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Abstract

This paper examines Poland's post-socialist economic transformation from an Industrial Organization perspective. Cluster analysis is used to group sectors which have experienced similar patterns of transformation. The analysis identifies two distinct patterns. Sector restructuring has been accomplished largely through firm turnover in the first group. The economic incentives established with the 1990 'Big Bang' reforms have been sufficient to promote restructuring in these sectors. Sector restructuring has lagged in the second group. Industry restructuring has been largely equivalent to firm restructuring. It appears that further institutional reform is required for sector restructuring to take place.

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"Poland: The First European Tiger - the reform process is secure, [and] the economy is roaring ahead."
CBI News, May 1994

"The reform process has been very good for the speculators and a few foreign firms. But large parts of the economy are in ruins and society groans under the onslaught of misdirected liberalism. We must not give away the national assets it took Poland 40 years to build."
Editorial in *Gazeta Wyborcza*, September 19, 1994

Five years after its 'Big Bang,' Poland has passed an important milestone on the path to a healthy economy. The country has largely succeeded in its first post-socialist challenge, introducing market mechanisms such as economically meaningful prices and private ownership. Growth has resumed, inflation is declining, and the unemployment rate has leveled off. However, these promising aggregate trends obscure wide variation in the pace of economic transformation across sectors of the economy. Most analyses to date have taken place at one of two extremes. They have focused either on aggregate macroeconomic statistics, such as changes in GDP and inflation, or on narrowly defined issues such as privatization. This paper analyzes Poland's economic transformation using industry-level data from all sectors of the economy. The analysis reveals that sectors have been transformed along two distinctly different paths. While many have been transformed quickly, others remain little changed and continue to be dominated by large state-owned enterprises (SOEs).

This paper has two aims. The first is to present an analysis of economic development based on detailed sector-level data. The second is to briefly consider Poland's policy options in the context of this analysis. Analyzing economic change at the sector level leads to a very different understanding of post-socialist development than does analysis based on aggregate statistics. My analysis is based on a data set containing detailed information on 17 sectors of the Polish economy for the period from 1989 through 1993. Fifteen economic measures are used to determine the extent to which each sector has been restructured. Cluster analysis is used to group the sectors by development path. The analysis reveals that the sectors fall into two distinct categories, which I will call Group A and Group B.

The variation between groups is striking. Group A sectors (53% of GDP and 59% of employees in 1993) have a set of characteristics which appear to be mutually reinforcing: economic activity has shifted quickly to the private sector; output and employment have increased after initial declines; and concentration ratios have fallen. Group B sectors, by contrast, (41% of GDP and 22% of employees) remain mired in an unattractive equilibrium: they continue to be dominated by SOEs; output and employment continue to decline; and concentration ratios remain high. These economic attributes appear to be mutually reinforcing. Group A sectors have experienced a virtuous cycle of entry, competition, and restructuring, while Group B sectors have stagnated. In Group A, both private firms and SOEs outperform the average firm in Group B. It appears that the competitive pressures unleashed in the Group A sectors force even the state-owned enterprises to restructure or to liquidate.

Which group each sector falls into is well explained using an Industrial Organization economics framework. The differences in transformation trajectory appear to be driven by the type of factors

studied by Industrial Organization economies, such as barriers to entry and minimum efficient scale in production. Group A has experienced high rates of new firm formation, while Group B has not. In the latter group, high barriers to entry appear to have significantly damped the pressure to restructure. In the race to reform, the Group B sectors appear to be stuck at the starting line.

Most work to date on post-socialist economies has been done at one of two extremes. Polish macroeconomic data has been analyzed by many authors.[1] This work has the virtue of being comprehensive, but much of the richness of the transition process is lost because the data have been aggregated. A second literature focuses on a small number of firms, a single industry, or a single issue such as privatization.[2] These analyses present a much more detailed picture of the transformation process, but the conclusions often have limited scope. This analysis attempts to pursue a middle path. It is comprehensive in that the data are drawn from all sectors of the economy. It provides a detailed view by breaking economic activity into 17 sectors (roughly equivalent to two-digit SIC classifications in the U.S.) and examining the transformation path of each sector. Cluster analysis is used to group the sectors by development path. The picture of two distinct economies which emerges is very different from analyses based on aggregate statistics. This difference has important implications for public policy.

The paper's second goal is to briefly consider Poland's policy options in the context of the sector analysis. The empirical results suggest that Poland's policy challenge today is much different than it was in 1989. The present challenge is twofold: to manage a mixed economy effectively, and to shift the focus of policy from macroeconomic stability and microeconomic liberalization measures toward the institutional reforms needed to promote restructuring in the Group B sectors. The most urgent challenge facing the government is to move reluctant state enterprises out of the political arena and into the economic one, countering strong pressures to transfer resources from a relatively efficient and prosperous private sector to the state sector, which is neither. Poland's current policy challenge may have more in common with Italy's and Mexico's, and Britain's 10 years ago, than it does with the present situation in Belarus or the Ukraine. Unfortunately, the growing debate about the proper role for government is often backward-looking. Instead of debating which type of incentives and institutional mechanisms are most likely to promote reform in the lagging sectors, the debate often revolves around the pros and cons of restoring bureaucratic guidance and cartels in 'strategic' sectors.

The remainder of this paper is organized into five sections. Section two provides a brief overview of the reform process. It starts with a short discussion of several key economic rules, institutions, and characteristics of the socialist economy prior to 1989 and concludes with an overview of the Balcerowicz plan implemented in January 1990.

Section three is the heart of the paper. It begins by presenting data on private and state activity in 17 sectors of the Polish economy. Two distinct development paths emerge when the data are analyzed using cluster analysis. Sector and group level data are presented on changes in output, employment, firm entry,

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1 See for example: Lipton and Sachs (1990a); Berg and Sachs (1992); Sachs (1993); Balcerowicz (1993a, 1993b, and 1994); Blanchard, Froot, and Sachs (1994); Gomulka (1994).

2 see for example: Johnson and Loveman (various articles); Pinto, Belka and Krajewski (1993); Gdansk Institute for Market Economics various papers.

concentration ratios, patterns of foreign investment, and productivity. The data illustrate the sharp contrast between industry restructuring which occurs as a result of firm turnover and that which occurs because of firm level restructuring. The latter has been a much slower process.

Section four provides a brief discussion of the two distinct impediments to reform. A ranking of the concentration ratios of industries in western economies turns out to be a very good predictor of group membership in our Polish sample. A second, firm-level framework for considering reform is also developed. The model posits that three conditions must be present for firm-level restructuring to occur. Interviews with managers, venture capitalists, bankers, and government officials in Poland confirm that the model appears to explain the prospects for reform at the firm level. All three factors are generally present in Group A sectors, while one or more is often missing in Group B sectors.

Section five uses the conceptual framework to analyze several policy options being considered in Poland today. The discussion concludes that neither the policy of fragmented intervention being pursued by the current government, nor the mass privatization program is likely to lead to a significant restructuring of the Group B sectors. The changes each policy is likely to bring fall short of those necessary to promote effective restructuring of the Group B sectors. Instead, Poland would be much better served by a Czech-style voucher privatization program or by a radical employee privatization plan.

Section six concludes.

Section II: The Situation in 1989

The condition of the Polish economy prior to the 1990 reforms has been extensively analyzed elsewhere.[3] This section does not attempt to provide a comprehensive overview of the situation in 1989. Instead, it highlights several important features of the socialist economy which had an important influence on sector development following the 1990 reforms. The section concludes with a short overview of the key elements of the Balcerowicz reforms.

