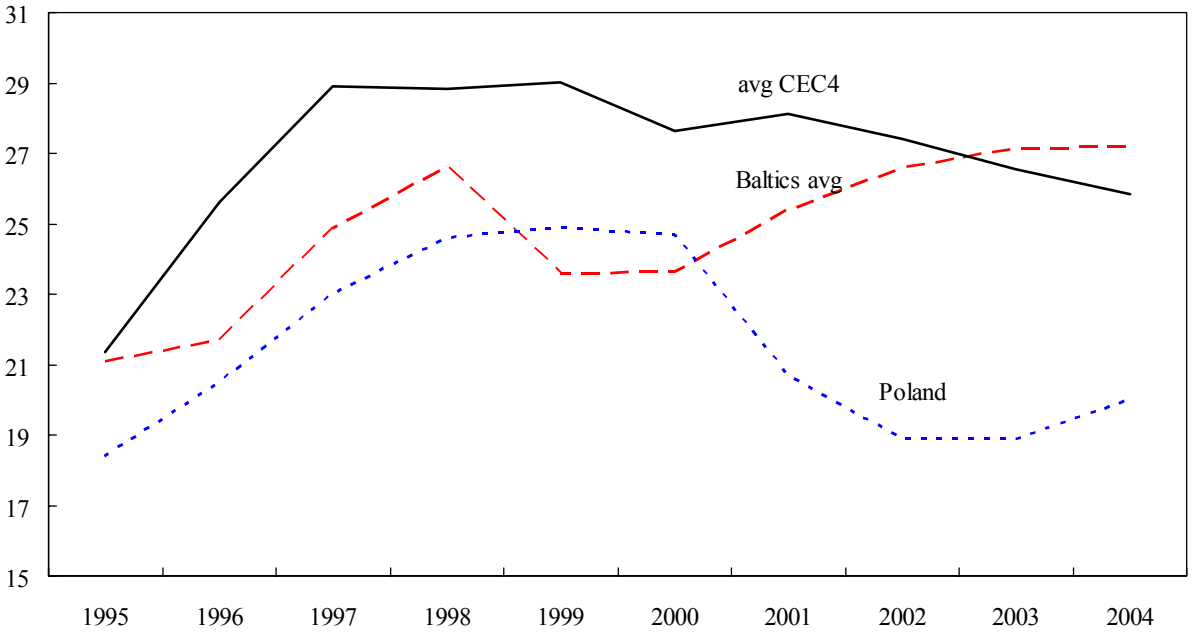
[3] The RAM-8 are eight of the recently acceded members (RAM) of the European Union: the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia.

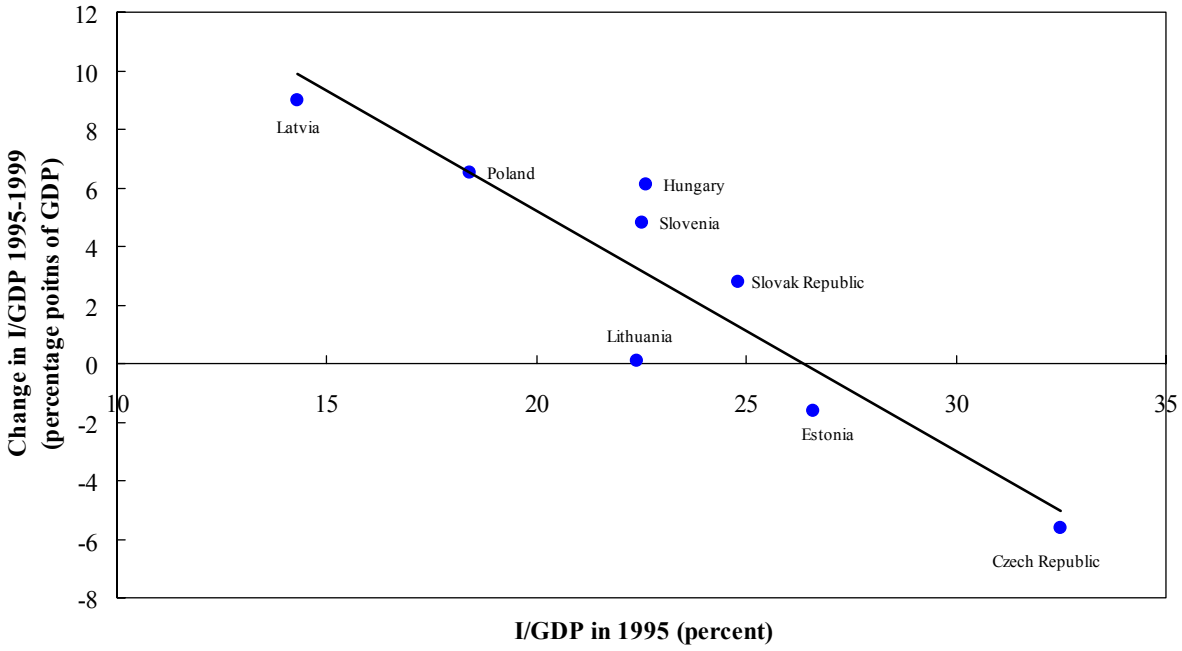
[4] EU-15 is defined as the EU prior to the 2004 enlargement.

Figure 1. RAM-8: Gross Capital Formation, 1995-2004 1/
(Current prices, in percent of GDP)



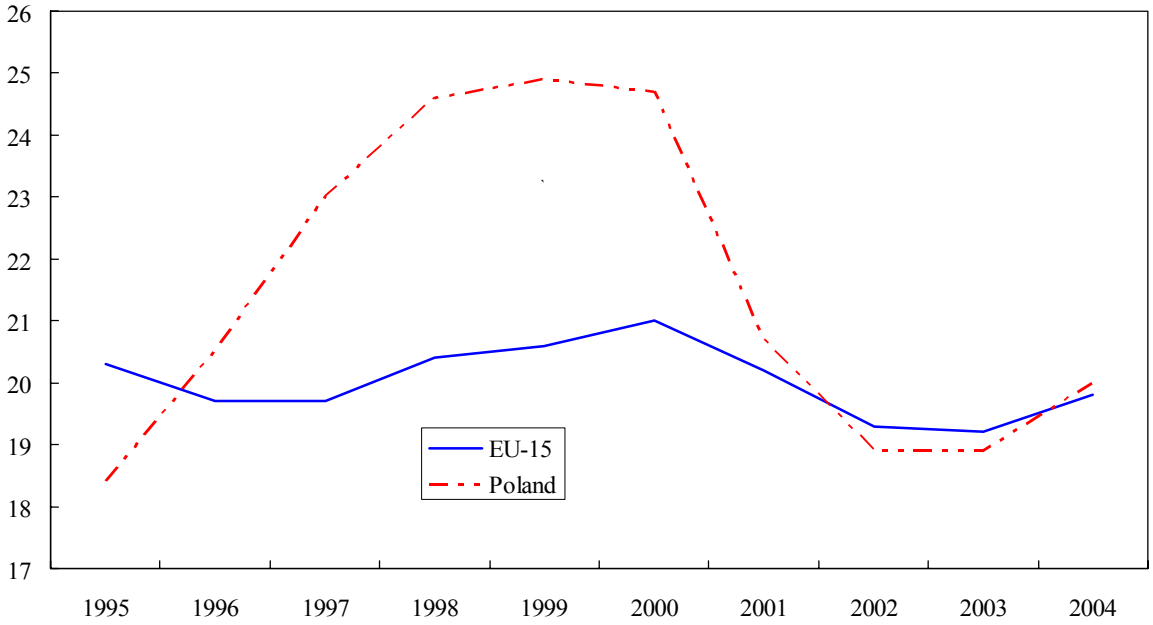
Sources: Eurostat; and IMF staff calculations.
1/ RAM-8 comprises the Czech Rep., Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Rep. and Slovenia.

Figure 2. RAM-8: Change in the Investment-to-GDP Ratio, 1995-99 1/



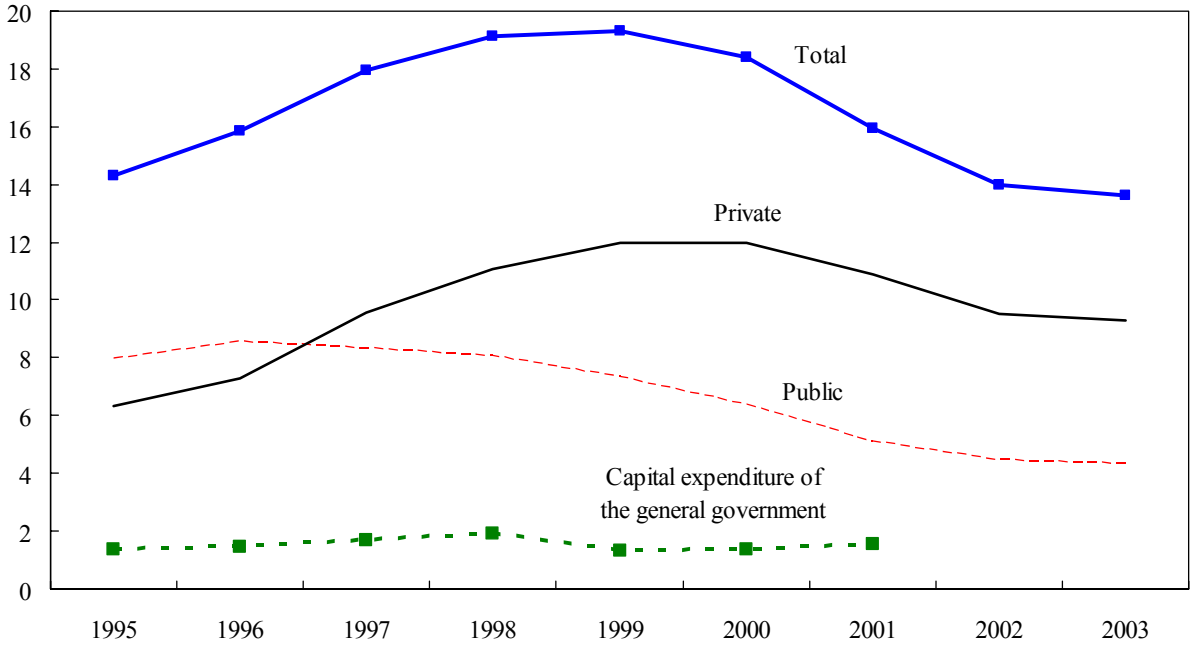
Sources: Polish authorities; and IMF staff calculations.
1/ RAM-8 comprises the Czech Rep., Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Rep., and Slovenia.