The pre-1989 socialist economy can be best understood by reviewing several rules and institutions which governed economic activity and then considering the economic outcomes which resulted from these policies. Two institutions were important. The first was that the state exercised enormous control over the economy. An extremely high proportion of output and employment were controlled either directly by the government or by state controlled entities. Table #1 shows these percentages for selected countries:

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3 See for example Balcerowicz (1993a, 1993b, 1994), Lipton and Sachs (1990a, 1990b), Berg and Sachs (1992), Clague and Rausser (1992), and Sachs (1993)

Table #1
Size of the State Sector (% of Total)

Country	Output	Employment
Czechoslovakia (1986)	97.0	-
East Germany (1982)	96.5	94.2
Soviet Union (1985)	96.0	-
Poland (1985)	81.7	71.5
China (1984)	73.6	-
Hungary (1984)	65.2	69.9
France (1982)	16.5	14.6
Italy (1982)	14.0	15.0
United Kingdom (1978)	11.1	8.2
West Germany (1982)	10.7	7.8
Spain (1979)	4.1	-
United States (1983)	1.3	1.8

Figures exclude government services, but include state-owned enterprises engaged in commercial activities.
Source: Sachs (1993), drawing upon Milanovic (1989)

The second important institutional rule is that prices were set by administrative fiat, not by the interplay of supply and demand. Balcerowicz reports that prior to reform, more that half of all sales took place at administered prices, including the prices of the most important goods such as food, housing, and industrial products (Balcerowicz 1994, p. 161).

There were, of course, many other rules and institutions which distorted economic activity in the pre-1989 socialist economies, but these two appear to be the most important. Together, they led directly to four large distortions: the structure of the economy was severely skewed; levels of industrial concentration were very high; managers devoted significant resources toward non-economic aims; and shortages and queues were common.

Prior to 1989, Poland's economy was severely skewed away from services and light industry toward heavy industry and agriculture. Table #2 compares the structure of Poland's economy in 1988 to that of several west European countries. Poland's share of manufacturing and construction was much higher than any of the EC countries', while its services and direct government expenditures were much lower. The low government share reflects the fact that, prior to reform, many social services were provided through state enterprises and were, therefore, reported as commercial sector activity, not as government expenditures.

Table #2
Composition of GDP by Sector (1988)

	Poland	Greece	Spain	Germany
Manufacturing	45%	21%	25%	35%
Construction	11%	7%	8%	6%
Services				
Trade/Trans./Comm/Finance	21%	24%	44%	30%
Government	9%	29%	18%	28%
Total	100%	100%	100%	100%

Source: GUS (a, e, g), see Bibliography for detailed references

A second distortion is that the economy was characterized by very high levels of concentration. The Central Statistical Office (GUS) collects data on the concentration of output for 138 industrial sub-

sectors. These figures show that concentration ratios were very high prior to reform. Of 4,922 industrial firms in 1988, just 141 (2.8%) accounted for 50% of industrial output.[4] Several authors have discussed socialist planners' fixation on economies of scale and large firms. Kornai (1992, pp. 400-403) provides a excellent overview of the political forces which led to this bias.

Binczak (1992) analyzes the GUS data and concludes that concentration ratios in Poland were much higher than in western countries. He compares the distribution of concentration ratios for Poland in 1987 to those for France in 1969 and Japan in 1970. He does not control for differences in market size or breadth of industry definition -- Poland's has a somewhat smaller market than either France or Japan and Binczak uses a larger number of industrial classifications for Poland. Nevertheless, the contrast is striking. In both comparisons, Polish industries appear to have had much higher concentration ratios:

Table #3
Distribution of Concentration Rates on Various Countries
(% of industries)

Concentration Ratio	Poland (C4)	France (C4)	Poland (C5)	Japan (C5)
90% and over	39	18	47	27
70 - 89.9%	21	11	23	26
50 - 69.9%	19	11	15	22
30 - 49.9%	14	21	11	19
10 - 29.9%	7	32	4	5
less than 10%	0	7	0	1

Source: Binczak (1992)

The third distortion was that firms' efforts were often directed toward non-economic ends. When an enterprise is state-owned, production, distribution, and investment decisions are often made for political, not economic, reasons. Several authors have highlighted this aspect of socialist economies. Pinto, et. al describe managers' orientation as follows: "In the days before the economic transformation program, the best managers bargained with the central authorities for favored allocations of subsidies and investments under the central investments program, and delivered the production target in return without regard to marketability or cost."[5] Mancur Olson has written extensively on this subject.[6] He observes that "in the absence of well-defined individual rights, the incentive to maximize the output of assets is missing, since the control over assets and the rights to the harvests they yield are unclear."[7] Anne Krueger writes, "Producers in society become accustomed, by and large, to reacting to events in the nation's capital, rather than responding to signals emitted through shifts in supply and demand."[8]

Finally, shortages and queues were prevalent. Because many key prices were controlled, they contained no information regarding shortage or surplus. This meant that producers were not able to act in a disaggregated manner and the need for centralized administrative control rose. This led to centralized production adjustments, not decentralized responses to changes in relative prices. Information regarding relative shortage and surplus was theoretically available in the form of queue lengths but, while shortages

4 *Zmiany w Poziomie Koncentracji Produkci Przemyslowej w/ Latach* 1989-1991
5 Pinto, et. al. (1993)
6 I recommend "The Hidden Path to a Successful Economy," (Olson, 1992), and *The Rise and Decline of Nations*, (Olson, 1982)
7 Olson (1992), pp. 70, 73
8 Krueger (1992), pp. 220

and queues are easily observed at the local level, they are extremely difficult to measure on any aggregated basis.

By late 1989, the Polish economy was suffering from a severe macroeconomic imbalance. The inflation rate for the second half of 1989 was in excess of 2,000%; the black market exchange rate for the zloty was more than 8 times the official rate; and there were severe shortage of almost all consumer goods.[9]

Despite these distortions, it is important to remember that the socialist system did work for many years. Vladimir Benachek of Charles University provides an insightful analogy.[10] He describes the socialist economies as perched at the top of a small hill (the planned economy). They would like to get to the top of a larger hill (the market economy). In between the two hills is a valley, which may be both wide and deep. He points out that it is generally impossible to proceed directly from one mountain peak to another. Instead, hikers must descend into a valley before climbing the second hill. The analogy illustrates two important points. First, the centrally planned economies did have an internal coherence -- they were at the top of their small hill. Second, changing to a new economic system means discarding existing rules, institutions, and operating routines -- the old hill is left behind, not used as a foundation. One of the reasons that change is so difficult is that leaving the old system behind inevitably creates winners (private entrepreneurs, consumers, well connected or unscrupulous SOE managers) and losers (bureaucrats, workers who are unable to adapt). This type of transformation is truly a problem of political economy because all of these groups fight for their interests in both the political and economic realms.

The Balcerowicz Plan

After the quasi-free elections in August 1989, Leszek Balcerowicz was appointed Deputy Prime Minister and Finance Minister. Balcerowicz had complete responsibility for government economic policy. In the fall of 1989, he assembled a team of Polish and western economists to design a strategy for the transformation. The plan was elaborated during late 1989 and launched, as a comprehensive package, in January 1990. The strategy was designed to address three areas: macroeconomic stabilization, microeconomic liberalization, and institutional reform. There were a large number of specific reforms, but they can be grouped into five broad categories: deregulating private activity and prices; reforming the foreign trade regime; changing macroeconomic policies to promote stability; revising the commercial code; and promoting efficiency with privatization. Balcerowicz thought of these policies as interlocking pieces, each of which was necessary for the transformation to succeed.