Figure 3. EU-15 and Poland: Investment, 1995-2004 1/
(Percent of GDP)



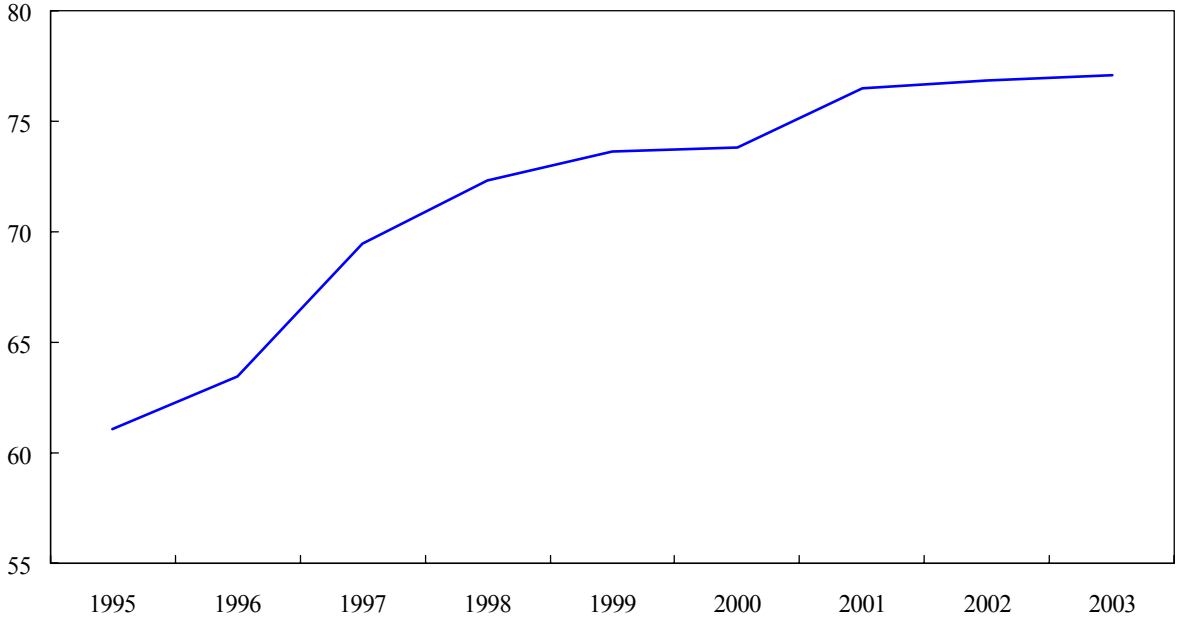
Sources: Eurostat; and IMF staff calculations.
1/ EU-15 is defined as the EU prior to the 2004 enlargement.

Figure 4. Public and Private Investment Outlays, 1995-2003
(Percent of GDP)



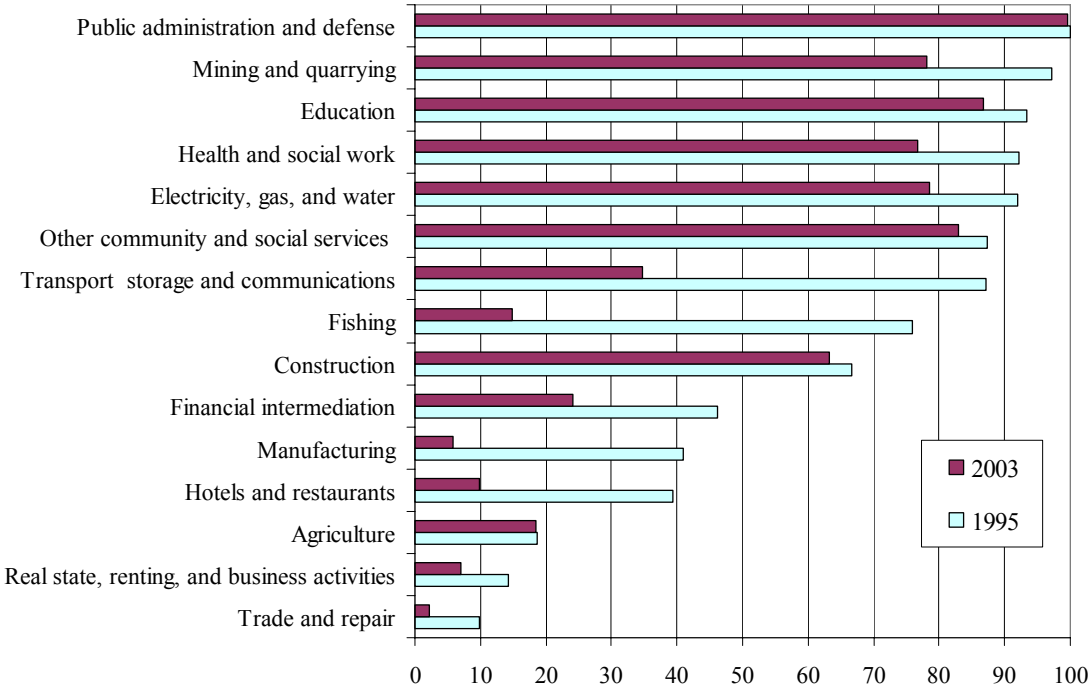
Sources: Polish authorities; IMF, *Government Finance Statistics Yearbook;* and IMF staff calculations.

Figure 5. Private Sector Output as a Share of Total, 1995-2003
(Percent)



Sources: Polish authorities; and IMF staff calculations.

Figure 6. Poland: Public Investment by Sector, 1995 and 2003
(in percent of total investment)



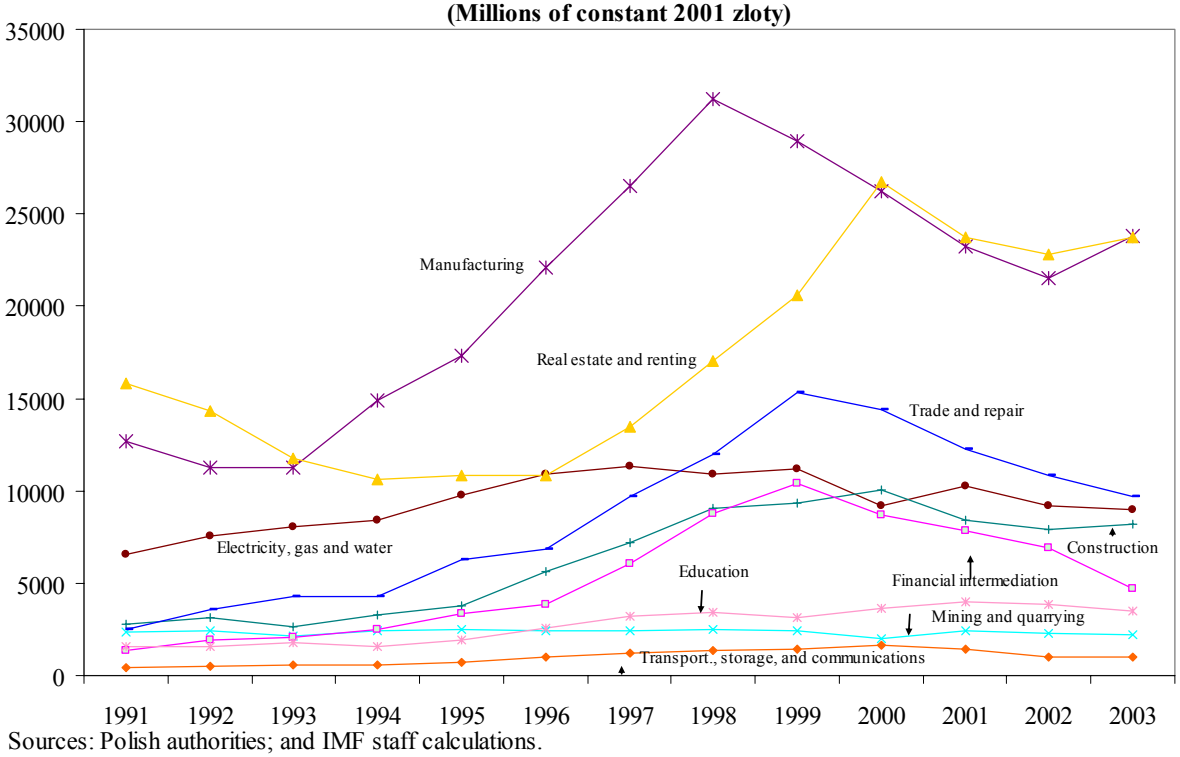
Sources: Polish authorities; and IMF staff calculations.

Changes in the sectoral composition of investment outlays coincided with the ongoing structural changes in the economy (Figures 7, 8, 9, and 10). Investment in manufacturing was by far the largest among all sectors, as the rapid structural changes in production led to a greater orientation toward EU markets and increased the share of manufacturing in total production. Investment in real estate and the trade sector was relatively high, reflecting the underdeveloped nature of these sectors in the early stages of the transition. Substantial investment in the power and telecommunications sectors was the outcome of the modernization of these sectors. Investment growth was most rapid in the financial intermediation sector because of restructuring, privatization, and modernization. On the whole, those sectors whose real investment grew most rapidly in the late 1990s also experienced the most rapid decline of investment after 2000. This might be due to higher procyclicality in such sectors, but could also reflect overinvestment and related excess capacities. The effects of investment on output (as represented by the incremental capital-output ratio—ICOR) varied across the sectors, ranging from very low in some of the sectors with large shares of public investment (electricity, construction, and other community services) to very high in some of the most underdeveloped sectors (transportation, trade, and hotels).

A number of hypotheses have been put forward to explain the rapid growth of investment in the late 1990s and the subsequent sharp drop (Figures 11 and 12). The rapid investment growth until 1998 has been viewed by some as fueled by strong economic growth not only in Poland, but also in the EU—Poland's main trading partner—possibly creating overly optimistic expectations about future demand growth for Poland. Other factors that could be behind the strength of investment in the 1990s include falling economywide unit labor costs relative to those in the EU, and FDI inflows, which played a crucial role in restructuring previously state-owned enterprises, creating competitive pressures, and upgrading managerial and technical expertise. FDI inflows also had important second-round effects on overall investment activity by promoting development of domestic suppliers' networks. User cost of capital, which rose through 1997 while inflation was dropping, may have been a mitigating factor. The subsequent reversal in investment growth could have been related to the slowdown in the EU and the sharp tightening of monetary policy, which resulted in a substantial real appreciation of the zloty during 1999–2002.

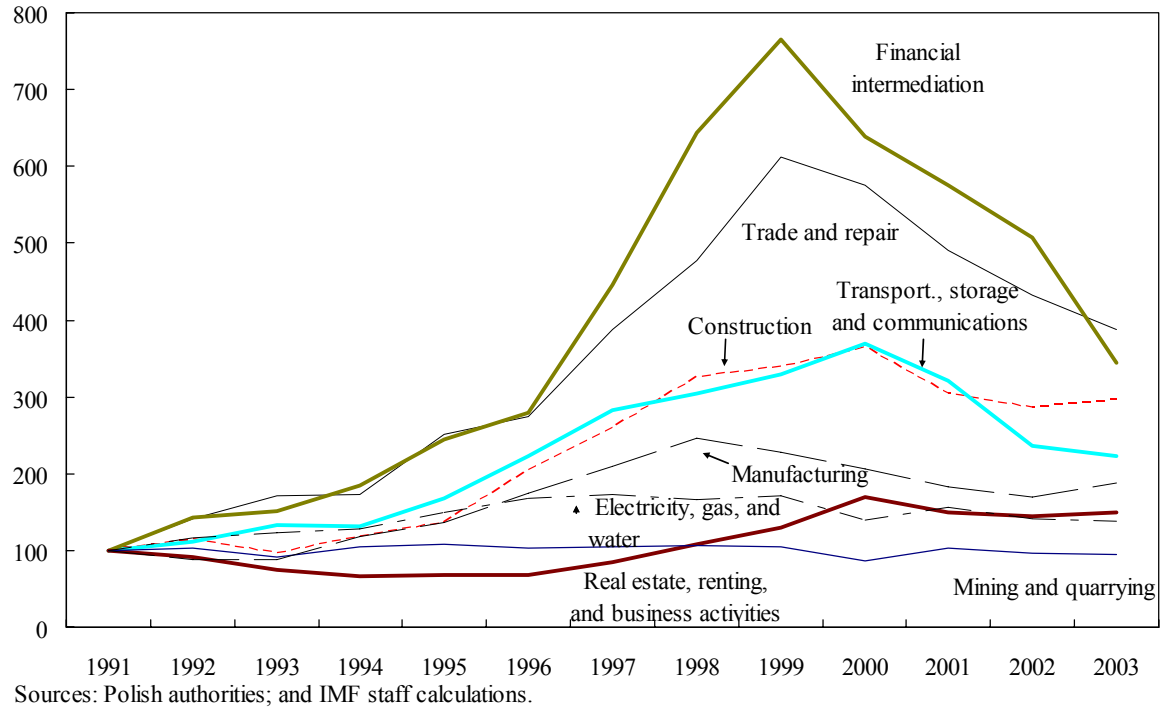
Institutional factors may have also contributed to weaker investment in the early 2000s (Figures 13 and 14). These include, for example, elimination of tax breaks on investment from 2001, and more uncertain business environment as the number of economic areas requiring administrative permission to pursue economic activity increased and the number of legislative acts related to business activity (of which less than one-fourth can be attributed to requirements related to EU accession) rose (Paczocha and Rogowski, 2005). In addition, perceptions of overall riskiness of Poland may have increased from 1999, particularly owing to higher political risk, as indicated by the International Country Risk Guide (ICRG) Risk Ratings System. While the perception of the overall political risk remained low in Poland, some of its individual components—in particular, government stability, law and order, and corruption—worsened, which may have been reflected in investor sentiment.

Figure 7. Poland: Investment by Sector, 1991-2003
(Millions of constant 2001 zloty)



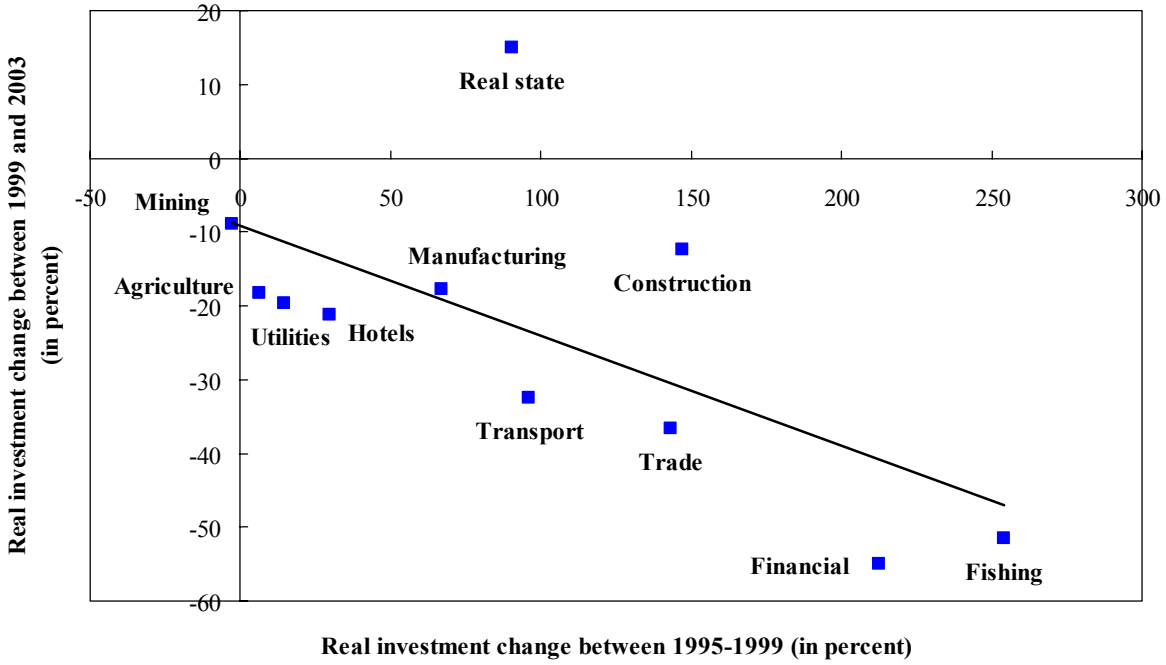
Sources: Polish authorities; and IMF staff calculations.

Figure 8. Index of Real Investment Outlays by Sector, 1991-2003
(1991=100)



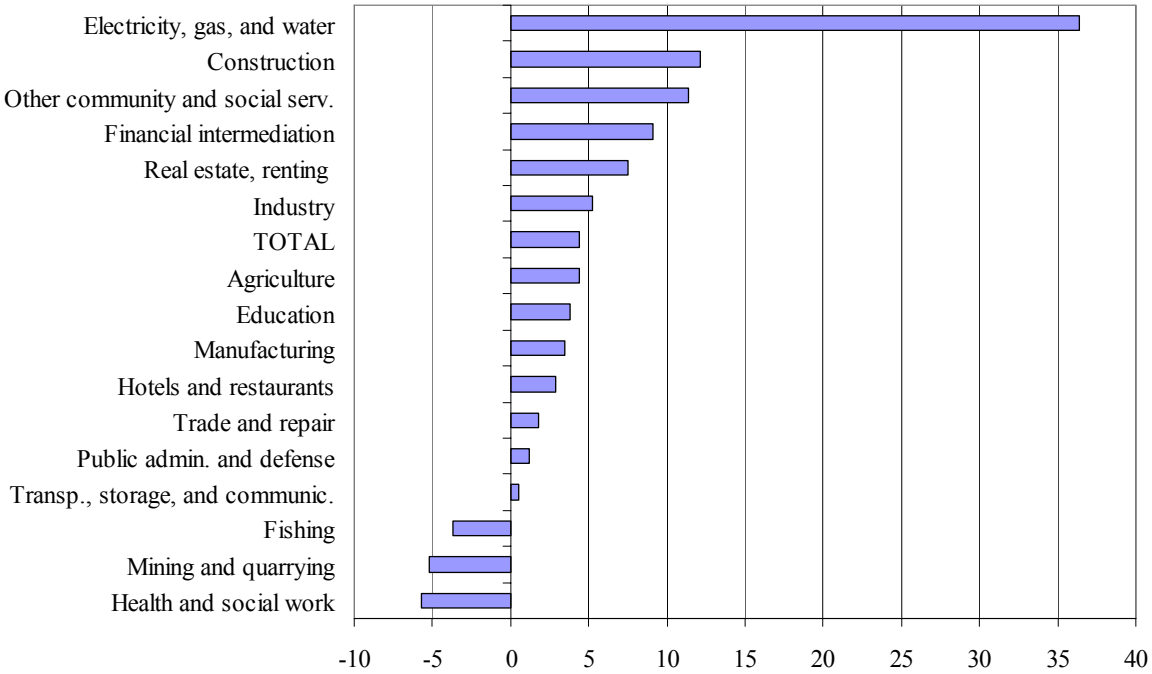
Sources: Polish authorities; and IMF staff calculations.

Figure 9. Change in Investment by Sector
(Percent)



Sources: Polish authorities; and IMF staff calculations.