The first reform was to remove all restrictions on private commercial activity and prices. This was designed to provide incentives to entrepreneurs, to help rebalance supply and demand, and to reduce the market power of large state monopolies. Balcerowicz reports that, measured by the volume of sales, the

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9 Balcerowicz (1994). While there was almost no food or consumer goods in the stores, there was very little malnutrition. It appears that trade agricultural products had moved almost entirely underground. The author's former landlord recalls going into a store in Warsaw during summer 1989 and finding all the shelves empty, except for a few bottles of vinegar. She walked a mile to a farmers market and found that meat, bread, milk, even candy bars from Germany were widely available.

10 Clague (1992)

share of free prices increased from 50% to about 90% in early 1990.[11] The only significant price controls which remain are on energy and housing.

The second category of reform addresses foreign trade. The zloty was massively devalued;[12] the exchange rate was fixed and unified; and the zloty was made convertible for most current account transactions. A parallel set of reforms encouraged imports by lowering and rationalizing tariffs. Finally, the long standing restrictions on foreign business transactions were largely removed. Fixing the zloty and permitting (relatively) free exchange were designed to provide stability, which would allow Polish firms to lengthen their planning horizons. Foreign trade was encouraged as a means of imposing the discipline of competition on the state-owned firms.

The third category of reform involved several measures designed to promote macroeconomic stability. This involved reducing the government's budget deficit, ending credit rationing by raising nominal interest rates above the inflation rate, and renegotiating Poland's foreign debt.

The fourth and fifth reforms were institutional. The fourth involved revising the commercial code to facilitate market interactions and force SOEs to act more like commercial entities. Other key elements were changes to the tax system and bankruptcy procedures.

The fifth key reform was privatization. Balcerowicz took a broad view of privatization, which he defined as shifting commercial activity from the state to the private sector. This shift could occur in at least three ways. The most obvious was the privatization of state firms. The second was through asset sales by state firms to private owners. The final method was through organic growth of the private sector. We will see below that this third method has been by far the largest source of economic growth.

The design of Balcerowicz' plan was strongly influenced by his feeling that 1989 and 1990 were a period of 'extraordinary politics.' He writes:

> A great political breakthrough, like the one that happened in Central and Eastern Europe in 1989, creates a special atmosphere of thinking and acting in terms of the common good. And the common good is relatively easy to define if the country inherits a macroeconomic catastrophe. But this period of 'extraordinary' politics gives way rather quickly to 'normal' politics of political parties and special interests. It is therefore advisable to concentrate on difficult measures in the first period, when the probability of these measures being accepted is much higher than it will be later. Balcerowicz (1993b)

Section III: Two Transition Paths

The reform program was designed to abruptly alter the competitive environment in which Polish firms operated. The program introduced competition by freeing prices and by allowing both new firm entry and imports. I have attempted to measure the extent to which the competitive environment changed in different sectors between 1989 and 1993. The 'competitive environment' is neither easily observed nor

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11 Balcerowicz (1994), pp. 161

12 The official rate against the U.S. dollar fell from 1,340 to 9,500 between September 1989 and January 1990.

quantified in a single variable, so I have used several measures of economic reform. Fifteen measures were collected for each sector. Cluster analysis was then used to group sectors whose environments changed in similar ways. Two groups emerge from the analysis. One group has rapidly shifted toward a classically competitive environment. The competitive environment in the second group has changed little.

This section is organized into three parts. The first discusses the sources and limitations of the data used throughout the analysis. The second describes the cluster-analysis methodology and presents the sector groupings derived with this analysis. The third presents an analytical comparison of the two groups. The comparison presents both data used in the cluster analysis and other measures of the competitive environment.

Data Sources, Organization, and Limitations

Several issues about the sources, organization, and limitations of the data used in this analysis should be noted. Although the Polish statistical agencies generally collect very detailed data, the ways these data are organized sometimes make them difficult to transform into useful information. The analysis is based almost entirely on Polish government data which is publicly available.[13] The bulk of the data come from the government's Central Statistical Office (Glowny Urzad Statystyczny, or GUS), from the State Agency for Foreign Investment (Panstwowa Agencja Inwestycji Zagranicznych, or PAIZ), or from the Ministry of Privatization (Ministerstwo Przeksztalcen Wlasnosciowych, or MPW).[14] Most data series start in 1989. Several changes made in 1989 make sector data prior to that year difficult to reconcile with the post-reform data. This is unfortunate in that the socialist government initiated some reforms in 1988. This means that our 1989 baseline data reflect each sector's status after some small initial reforms had been implemented.

GUS and the other Polish agencies use an economic classification scheme which is somewhat different from that used in western Europe or the United States. All economic activity is organized into sectors, sub-sectors, and branches of the national economy. Unfortunately, these sectors are defined with widely varying scope. For example, all industrial activity (44% of GDP in 1989) is assigned to one branch. This sector is located at the same level as forestry (1.1 % of GDP). I have slightly modified the GUS sector hierarchy so as to achieve more equal-size units of analysis. The primary change was to elevate several large sub-sectors to sector status. This yielded a total of 17 sectors.[15] Each of the sectors is further

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13 There are only two exceptions to this rule. First, portions of the concentration data (specifically the C6 measures) for 1992 and 1993 have been collected but not specifically published by GUS. GUS has made this information available on the condition that it be presented only in aggregated form (i.e. at the branch level). The data are official, but not widely available. Second, many comments in section V are from interviews. Most are attributed to specific individuals, but for obvious reasons, several interview subjects involved in the Mass Privatization Program agreed to speak frankly, but only if their positions and organizations were described generically.

14 While all data are from publicly available sources, in many cases GUS staff have provided invaluable assistance in ensuring year to year compatibility in data series or by providing detail not available in widely circulated publications.

15 The economy is organized into 10 'sectors', one of which is 'Industry,' a sector which makes up almost 50% of GDP. The sectors are:

1. Forestry
2. Agriculture
3. Industry
4. Construction (non-housing)
5. Housing (construction)
6. Transport
7. Communication
8. Trade
9. Banking and Finance
10. Government

The government sector will be set aside for the remainder of the analysis as it consists of activities (such as defense, justice, police, elder care, cultural activities, etc.) which are typically provided by governments in western Europe.

The Industry sector was then subdivided into 9 sub-sectors. These are:

subdivided into private and state enterprise activity, which I refer to as segments. This brings the finest level of detail to 17 state-private pairs (sectors), or 34 total units of analysis (segments).

The level of detail available varies somewhat by data series. Most types of data, including value added,[16] employment, and number of firms are available for all 17 units of analysis. Some, such as profitability and foreign direct investment statistics, are not available for the industry sub-sectors. Concentration measures are available for the industry subsectors but not for the non-industry sectors (see footnote 15).

There are two limitations to the available data. I do not believe either is large enough to affect the basic analysis and conclusions. Both tend to understate the extent of private sector activity. First, all figures used in the analysis ignore the underground economy. GUS has done several studies to estimate gray market activity. Dr. Leszek Zienkowski, of the Department of Statistics and Economics Research at GUS, estimated the gray market at approximately 20% of GDP in 1993, up from less than 10% in the 1980s.[17] The study suggests that the overwhelming majority of this activity takes place in the private sector, specifically in small retail operations, work done in the home, and services provided by individuals.

The second data limitation is that GUS intentionally excludes the activity of small firms is in some series. Data on employment and wages are collected only for firms with more than 5 employees. There are detailed data on FDI for investments larger than $1 million, but only estimates are available for investments under this threshold.

As we will see below, both of these limitations would bias the analysis toward understating the differences between Group A and Group B sectors. Activity in the gray market and in firms with less than 5 people is primarily private and most likely to take place in Group A sectors.

The Cluster Analysis

The 17 non-government sectors discussed in footnote 15 were analyzed using cluster analysis. Cluster analysis is a multivariate procedure for detecting natural groupings within data. The technique resembles

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1. Mining	4. Electro-Engineering	7. Wood and Paper
2. Fuel and Power	5. Chemical	8. Light Manufacturing
3. Metallurgical	6. Minerals	9. Food Processing

This analysis yielded 17 non-government sectors: 8 non-industry GUS sectors plus the 9 industry sub-sectors.

16 The composition of GDP is reported only at the branch level, meaning that all industry is reported as one figure. Data on "Sold Production," which varies slightly from value added, is broken down by industrial sub-branch. To calculate GDP contribution for the industrial sub-branches, Industry GDP was allocated according to each sub-branches' proportion of sold production.

17 The study involved extensive anonymous surveys and direct observation of economic activity in small towns. Data collected were then compared to official statistics. This technique is obviously imprecise, and because of the effect that official observers may have, the 20% estimate may still be low. *Rzeczpospolita*, October 31, 1993, p. 1, 8

A separate study by the Market Economy Research Institute contains several estimates which confirm that the gray market is very large.

- 50% of the Poles registered as unemployed are actually in the workforce,
- one in three Polish adults has at least some employment not reported as income,
- 12-15% of workers in private companies are not registered as employed.

The largest concentrations of these workers were found in the construction industry, small service and trade companies, and personal services such as teaching, child care, and housekeeping. *Gazeta Wyborcza* September 29, 1994, p. 3

discriminant analysis in that it seeks to classify a set of objects into groups, although neither the number nor the members of the groups are known in advance. The procedure sorts data into groups such that within-group variation is minimized and between-group variation is maximized. Two variations of the technique, hierarchical and Kmeans (or non-hierarchical), were used and returned very similar results.

To perform the analysis, 15 economic measures of transformation were collected for each sector. These measures are listed in Table #4.

Table #4
Variables Used in Cluster Analysis
(differences between 1989 and 1993)

Output Measures *	Concentration Measures
1. % change in total sector output	9. Change in C6 ratio
2. % change in private output	10. Change in Lorentz (Gini) ratio
3. Change in the private share of sector output	
4. Change in that sector's share of total GDP (measured as a % of total output)	Number of Firm Measures
	11. Log of the change in the # of firms
	12. % change in the number of SOEs
Employment Measures	Privatization Measures
5. % change in total sector employment	13. Log of the number of privatizations
6. % change in private employment	
7. Change in the private sector share of total employment	Profitability
8. Change in that sector's share of total employment (measured as a % of total employment)	14. Change in net profits as a % of revenues
	Relative State / Private Productivity
	15. Sales/employee private vs. state sector

* output measures are inflation adjusted.

The data were normalized so that the various measures became points on a series of normal distributions. The data and methodology are described in more detail in Appendix A. The analysis revealed three distinct groups, two clusters and one outlier. The measures which have the most explanatory power were (in descending order of importance): #7, #6, #9, #3, and #2. The cluster analysis results, which contain F-ratios for the different variables, are contained in Appendix A.

The sectors which comprise each group are as follows:

Table #5
Sector Membership in Cluster Groups

Group A:	Group B:	Outlier:
1. Wood and Paper	1. Forestry	1. Agriculture (reformed)
2. Light Manufacturing	2. Mining	
3. Food Processing	3. Fuel and Power	
4. Construction (non-housing)	4. Metallurgy	
5. Housing (construction)	5. Electro-Engineering	
6. Trade	6. Chemicals	
	7. Minerals	
	8. Transport	
	9. Communications	
	10. Banking, Securities and Finance	

As we see below, sectors in Group A share a set of economic characteristics which indicate they have developed along a path much like that envisioned by the reformers in 1989. Sectors in Group B have continued to experience poor economic performance and show few signs of reform.

The agriculture sector is somewhat unusual, but for reasons which are well understood. Agriculture was primarily private even before 1990 and output has declined because of two droughts since 1990.

Although it has not followed the same transition path as Group A, the sector is reformed in the sense that it operates on western principles (e.g., private ownership, tariff protection, and subsidies). I have informally assigned the agriculture sector to Group A. Its output and employment figures are included in the national aggregate figures in the introduction and conclusion of this paper. Figures from the sector are not included, however, in the group figures used in the analytical comparison which follows.

Analytical Comparison of the Groups

Now that the sectors have been clustered by their pattern of transformation, we can compare the characteristics of the transition in the two groups. These differences are striking. The groups show distinct patterns of transformation on most economic measures examined. A summary of the differences is contained in Table #6. The characteristics listed are general tendencies for the groups. Not every sector experienced all of the changes listed for its group.

Table #6
Generic Characteristics of the Cluster Groups

Characteristic:	Group A Sectors	Group B Sectors
ownership	primarily private	primarily public
output	decline then growth	stagnant or falling
employment [18]	decline then growth	stagnant or falling
rate of entry	high	low
concentration	falling	remains high
productivity	low, but growing	varied current levels, state sector stagnant
foreign investment **	many small investments	a few large investments

** not used as an input into the cluster analysis.

The remainder of this section explores these differences in greater detail. To avoid confusion, I will use the following terminology throughout the discussion. *Group* will refer to the two groups of sectors identified in the cluster analysis. *Sector* will refer to one of the 18 branches of the economy discussed above. *Segment* will refer to the state or private set of firms within a sector or group.

Output

The pattern of output growth varied significantly between Group A and Group B. Figures #1 and #2 show that the Group A sectors suffered an abrupt decline in output immediately following macroeconomic reform in 1990, but have shown steady growth since that time. This growth has been driven by a dramatic expansion in private segment activity. The Group B sectors followed a very different path. The decline in output was both delayed and prolonged. The shift from state to private segment activity has been much smaller and appears to be slowing.

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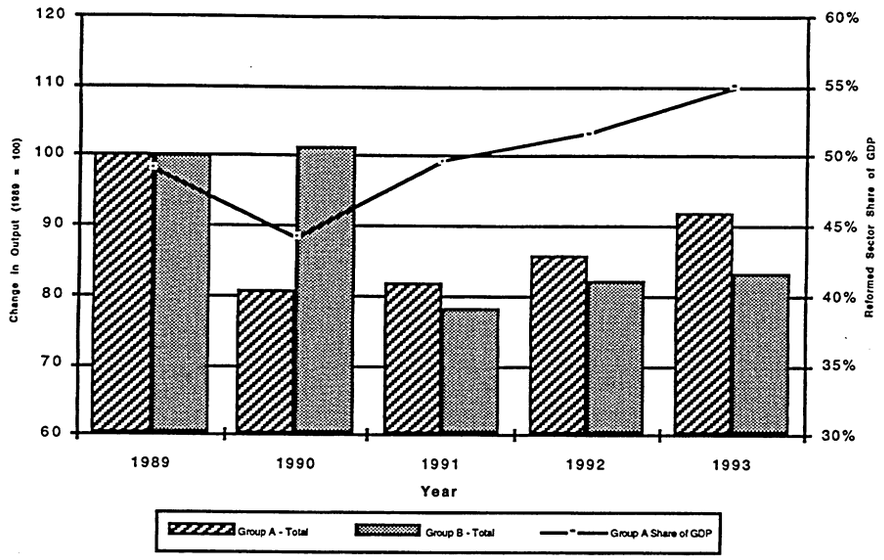
18 The change in sector employment provides a somewhat muddled signal. The primary goal of the reform process was to increase the intensity of competition and, over time, the productivity of firms. Productivity increases imply reduced employment per unit of output. This means that the absolute change in sector employment is positively related to output increases but negatively related to productivity increases. The optimal direction for sectoral employment change depends very strongly on initial conditions in the sector, specifically a sector's over or under weighting as a share of aggregate pre-reform output and its productivity level relative to western firms. For example, the optimal change in employment levels for heavily industrial sectors with relatively low productivity would probably be negative, while it would be positive for higher productivity sectors traditionally under-emphasized by the socialists.