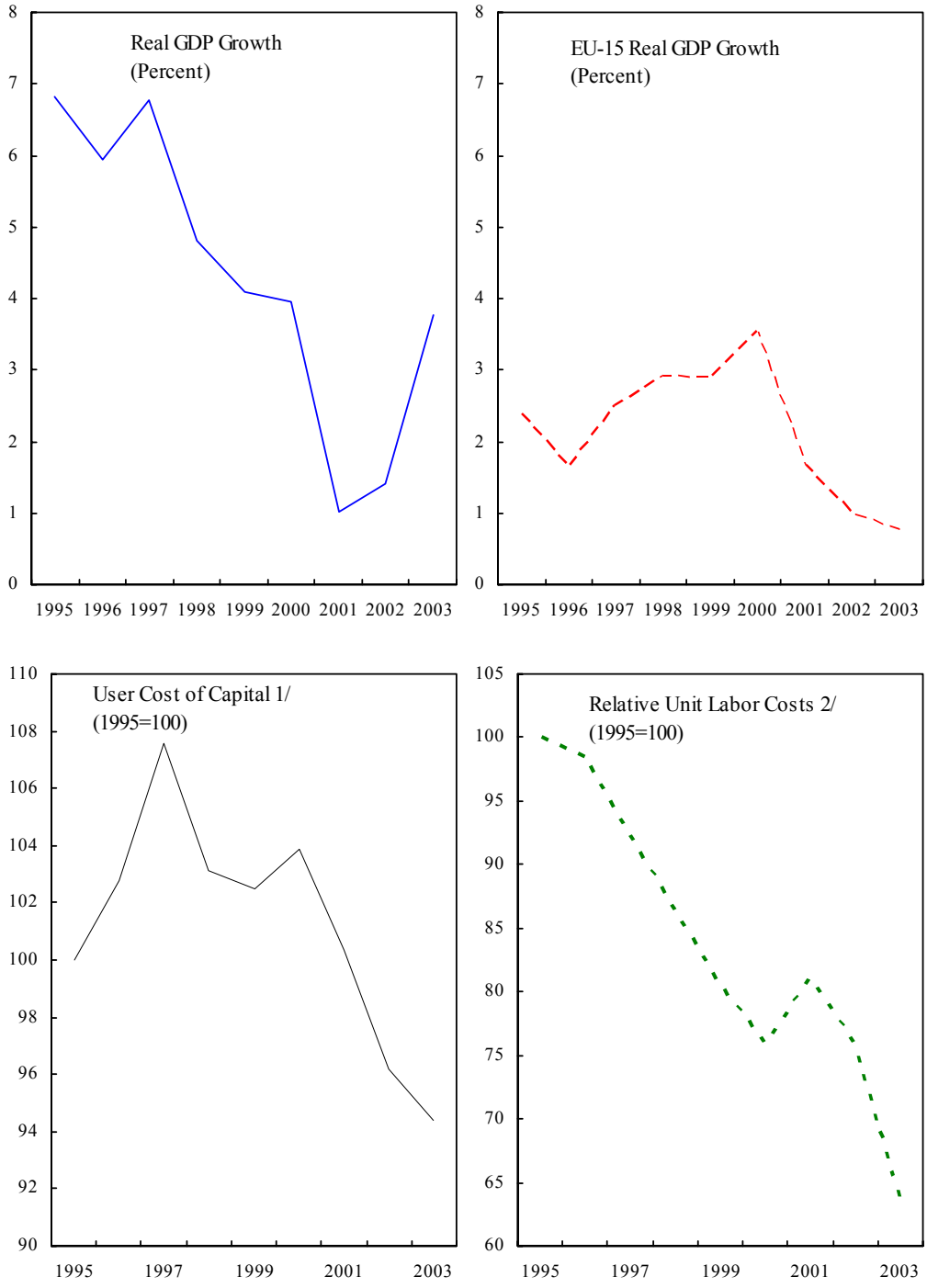
Figure 10. Incremental Capital-Output Ratio by Sector, 1995-2003 1/



Sources: Polish authorities; and IMF staff calculations.

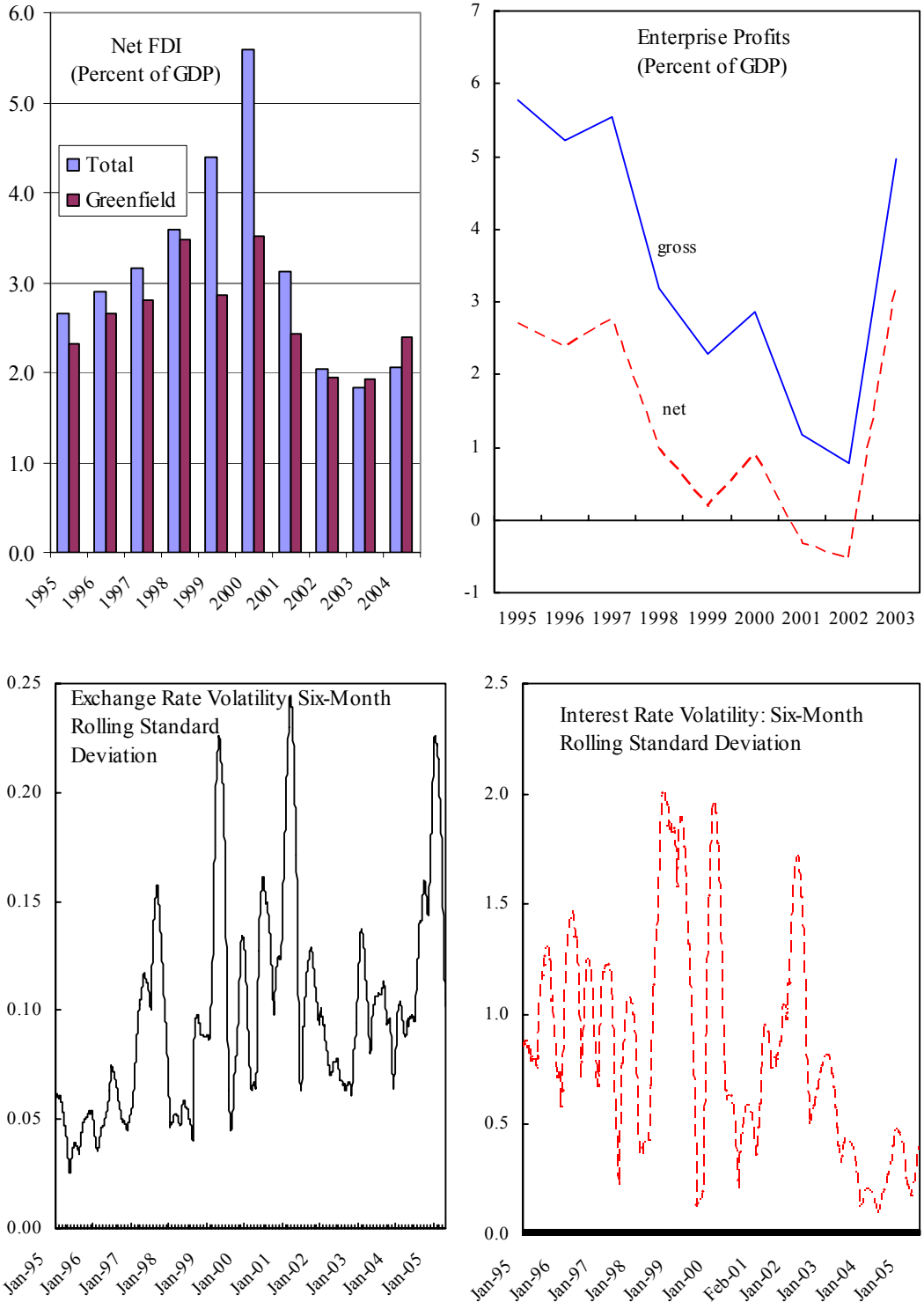
1/ ICORs are the sum of real investment over the change in real output between 1995 and 2003.

Figure 11. Factors Affecting Investment Growth, 1995-2003



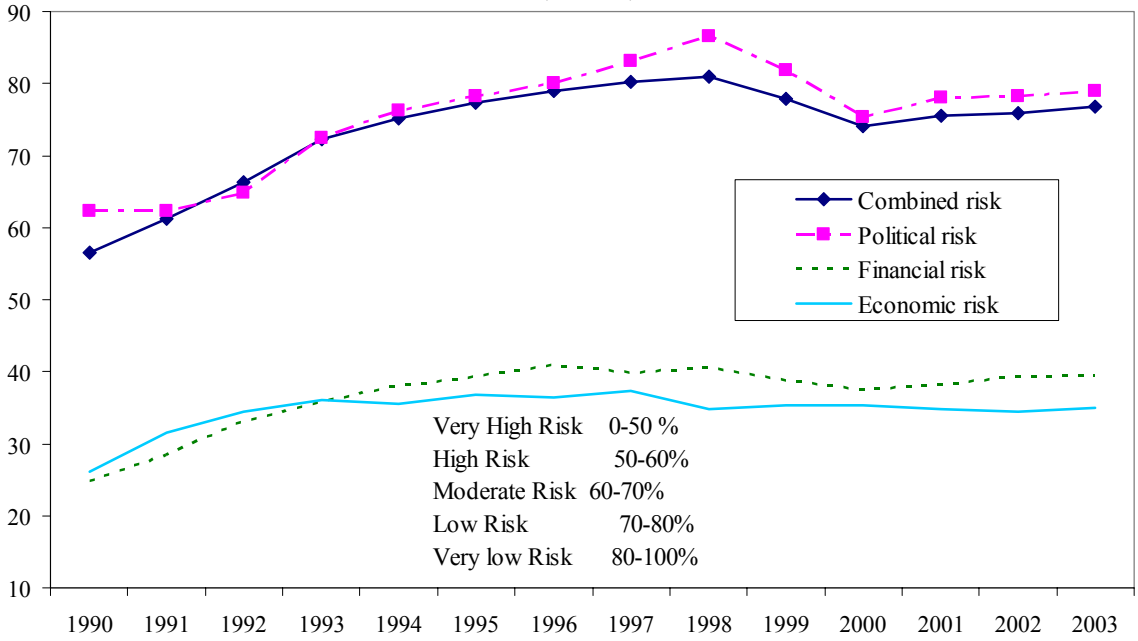
Sources: Polish authorities; Eurostat; Datastream; and IMF staff calculations.
1/ Product of the real interest rate and the relative price of capital (the ratio of the investment deflator to the GDP deflator).
2/ Unit labor costs in Poland relative to the EU.