Figure #1
Sector Growth and Share of GDP



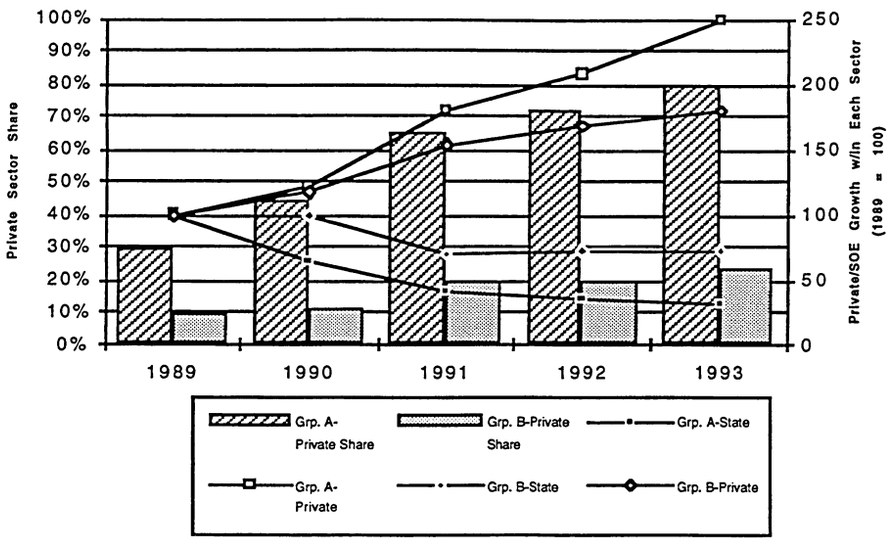
Source: GUS (a, e, f)

The columns in Figure #1 chart the change in aggregate output for Group A and Group B relative to the 1989 level for each group. The figures show that, in 1990, output in the Group A sectors fell by 19% and that growth resumed in 1991. By 1993, output in these sectors had recovered to 93% of the 1989 level. In contrast, Group B's measured output increased slightly in 1990, perhaps as a result of monopoly pricing in many sectors,[19] but then fell by 22% in 1991, a collapse which coincided with the dissolution of the CMEA trade area.

The line in Figure #1 records Group A's share of total GDP. This group made up 49% of GDP in 1989. This fell to 44% in 1990, but had grown to 53% by 1993.

19 Pinto, et. al. (BPEA, pp. 220-21, and 227) have discussed this issue.

Figure #2
State/Private Share of Output within Sectors and Growth Rates



Source: GUS (a, e, f)

Figure #2 provides additional detail on the changes in output. The columns, charted against the left axis, show that the private segments' performance differed significantly between the groups. In Group A, private output has grown from 29% to 80% of total output. In Group B, the private segment's share of output has grown from 9% to only 23%.

Data are not available which would allow me to separate the growth in private segment output into its component parts: privatization activity and organic growth by initially private firms. Data are presented below which indicate that privatization activity has been slow and its effect minor (only 7% of the 1989 state-owned-enterprises have been privatized). My sense is that the private segments' growth has come primarily from initially private firms.

The lines in Figure #2 show the four segments' output trajectory relative to the 1989 level. They show that in Group A, private sector output increased 150% in four years, while state segment output fell 70%. The growth rate of the private segment remains high, indicating that Group A output may continue to show strong gains. In Group B, private segment output increased 80%, but most of this increase occurred during the first two years following reform. Private segment output continues to grow, but at a declining rate.

When we consider the composition and growth in employment, we see that the pattern of transformation is very similar to that for output.

Employment

There has been a large aggregate shift in employment toward the private sector. Table #7 shows how the structure of employment has changed in the period since 1989. Fifty-eight percent of workers in Poland now work in the private sector, up from 44% in 1989. This comparison understates the true

magnitude of the shift, however, because the percentage of workers employed in agriculture has remained nearly constant at just over 25%, while the percentage of non-agriculture private sector workers has grown from 22% to 34%.

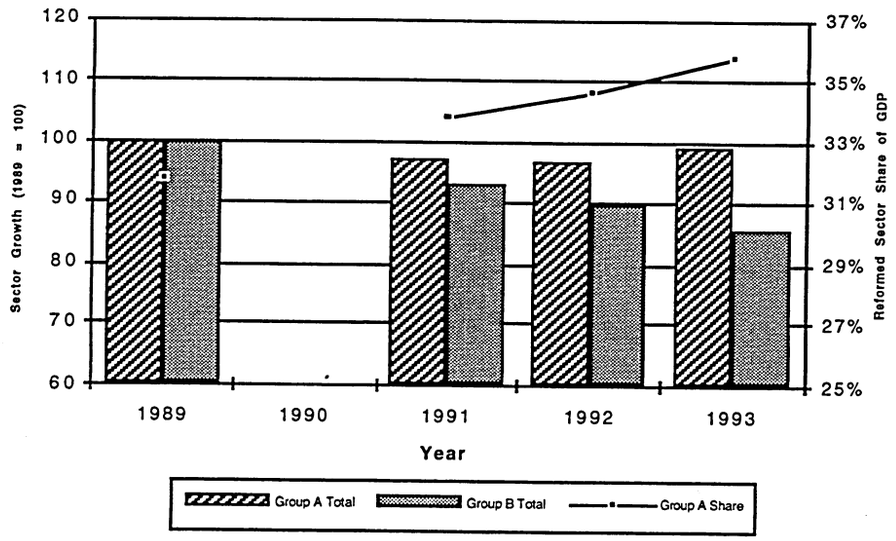
Table #7
Work Force Composition[20]
(% of Total Employment)

	Agriculture		Non-Agriculture		Total	
	State	Private	State	Private	State	Private
1989	3.8	22.0	52.3	21.8	56.1	43.9
1990	3.6	22.1	51.3	23.0	54.9	45.1
1991	3.0	23.0	46.8	27.2	49.8	50.2
1992	2.2	23.2	44.1	30.5	46.3	53.7
1993	1.6	23.6	40.9	33.9	42.5	57.5

Source: *Rocznik Statystyczny*, 1994, forthcoming, *Statistical Yearbook*, Warsaw, Central Statistical Office

When we disaggregate the employment figures into groups and segments, we see an even more dramatic shift. Figures #3 and #4 chart how the structure of employment has changed in the period since economic reform. Employment in Group A sectors suffered an initial decline but has subsequently recovered to nearly its 1989 level. Employment in Group B sectors continues to decline. The line in Figure #3 shows Group A's share of total Polish employment. The percentage share accounted for by Group A is somewhat lower than the output series because the large number of Polish workers employed in low productivity agriculture (23% of workers, but only 13% of GDP) skews the totals.

Figure #3
Sector Growth and Share of Total Employment



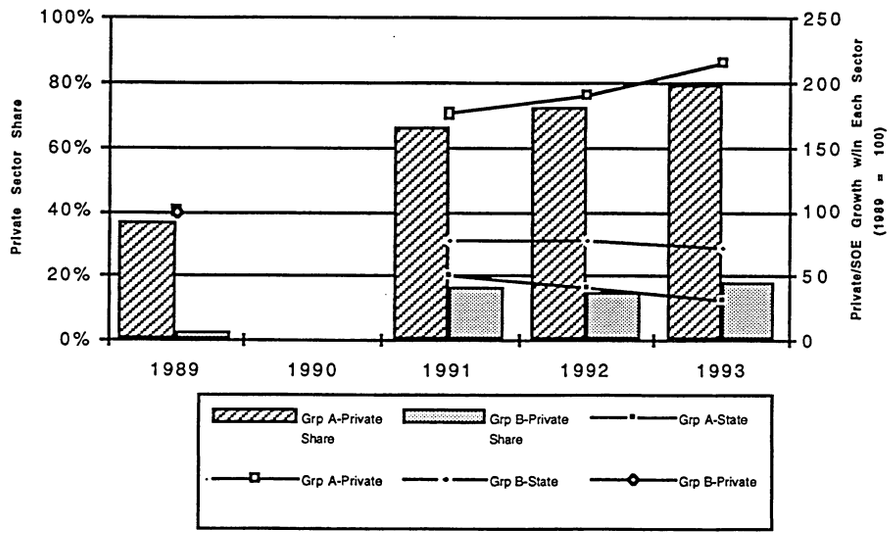
Source: GUS (a, c, g)

20 Data forthcoming in the *Rocznik Statystyczny, 1994*, GUS Publication. Information provided by GUS staff. Non-agriculture data are based on businesses with more than 5 employees, so the estimates off private sector employment are likely to be understated.

Figure #4 charts the change in employment over time for the private and state segments within each group. The columns show the private segment's share of each group's total employment. Private employment in Group A has grown from 37% to 79% of group employment, while in Group B it has grown only from 3% to 18%.

The lines show the growth for each segment, setting the 1989 segment employment equal to 100. The growth line for Group B is not shown because its multiple is calculated on a very small 1989 base.

Figure #4
State/Private Share within Sectors and Growth Rates of Employment



Source: GUS (a, c, g)

Figures #1 through #4 show that changes in output and employment have followed similar patterns. In Group A sectors, the private segments' share of output and employment increased sharply, while the group figures showed an initial sharp decline and then subsequent growth. In Group B, total output initially rose, but subsequently entered an extended decline. Private segment output and employment have grown, but are still a small fraction of the group's total. In Group A, the private segment now dominates output and employment. Private segment activity in Group B appears to be much more isolated, filling previously unserved niches and operating at the margin. State enterprises, although in relative decline, still dominate the Group B segments.

Entry

The dichotomy between the patterns of new firm entry Group A and Group B is even wider than the differences in output and employment growth rates. Figure #5 shows the number of legal persons[21]

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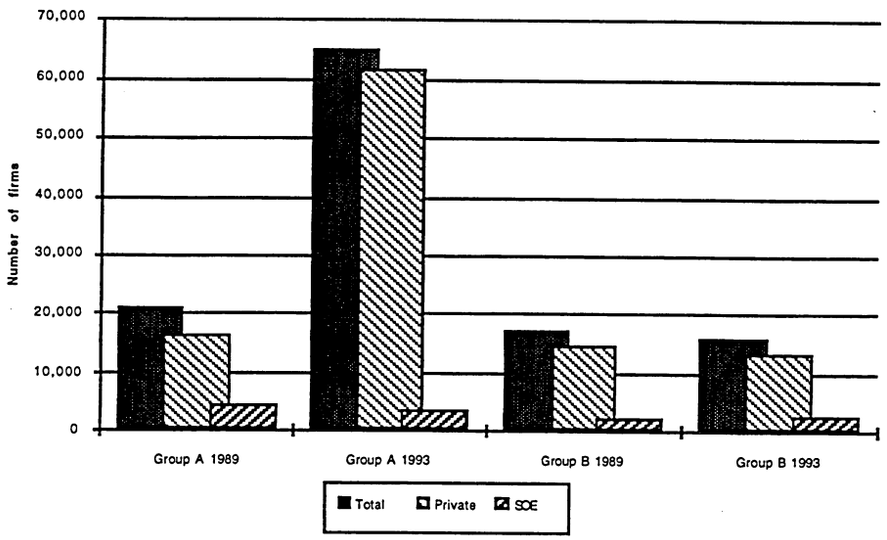
21 The concept of legal persons is somewhat analogous to corporations and partnerships in the U.S. Independent business enterprises (IBEs) are not legal persons, but are discussed briefly below.

State segment units include: state enterprises, communal enterprises, commercial law partnerships of the Treasury, commercial law partnerships of state legal persons (Voyevoids, Ministries, or other state enterprises, for example).

Private segment units include: private commercial law partnerships, joint ventures, cooperatives, and foreign small scale enterprises.

registered in each segment and group for 1989 and 1993. (I refer to them informally as corporations.) The total number of firms in Group A more than tripled, with the number of private corporations increasing 273% to 61,496, and the number of state entities falling by 22% to 3,478. In Group B, the total number of firms fell 6% from 17,230 to 16,150. The number of private corporations declined 9% to 13,397, while the number of state entities increased 10% to 2,753.

Figure #5
Number of Legal Entities by Segment



Source: GUS (d, i)

The changes in the number of legal persons is dwarfed by the increase in the number of Independent Business Establishments (IBEs). Between December 1990 and December 1993, the number of IBEs rose from 1.11 million to 1.78 million. Unfortunately, data on IBEs are not available before 1990, and the availability of branch detail is too sparse to allow a sector by sector comparison of the two groups. The available data do suggest, however, that the majority of IBE activity takes place in Group A sectors. Table #8 contains a brief summary of sectors with large numbers of IBEs:

Table #8
Independent Business Units - December 1993

Selected High Entry Sectors		
Trade Sector	761,041	
Construction	195,874	
Transportation	80,073	
Subtotal	1,036,988	
Total IBEs December, 1993		1,783,900

Source: GUS (d, i)

Independent Business Establishments are similar to sole proprietorships in the U.S. All such establishments must be legally registered with the tax authorities.

More than 58% of all IBEs operate in just three Group A sectors. Although the output of an average IBE is very small, informal evidence suggests that they play an important role in many industries.

The rate of firm formation in Group A sectors appears to be extremely high. The number of corporations has more than tripled in only four years, with even higher growth in the private segment. By contrast, there has been no net firm formation in Group B.

Changes in Concentration Ratios

Data on concentration ratios[22] are available only for industrial sectors. The C6 concentration ratio and the Gini coefficients are available for eight industrial sectors. Although this limited sample allows only tentative conclusions regarding changes in concentration, three strong regularities can be observed.

First, prior to reform, the Group A sectors had lower C6 ratios than did the Group B sectors. The average C6 ratio in 1989 was 56.6% in the reformed group, compared to 73.9% in the unreformed group.

Second, while C6 ratios declined in all eight sectors, the declines in the Group A sectors have been much larger than in Group B. Figure #6 shows that the average C6 ratio declined by 10.6% in Group A, but by only 4.5% in Group B. No Group B sector had a decline as large as the 10.6% Group A average. While the Gini coefficient rose in seven of the eight sectors, the average increase has been smaller for Group A, 6.6% versus 12.0% in Group B.