Figure 12. Factors Affecting Investment Growth, 1995-2005



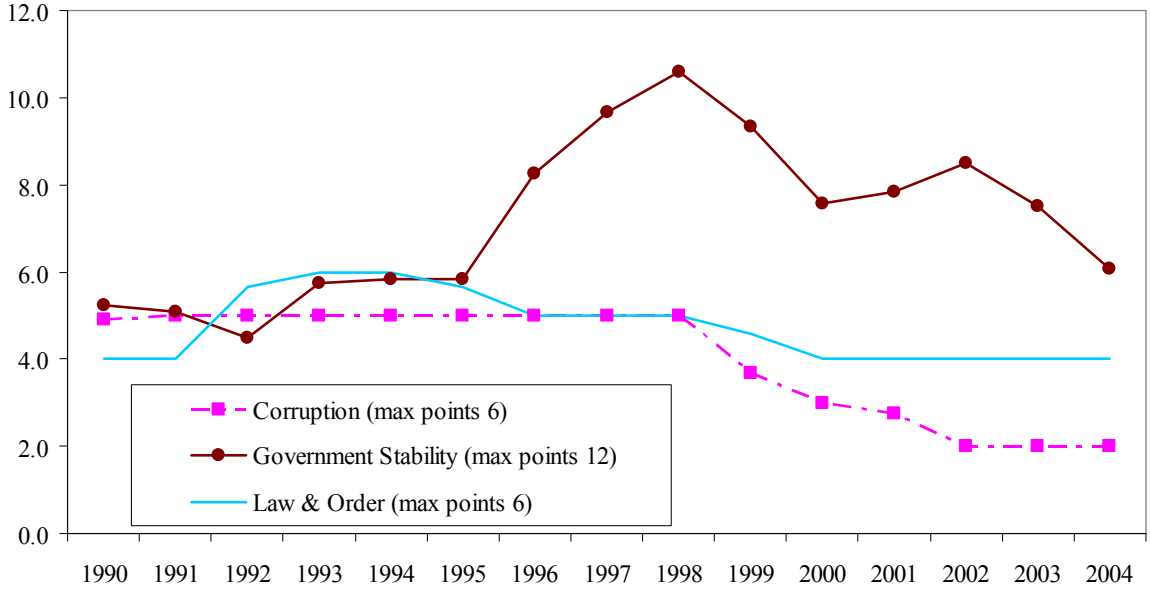
Sources: Polish authorities; Eurostat; Datastream; and IMF staff calculations.

Figure 13. Risk Assessment, 1990-2003 1/
(Percent)



Sources: International Country Risk Guide, the PRS Group Inc.
1/ A higher value signifies lower risk.

Figure 14. Selected Components of the Political Stability Risk Rating, 1990-2004 1/
(Percent)



Sources: International Country Risk Guide, the PRS Group Inc.
1/ The three selected indicators are part of the 11 political risk components, and jointly account for 24 percent of the total weight in political risk. A higher value signifies lower risk.

III. Panel Data Econometric Analysis of the Potential Determinants of Investment

To address the questions outlined in the introduction, it is necessary to estimate a relationship between investment and a number of its potential determinants. In the case of Poland, long-run time series are not available. Therefore, this study relies on panel estimation, drawing on a relatively underexplored data set on sectoral investment, output, and unit labor costs, as well as a variety of additional controls. This approach allows us to analyze investment in individual sectors, as well as the whole economy, and to build a simple model that can be used to simulate a future investment path. Because investment in Poland is an underresearched area, the objective of this paper is to explore general hypotheses about the factors that determine investment.

A. Theoretical Considerations

Theory suggests a number of possible determinants of investment. These include variables that influence the desired capital stock in the future, and through that mechanism, investment. For example, high future levels of sectoral output reveal positive news about demand in all future years for the output of a given sector. Responding to the news, firms in the sector will increase investment compared with the level they would have chosen in the absence of such news. More generally, as explained in detail below, the factors considered may be viewed as affecting not only the demand for, but also the supply of, investment, implying that the estimated equations need to be interpreted as reduced-form equations. The determinants can be divided into two groups: those that are sector specific, and those control variables that are common across all sectors. The full list of potential explanatory variables includes the following.

Sector specific variables

- *Lagged real investment* (sectoral). Investment is autocorrelated (investment inertia) because investment projects often span a number of years.

- *Lead real production* (sectoral). A proxy for expectations of economic activity in the sector is used under the assumption of perfect foresight—higher expected domestic production would require additional investment.[5]

[5] Specifically, the regressions include the (log) level of real future production as a determinant of the (log) level of real investment—both variables are I(1), that is, integrated of order 1. This is broadly equivalent to an alternative specification in which both variables would be divided by current output, that is, where the investment to GDP ratio would be regressed on the growth rate of output.

- *Relative unit labor costs* (sectoral). A proxy is used for cost effectiveness, defined as the unit labor cost (ULC) in Poland relative to those in the EU, and captures effects of exchange rate changes on competitiveness. Higher relative unit labor costs reduce competitiveness and thus investment.

Control variables

- *Economic activity in the EU* (aggregate data for the economy). This variable represents broader prospects for developments in the global environment not captured by the expectations of future production of each individual sector. A higher domestic demand in the EU leads to higher investment in Poland, which in turn will increase the country's export potential in the tradables sectors. In the nontradables sectors, higher EU effect likely promoted investment via a positive confidence effect.

- *Real greenfield foreign direct investment (FDI)* (aggregate data for the economy). FDI inflows not only directly finance investment but also have important spillover effects for domestic investment, possibly with a lag.

- *User cost of capital* (aggregate data for the economy). This represents the opportunity cost of investment. The user cost of capital is defined as the product of the real interest rate and the relative price of capital (the ratio of the investment deflator to the GDP deflator); lower user cost of capital tends to increase investment.

- *Profitability of the enterprise sector* (aggregate data for the economy). It is measured in real zloty. To the extent investment is financed out of firms' own resources, higher profitability leads to higher investment. In addition, large profits may attract new investment.

- *Exchange rate and interest rate volatilities* (aggregate data for the economy). They serve as proxies for uncertainty. High volatility lowers the risk-adjusted rate of return and thus may hamper investment activity.

- *Dummy variable for the change in monetary policy regime* (D). This is set equal to 1 for 1999–2003, when inflation targeting was in place. This dummy variable is used interactively with the user cost of capital, policy interest rates, and the relative investment-to-GDP deflator to test the hypothesis that the switch to inflation targeting instilled greater confidence.

B. Data

The estimations are based on a panel of 11 sectors of the economy for 1995–2003. Data sources and the construction of variables are explained in greater detail in Appendix I. The list of sectors included in the analysis is presented in Appendix II. Sectors with a majority share of public investment were excluded from the analysis because investment decisions would seem unlikely to be based on market incentives. The series are in logarithms of

constant prices, with the exception of dummy variables and exchange rate and interest rate volatilities.

C. Panel Estimation: Fixed Effects

The estimation results using the fixed-effects method are presented in Tables 1 and 2. The endogenous variable is the log of real investment. Table 1 presents baseline estimations using only sector-specific determinants (lagged investment, lead production, and relative ULC) of investment and individual-year dummy variables. Estimated coefficients on sector-specific determinants had the expected signs, although ULCs were not significant. Table 2 presents estimations where the year dummies were replaced with control variables, yet coefficients on sector-specific determinants remained similar as in Table 1. In equation (i) all right-hand-side (RHS) variables have the expected signs, although not all are significant. Equation (iii) indicates that the individual components of the user costs of capital—the real interest rate and the relative cost of capital—were not significant determinants of investment either. Equations (ii) and (iv) suggest that the change in the monetary policy regime (represented by a dummy variable) did not have an impact on investment through the confidence effect. Exchange rate volatility did not have an important effect either.[6] Equations (v)-(ix), which test for the significance of a subset of explanatory variables, suggest that lagged investment, future production, financial results, and current and lagged greenfield FDI were, in various specifications, all significantly related to investment developments. EU demand was significant at about 20 percent in equations (viii) and (ix), relative ULCs at about 25 to 30 percent in equations (vi) and (vii). While in theory relative ULCs should be more important for tradables sectors, including a multiplicative dummy variable with the ULCs distinguishing tradables and nontradables sectors did not improve the significance. Because production technologies could differ across sectors, formal tests were conducted to see whether the statistical relationship between investment and production across sectors differs. The null hypothesis, that the coefficient on production is the same across sectors, was not rejected at conventional significance levels, thereby supporting the appropriateness of pooling data. The fixed-effect estimation method allows hypotheses to be explored from the general to the more specific, and the results presented in Table 1 are easily understood due to the intuitive specification of the equations. However, the estimated coefficients need to be interpreted with caution, owing to a bias in the coefficients that rely on panel regressions that include the lagged dependent variable. Therefore, equations with a good fit and significant coefficients were subsequently reestimated using the Arellano-Bond method.

[6] Interest rate volatility was also not a significant determinant of investment (regression results are not shown in the paper).

Table 1. Panel Estimation Using Fixed Effects with Year Dummies, 1995-2003

	(i)	(ii)
Lagged investment	0.268	0.337
	[2.53]**	[3.54]***
Lead production	0.458	0.6
	[2.05]**	[3.03]***
Relative ULC	-0.158	
	[1.10]	
Lagged relative ULC		-0.195
		[1.53]
1995 dummy	-0.071	0
	[0.74]	[.]
1996 dummy	0.09	-0.064
	[0.97]	[0.78]
1997 dummy	0.175	0.011
	[2.02]**	[0.15]
1998 dummy	0.228	0.036
	[2.77]***	[0.53]
1999 dummy	0.261	0.059
	[3.27]***	[0.92]
2000 dummy	0.21	0
	[2.66]***	[.]
2001 dummy	0.132	-0.094
	[1.66]	[1.46]
2002 dummy	0	-0.21
	[.]	[3.24]***
Observations	88	77
Number of sectors in the sample	11	11
R-squared	0.64	0.64

Absolute value of *t*-statistics in brackets

* Significant at 10%; ** significant at 5%; *** significant at 1%

Source: IMF staff calculations.

Table 2. Panel Estimation Using Fixed Effects, 1995-2003

	With User cost of capital and ER volatility				Without User cost of capital and ER volatility				
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)
Lagged investment	0.282	0.268	0.269	0.268	0.354	0.342	0.34	0.307	0.268
	[2.67]***	[2.52]**	[2.57]**	[2.53]**	[4.00]***	[3.54]***	[4.10]***	[3.25]***	[2.62]**
Lead production	0.516	0.505	0.456	0.458	0.52	0.525	0.594	0.494	0.514
	[2.34]**	[2.29]**	[2.06]**	[2.05]**	[2.44]**	[2.40]**	[3.15]***	[2.32]**	[2.41]**
Financial results	0.188	-0.21	-0.208	-0.252	0.092			0.165	0.168
	[0.96]	[0.50]	[0.73]	[0.32]	[2.45]**			[2.56]**	[2.60]**
Lagged FDI	0.268	0.126	0.189	0.074	0.267			0.189	0.199
	[1.93]*	[0.65]	[1.46]	[0.35]	[4.30]***			[2.26]**	[2.36]**
FDI						0.421	0.357		
						[3.95]***	[3.89]***		
Relative ULC	-0.139	-0.157	-0.156	-0.158		-0.16			-0.135
	[0.97]	[1.09]	[1.10]	[1.10]		[1.15]			[0.96]
Lagged relative ULC							-0.118		
							[0.96]		
EU demand	0.978	-0.044	2.827	-1.509					
	[0.90]	[0.03]	[1.67]*	[0.20]					
Lead EU demand								1.454	1.302
								[1.38]	[1.22]
Exchange rate volatility	-0.206	-1.156	-1.195	-0.159					
	[0.15]	[0.71]	[0.90]	[0.14]					
User cost of capital	-0.521	2.885							
	[0.17]	[0.65]							
D*user cost of capital		3.634							
		[1.06]							
Interest rate			3.353	2.567					
			[0.98]	[0.55]					
Investment/GDP deflator			9.056	0					
			[1.52]	[.]					
D*interest rate				0.628					
				[0.45]					
D*investment/GDP deflator				8.631					
				[0.55]					
Observations	88	88	88	88	88	88	77	88	88
Number of sectors in sample	11	11	11	11	11	11	11	11	11
R-squared	0.62	0.63	0.64	0.64	0.61	0.59	0.6	0.62	0.63

Absolute value of *t*-statistics in brackets

* Significant at 10%; ** significant at 5%; *** significant at 1%

Source: IMF staff calculations.

D. Panel Estimation: Arellano-Bond

The estimation results using the Arellano-Bond method (Arellano and Bond, 1991) are presented in Table 3. The change in logarithm of real investment is the endogenous variable. The magnitude of the coefficients obtained through the fixed-effects method is broadly similar when estimated using the Arellano-Bond method, which uses lags of all the variables as instruments in order to correct for the bias mentioned above. The results reported in Table 3 are based on the Arellano-Bond estimation, which also takes into account that some variables, such as production, are endogenous. [7]

Table 3. Panel Estimation Using Arellano-Bond,1995-2003

	AB(i)	AB(ii)	AB(iii)	AB(iv)	AB(v)
Investment	0.162	0.486	0.405	0.601	0.323
	[1.30]	[3.47]***	[2.29]**	[4.53]***	[1.94]*
Production	0.963	0.706	1.079		
	[2.96]***	[1.61]	[3.59]***		
Lead production				1.493	0.807
				[4.23]***	[2.57]**
Financial results	0.033	0.011	0.057		
	[1.03]	[0.28]	[1.68]*		
Lagged FDI	0.299		0.254		
	[4.96]***		[1.55]		
FDI		0.202			0.305
		[3.41]***			[2.37]**
EU demand		0.469			
		[0.22]			
Lagged relat.ULC			-0.045	-0.179	-0.045
			[0.28]	[1.06]	[0.29]
Observations	88	99	77	66	66
Number of sectors	11	11	11	11	11

Absolute value of *z*- statistics in brackets

* Significant at 10%; ** significant at 5%; *** significant at 1%

L = lag; D = difference

Source: IMF staff calculations.

[7] The fixed effects and Arellano-Bond estimations were also repeated with the inclusion of the ICRG indicator of political stability (presented in Figure 13). The estimated coefficients on political stability had the expected sign (positive—higher political stability is expected to lead to higher investment), and significant in some specifications.

A number of determinants of investment can be identified from the estimation results. These include lagged investment, lead production, and financial results, greenfield FDI inflows, EU demand, and relative ULCs (though ULCs were significant at the 25 percent level).[8] [9] The user cost of capital does not feature as a significant determinant of investment, probably because about half of new investments tend to be financed with firms' own resources, and only about a third financed with credits (National Bank of Poland, 2005), suggesting possible capital market imperfections. This result is corroborated by Gradzewicz (2005) and Dobrinsky (2005). Empirical studies of investment generally have difficulties finding a significant relationship between investment and the user cost of capital. There are a number of possible reasons (other than capital market imperfections). First, firms may adjust expectations about economic activity in response to monetary policy changes, and thus revise their investment plans. Second, the cost of capital may be mismeasured, particularly to the aggregate level. Third, there may be an identification problem inherent to reduced-form estimates that include potentially endogenous regressors. Nevertheless, in this paper monetary policy can have an impact on investment by affecting relative unit labor costs and profitability through the exchange rate, and perhaps to a lesser extent, the interest rate channels.[10]

E. Simulations

1. In-sample dynamic simulations of the estimated equations point to some overinvestment in the second half of the 1990s and underinvestment during 2000–02 (Figures 15-17).[11] All simulated models based on the Arellano-Bond estimation capture

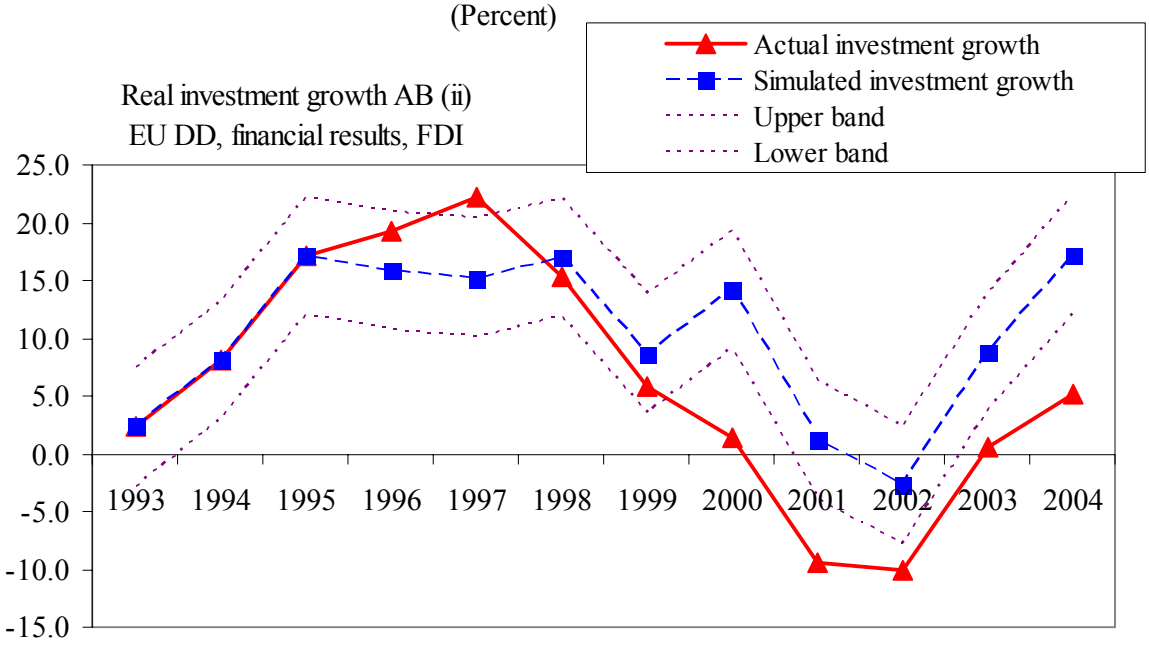
[8] Lagged investment, lead production, and financial results were also found to be significant by Gradzewicz (2005).

[9] To determine whether the impact of the 1998 Russia crisis may have contributed to the investment slowdown, the equations were reestimated using Poland's partner country demand (weighted by trade shares) calculated in the IMF's *World Economic Outlook* (WEO), instead of EU demand. While the estimated coefficients on the partner country demand had the expected sign (positive), the overall fit of the models was much worse than when using EU demand. This may be due to the relatively low share of Polish exports to Russia in total exports prior to the crisis (less than 7 percent) and a high share of exports to the EU (about two-thirds) throughout the sample period.

[10] Similarly to Gradzewicz (2005), the regressions in this paper were reestimated using the Monetary Conditions Index (MCI), defined as a linear combination of the real policy rate and the real effective exchange rate. In various specification the MCI was either not significant, or had the wrong sign. This could simply indicate that monetary policy is leaning against the wind.