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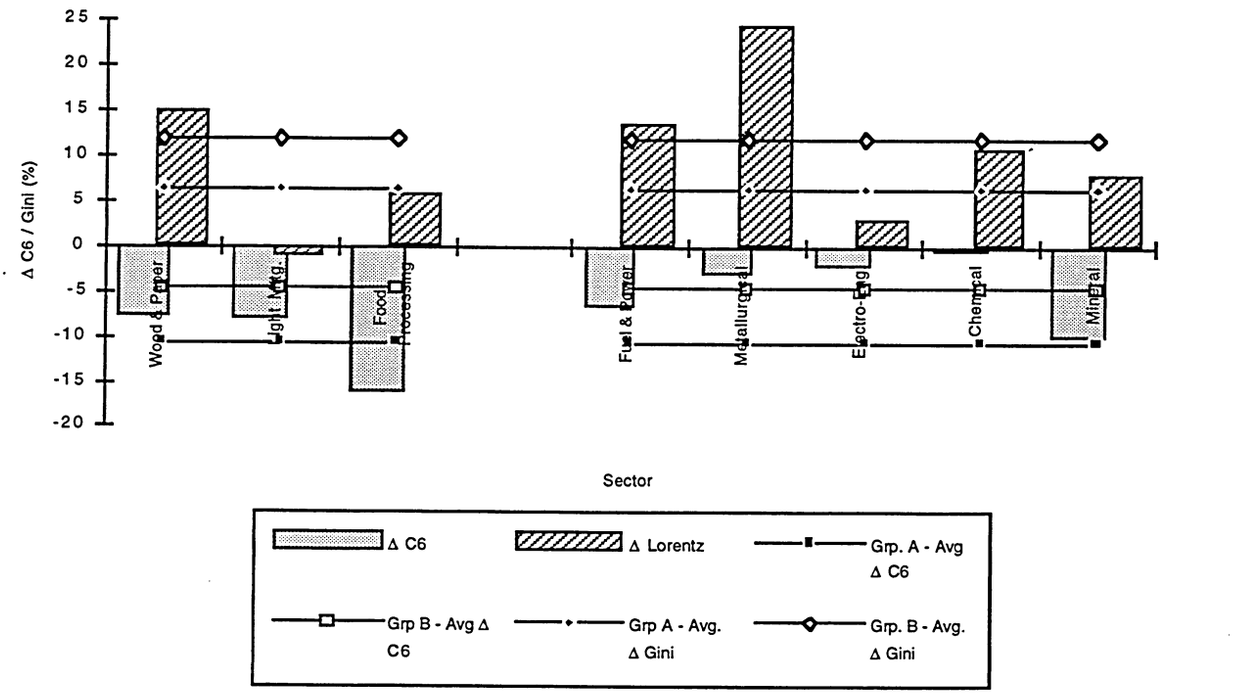
22 The concentration data were collected at the sub-sector level, which leads to 138 sub-sector measures. The data presented here are the C6 level averaged across a sector's sub-sectors, not the C6 for the broadly defined sector (e.g., the figure for the chemical sector is not the share of the 6 largest firms in the entire sector, but rather the C6 in organic chemicals, fertilizers, pharmaceuticals, etc., averaged across the 13 sub-branches in the Chemical sector).

A second reason the data are presented in this form is because of a non-disclosure agreement with GUS. GUS has published concentration data for 1989 through 1991. The data for 1992 and 1993 have not been published in detailed form. GUS provided this data on the condition that it be published only in aggregate form. The eight sectors presented here were agreed to by GUS.

Figure #6
Changes in Concentration Ratios



Source: GUS (f, h)

The final regularity is that, while all C6 ratios fell, seven of eight Gini coefficients rose. This may appear puzzling at first, as both statistics purport to measure concentration. This result would, however, be obtained with precisely the type of market structure changes observed in Poland. Before reform, most industries were highly concentrated, with very few large firms. C6 ratios were high, but if the firms were of similar size, Gini coefficients might be low. After reform, entry by new firms would likely lower the share of output controlled by the very largest firms but increase the range of firm sizes, thereby raising the Gini coefficient.[23]

Changes in Productivity Levels

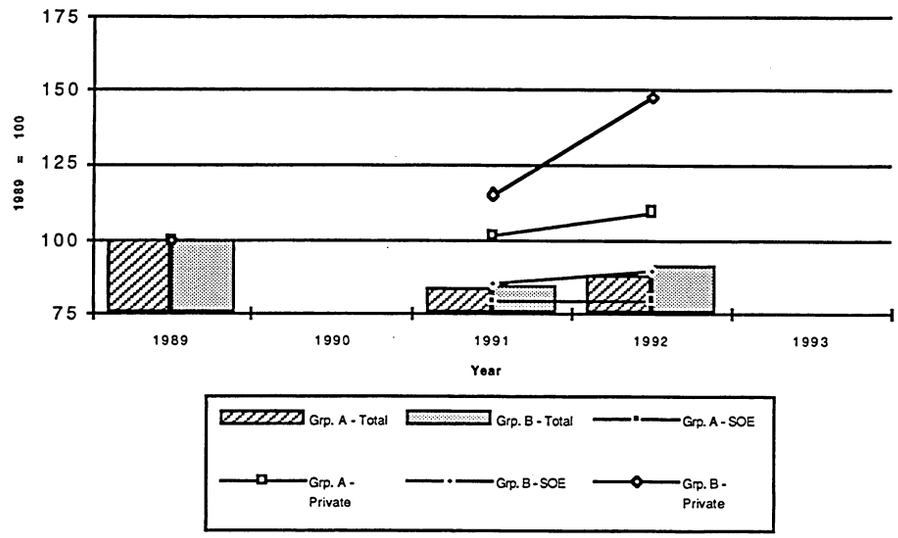
Measuring productivity through time and across industries is a challenge in any country. It is especially difficult in an environment as volatile as Poland's. Nevertheless, we can gain several insights about developments in Poland by standardizing each segment's revenue per employee by its 1989 level. Figure #7 charts revenue per employee over time for the two groups and each of the four segments, standardizing the 1989 ratio to 100. Two results are immediately apparent. First, the private segment in

23 A simple example may make this more clear. Consider an industry which, before reform, had consisted of 5 firms, each with output of 20. After reform, 10 new firms enter the industry, each with output of 2, and each of the original firm's output falls to 16. Total industry output has stayed constant, but the variance of firm size has increased. The measured C6 would fall but the Gini Coefficient would rise:

	Pre-Reform	After Entry
C6	100%	82%
Gini	0%	46.7%

each group has outperformed the state segment in that group. Private segment productivity in Group A sectors has grown 9% from its 1989 level, while it has increased by 47% in Group B sectors.[24]

Figure #7
Revenue per Employee by Group and Sector
(1989 = 100)



Source: GUS (a, c, e, f, g)

The second result is that the Group A sectors have performed somewhat less well than the Group B sectors. Total Group A productivity has declined by 12%, while Group B productivity has declined by only 8%. This result is somewhat unexpected, but may be partially explained by shifts toward small firms and labor-intensive activities in Group A, and by residual market power and tariff protection in the unreformed sector.

Average Firm Size

Since reform, average firm size has declined significantly in both sectors and across all size classifications. Unfortunately GUS does not publish data with firms classified by output categories or by total employees. With some manipulation of several independently published data series,[25] we can calculate the average firm's size for several broad categories of industry output.

Figure #8 shows that the average size of large firms has declined in both Group A and Group B sectors (from 154 to 52 billion zloty and from 583 to 320 billion Zloty respectively -- inflation adjusted output

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24 The figure for the private segment of the unreformed group may be somewhat distorted for at least two reasons. First, the 1989 level was calculated on an small base (9.7% of output), a level which has doubled in the period since. Second, as we will see below, the nature of private firms in the sector may have changed by a small number of very large foreign investments. If capital per worker has increased substantially in this segment (as seems likely given the nature of segment FDI), we would expect revenue per employee to increase substantially.