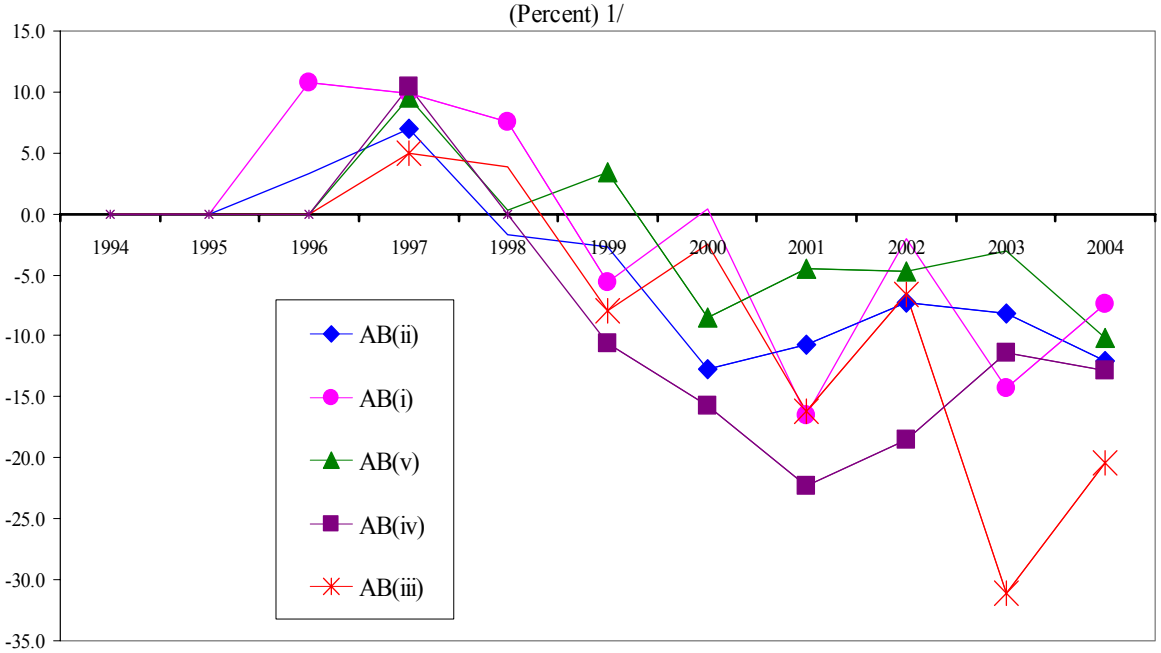
[11] The figures are based on the equations estimated using the Arellano-Bond method.

Figure 15. Real Investment Growth: Actual and Fitted Values, Arellano-Bond Estimation, 1993-2004, (Percent)



Sources: Polish authorities; and IMF staff calculations.

Figure 16. Real Investment Growth: Actual Minus Predicted, 1994-2004, (Percent) 1/



Source: IMF staff calculations.

1/ Each line represents a deviation of actual from predicted growth based on different estimated equations in Table 3. Positive values represent "overivestment", negative "underinvestment." Individual observations highlighted with bold markers represent significant "overinvestment" or "underinvestment".

the broad turning points in investment since 1995. The illustrative model based on equation AB(ii) from Table 3 suggests that actual investment growth somewhat exceeded predicted investment growth, especially in 1997 (Figure 15). Moreover, while the slowdown of investment growth in 1998–99 is consistent with developments in fundamentals, there seems to have been substantially less investment in 2000–04 compared with what the estimated models would imply. These results are reasonably robust to changes in equation specification (Figure 16).[12] Some models that include financial results (for example, equation AB(iii)) predict a sharp increase in investment in 2003, owing to the very high increase of real corporate profits (albeit from a very small base). In reality, investment growth did not grow in 2003 because enterprises built up deposits in the banking sector instead. The reasons for underinvestment are by definition not captured in the model; they may include lack of investor confidence—perhaps due to prevailing uncertainties about future macroeconomic policies—or institutional factors emphasized by others. Sectoral simulations suggest that overinvestment in the mid-1990s may have occurred, mainly in transportation, real estate, manufacturing, and construction, whereas underinvestment may have occurred since 2000 mainly in hotels, trade, and transportation (Figure 17).

Out-of-sample simulations indicate that, under reasonable assumptions, investment relative to GDP may not reach the previous peak in the medium term (Figure 18). The speed of increase of the investment-to-GDP ratio depends on the specification of the model and the assumptions about RHS variables. Two separate illustrative scenarios of the real investment-to-GDP ratio are presented in Figure 18. Both scenarios use WEO projections for EU domestic demand (ranging from 1.7 percent to 2.2 percent during 2005–10) and GDP growth in Poland (averaging 3¾ percent in the medium term). The conservative scenario 1 assumes no change in corporate financial results (albeit from the high base of 2004 after two years of exceptionally strong profit growth), unchanged relative ULC, and 2.4 percent growth of real greenfield FDI (equal to the growth of FDI in 2003) each year. The more optimistic scenario 2 assumes a rise in corporate financial results in line with nominal GDP, a 5 percent growth of real greenfield FDI, and a 3 percent fall in relative ULC per year. In the medium term, real investment to GDP is projected to continue growing under plausible assumptions, including continued growth in Poland and improvement in the other explanatory variables.[13] However, the out-of-sample simulations also suggest that the investment-to-GDP ratio may not rebound to its peak level of the late 1990s.

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[12] Simulations of estimated equations that included the indicator of political stability yielded similar results.

[13] Investment as a share to GDP rises owing to combination of a relatively high estimated elasticity of investment with respect to output and the positive estimated coefficient on the lagged investment variable.

Figure 17. Real Investment Growth: Actual and Fitted Values by Sector, 1995-2003
(Percent)

Figure 17. Real Investment Growth: Actual and Fitted Values by Sector, 1995-2003 (Continued)

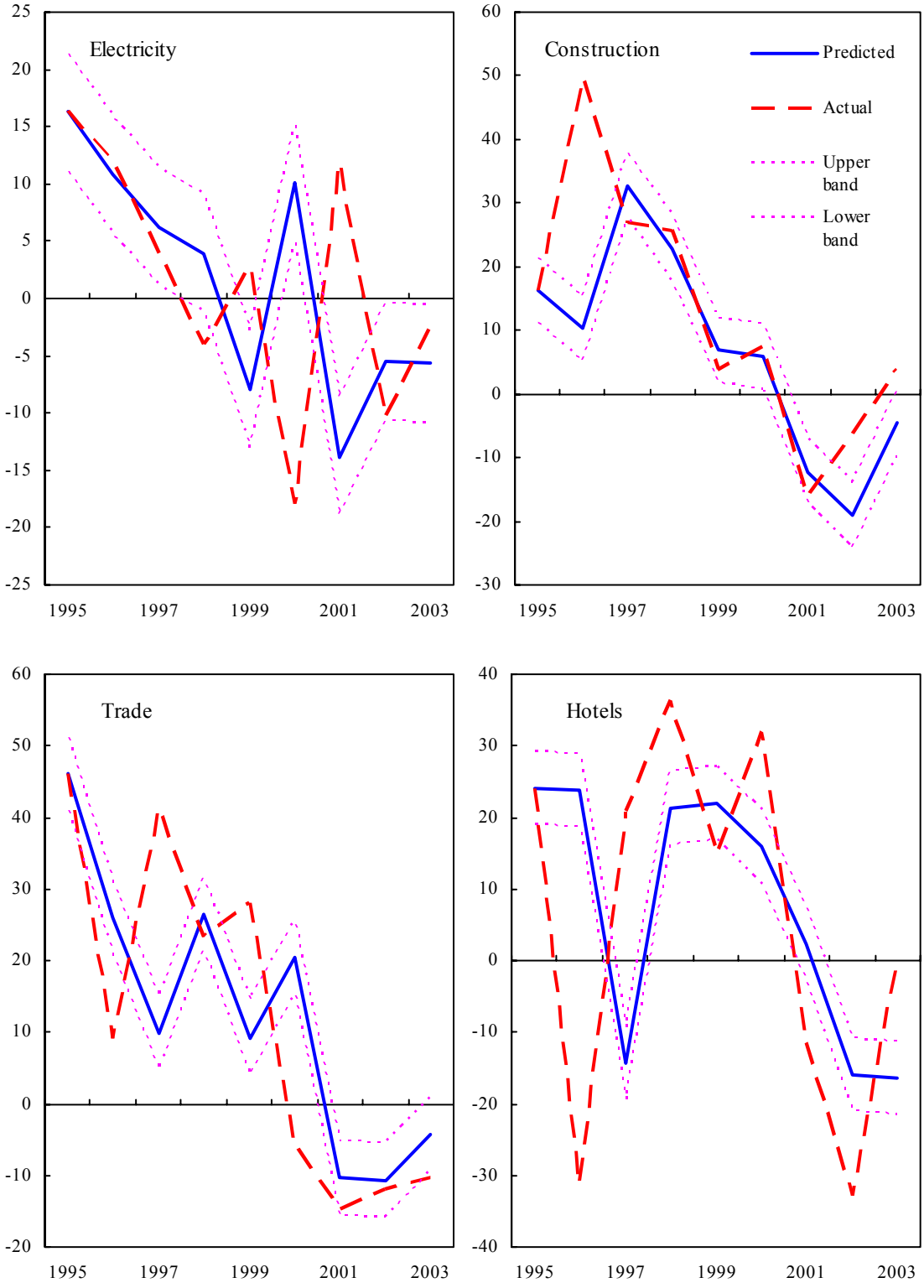
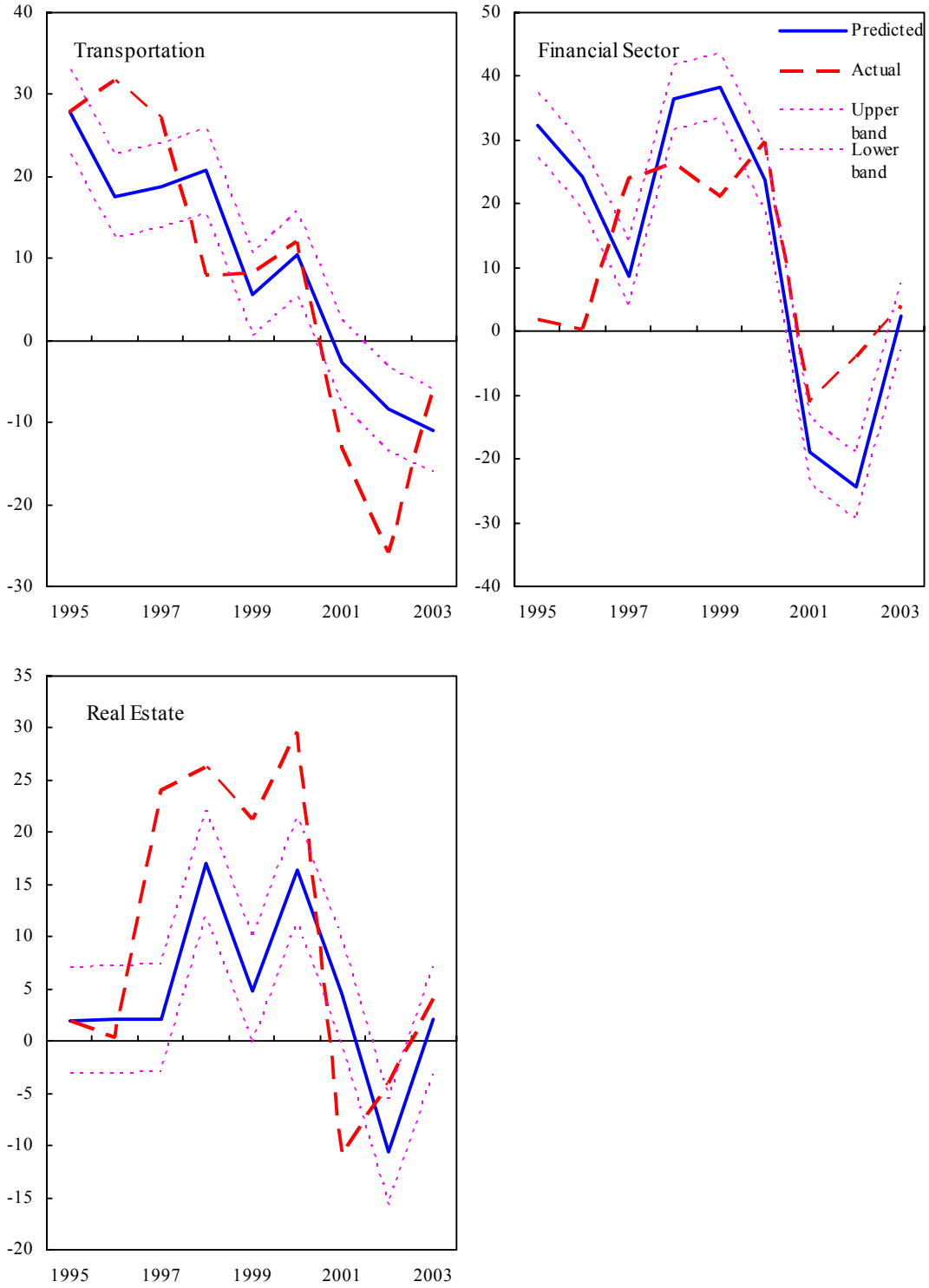
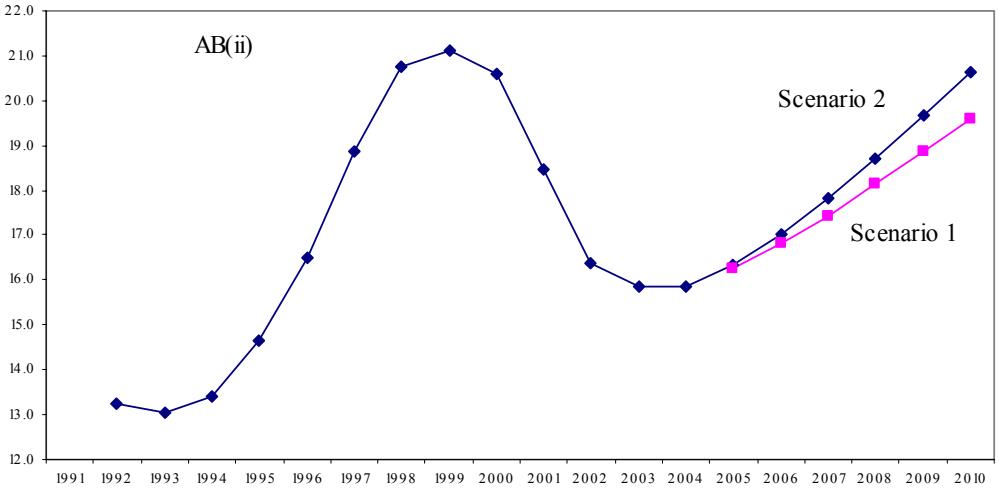


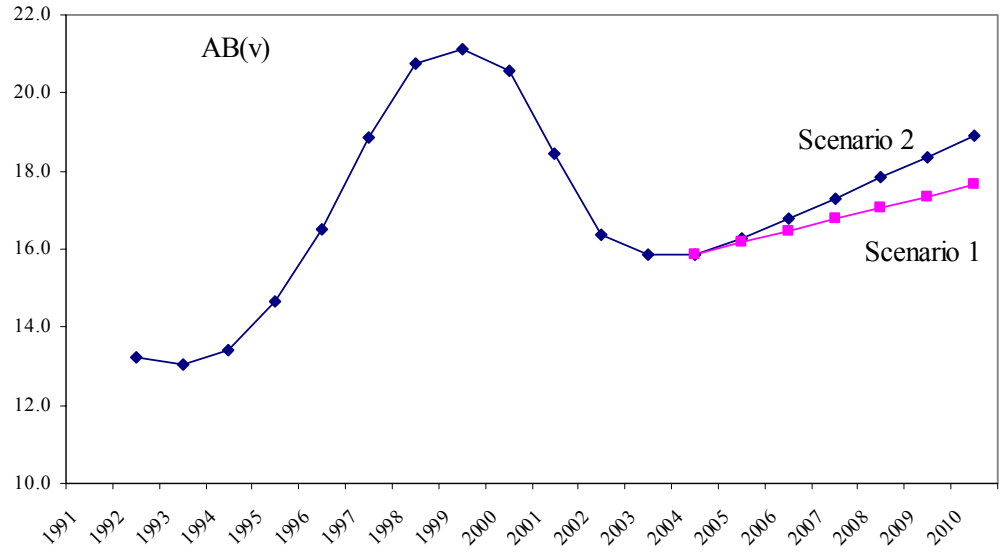
Figure 17. Real Investment Growth: Actual and Fitted Values by Sector, 1995-2003 (concluded)



Sources: Polish authorities; and IMF staff calculations.

Figure 18. Real Investment-to-GDP Ratio: Out-of Sample Simulation, 1991-2010 1/
(Percent)





Sources: Polish authorities; and IMF staff calculations.
1/ Scenario 1 assumes unchanged financial results, unchaged relative ULC, and real greenfield FDI growth of 2.4 percent per year.
Scenario 2 assumes growth of financial results in line with GDP, 5 percent growth of real greenfield FDI, and 3 percent fall in relative ULC per year.
See Table 4 for specification of equations AB(ii) and AB(v).

IV. CONCLUSIONS

This study has sought to identify the determinants of investment in Poland and provide a gauge for assessing whether investment has displayed an overly cyclical pattern in the past. Based on a sectoral panel covering the past decade, the main determinants of investment include lagged investment, production expectations, profitability, relative unit labor costs, greenfield FDI, and EU demand. The estimates point to some overinvestment in 1997, and sizable and more prolonged underinvestment during 2000–02 than what the model would imply. The relatively low investment in 2000–02 is thus unlikely to be related to the previously created excess capacity. Other factors, such as investor uncertainty, must have been at play.

Strong investment is essential for Poland to realize its potential output. Policies can play a role in promoting investment by affecting several of the determinants of investment identified in the estimates. In light of the estimates suggesting a key role for FDI inflows, structural policies aimed at maintaining Poland's attractiveness for foreign investors will be important. The reduction of the corporate income tax introduced in 2004 is also likely to play a role by boosting after tax profitability. In addition, relative unit labor costs can be influenced by macroeconomic policy coordination to support a competitive real exchange rate; and through structural policies seeking to improve workers' skills and enhance labor market flexibility. Measures to reduce uncertainty regarding the macroeconomic framework and the business environment would also help; such measures could, for example, include improvements in fiscal institutions.

Finally, EU membership and EU transfers are likely to have a positive impact on private investment by deepening trade integration, creating opportunities for new private projects, and financing infrastructure. The investment equations were estimated for the period before the EU accession and thus do not take into account the benefits of EU membership and EU funds. Therefore, the medium-term projections based on the estimated models may prove to be lower bounds for future investment.

Data Sources and Construction of Variables

Unless noted otherwise, all variables are based on data from the various issues of the Statistical Yearbook of the Republic of Poland, Central Statistical Office (GUS).

- *Real investment* is based on investment outlays by sections and divisions in constant prices (converted into 2001 constant prices series).

- *Real production* is based on indices of gross output by sector in constant prices, (converted into 2001 constant price series).

- *Relative unit labor costs* are defined as the ratio of the sectoral unit labor costs (ULC) in Poland to sectoral unit labor costs in the EU. ULC for Poland was calculated using data on employed persons by sector, average monthly gross wages and salaries by sector, and gross output by sector. Sectoral ULCs for the EU were obtained from Datastream.

- *Domestic demand in the EU* in constant prices was obtained from Eurostat.

- *Greenfield FDI* in U.S. dollars for the economy as a whole is defined as total FDI inflows less privatization receipts from abroad, obtained from the National Bank of Poland (NBP), converted into zloty at period average exchange rates (from the NBP), and deflated by the investment deflator.

- *User cost of capital* is defined as the product of the real interest rate (proxied by nominal policy rate from the NBP deflated by the GDP deflator) and the relative price of capital (the ratio of the investment deflator to the GDP deflator).

- *Profitability of the enterprise sector* is defined as the gross financial results on economic activity deflated by the GDP deflator. Ideally, net profitability series would be used to capture the impact of taxation, but these cannot be used for technical reasons (the net profitability series have negative values during some periods of the sample and thus cannot be used in a log-linear form in the estimation). However, because of the co-movement of the gross and net profitability, the results based on gross profitability series can be assumed to apply to the net series as well (see Figure 12).

- *Exchange rate and interest rate volatility*—Daily observations of the zloty/euro exchange rate from the NBP and of three-month Warsaw Interbank Offered Rate (WIBOR) from Datastream; a sixth-month rolling standard deviation is averaged for each calendar year.

- *DULC--a* dummy variable, used in a multiplicative form with relative ULCs, was set equal to 1 for the tradables sectors (agriculture, fishing, manufacturing (industry), mining, and electricity), and to zero otherwise.

List of Sectors Included in the Panel Data Analysis

AGR	Agriculture
CONST	Construction
FIN	Financial intermediation
FISH	Fishing
HOT	Hotels and restaurants
MANUF	Manufacturing (industry)
MIN	Mining and quarrying (industry)
POWER	Electricity, gas, and water (industry)
REALEST	Real estate, renting, and business activities
TRADE	Trade and repair
TRANSP	Transport, storage, and communications

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