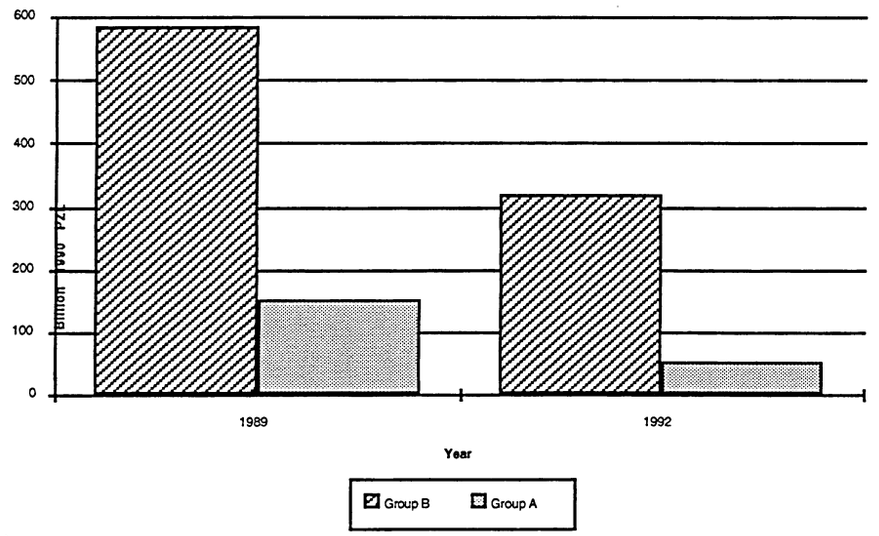
25 The particular data series used here are:

- the number of firms by sector
- sector output
- a concentration series which indicates the percentage of firms which contribute 50% of sector output and 80% of sector output.

These can be manipulated to calculate the average revenue per firm for the 'large' firms (those who produce the top 50% of sector output), medium firms (0% to 80% of output), and for small firms (80% to 100% of sector output). There are several obvious shortcomings with this methodology, but this is the only data available.

figures). These figures confirm abundant anecdotal evidence that many of the bureaucratically constructed cartels from the communist era have collapsed. The chart also shows that the average size of large firms in Group B sectors continues to be much larger than in Group A sectors.

Figure #8
Average Revenue of Large Firms
(Firms Producing Top 50% of Sector Output)
(Constant 1990 PZL)



Source: GUS (a, e, f, h)

Table #9 contains data on the average firm size in 1992 for each of three broad categories. It shows that firms in Group B are larger than firms in Group A for all size classifications. It is not the case that just a few large state-owned firms in the Group B sector are skewing the size distribution of firms. Even small firms in Group B sectors are much larger than small firms in Group A sectors.

Table #9
Average Firm Size, by Segment and Size Category
(billion 1990 PZL)

	Group B Sectors	Group A Sectors
Large (Top 50% of output)	320	52
Medium (50% to 80% of output)	81	10
Small (80% to 100% of output)	12	2

Source: GUS (a, e, f, h)

It may be that the average size of large firms in the Group B sectors (almost $30 million) has impeded the restructuring of these sectors. I will discuss this issue in more depth in section IV.

Another way in which to view this issue is to look at Poland's largest firms. *Gazeta Bankowa* reports that 86 of Poland's 100 largest firms, ranked by revenue, are still 100% state-owned.[26] Another four have mixed ownership. Only 10 of the top 100 firms are privately owned.

26 *Central European Economic Review*, Summer, 1994. p. 14

Privatization Activity

Through mid-1994, privatization played only a minor role in transferring firms from the state to the private sector. As Table #10 shows, there were 12,888 Polish State Enterprises in 1989. Through year end 1993 only 18% of these enterprises had been commercialized and 7% privatized.[27] The Ministry of Privatization does not publish detailed enough data to accurately determine the proportion of state-sector output or employment accounted for by these firms.

Table #10
Privatization Activity by Sector

	# of SOEs 1989	# Comm.	# Privatized	% Comm.	% Privatized
Group A					
Wood & Paper	336	83	36	25%	11%
Light	434	142	34	33%	8%
Food Processing	405	144	77	36%	19%
Construction/Housing	2,483	658	356	27%	14%
Agriculture	5,900	239	64	4%	1%
Trade	832	245	144	29%	17%
Group Total	10,390	1,511	711	15%	7%
Group B					
Forestry	61	14	4	23%	7%
Mining	NA	NA	NA	NA	NA
Fuel and Power	213	51	0	24%	0%
Metallurgical	75	95	25	127%	33%
Electro-Engineering	1,314	307	93	23%	7%
Chemical	218	84	36	39%	17%
Mineral	386	159	46	41%	12%
Transportation	224	143	37	64%	17%
Communication	7	1	1	14%	14%
Group Total	2,498	854	242	34%	10%
Total	12,888	2,365	953	18%	7%

Source: *Ministry of Privatization*, misc. documents

There have been significantly more privatizations in Group A than in Group B. This may be related to the average firm size in the different groups if small privatizations are easier to complete than large ones. As a percentage of firms in 1989, the ratio of firms commercialized in the Group B sectors is more than twice as high as in Group A, and the ratio of firms privatized is slightly higher.

If we compare the totals in Table #10 to the data presented above on firm formation, we see that privatization activity has played only a small role in the shift toward private control of economic units. If we combine both groups of sectors, the number of private corporations has increased from 37,247 to 74,893. The 953 privatizations accomplished through December 1993 account for only 2.5% of this increase.

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27 Commercialization involves the legal transformation of a state enterprise to a wholly treasury owned company which must then operate under the commercial code. During commercialization, the state treasury retains all ownership shares. A firm is 'privatized' when one of three actions occurs:

1. some or all of the shares are sold to a private investor. This is called Capital Privatization.
2a. the assets of the firm are sold to a private investor and the state owned legal entity ceases to exist. This is called Privatization through Liquidation.
2b. the employees establish a partnership and sign a long term lease to manage the assets, in exchange for a fee and profit sharing. This is a recently established form of Privatization through Liquidation.

The privatization figures used here are from the GUS publication *Prywatyzcja Przedsiebiorstwo Panstwowych*, 1993, and built up from actual sector totals. The Ministry of Privatization publishes several lists of privatization activity, some of which have slightly higher totals, but in all cases are within 10% of the figures in Table #5.
Through June 30, 1994, the totals reported by the Ministry of Privatization are 1,171 SOEs privatized, 977 through liquidation and 115 through the capital method.

Pattern of Foreign Direct Investment

The type and size of foreign direct investment into the two sectors differs substantially. Group A sectors have had a large number of relatively small inbound foreign investments. Group B sectors have realized far fewer -- but substantially larger -- investments. As with many data series in Poland, comprehensive data are difficult to obtain, but data are available on large investments, defined as greater than $1 million. As of November 1993, there had been 172 large investments into Poland. These represented a total of $2,612.1 million in realized investments and $6,079 million in committed funds.

Table #11
Large Inbound Foreign Direct Investment

	# of Inv.	Realized Investment	Total (R + C) **	Avg. Realized	Avg. (R + C)
Group A Sectors					
Wood and Paper	10	198	504	19.8	50.4
Light Mftg.	9	105	304	11.7	33.8
Food Processing	33	412	738	12.5	22.4
Construction	14	376	616	26.9	44.0
Trade	27	129	221	4.8	8.2
Total FDI - Group A	93	1,220	2,383	13.1	25.6
Group B Sectors					
Finance and Securities	15	291	474	19.4	31.6
Fuel and Power	8	101	378	12.6	47.3
Metallurgical	4	40	190	10.0	47.5
Electro-Engineering	17	412	1,455	24.2	85.6
Chemical	12	213	252	17.8	21.0
Minerals	7	103	299	14.7	42.7
Transport	4	13	13	3.3	3.3
Communication	8	210	413	26.3	51.6
Total FDI - Group B	75	1,383	3,474	18.4	46.3

Source: *Agency for Foreign Economic Cooperation (PAIZ)*, various documents
Lista Wazniejszych Inwestorow Zagranicznych w Polsce, March 1994, List of Major Foreign Investors, Warsaw, PAIZ
** R + C = Realized plus committed

Table #11 shows that the average size of an investment commitment is almost twice as high in Group B sectors than in Group A sectors ($46.3 million versus $25.6 million). The average amount realized is more than 40% higher in Group B sectors ($18.4 million vs. $13.1 million).

Data for all inbound FDI is published only in very aggregated form. Table #12 contains summary data for the sectors with the highest total amounts of inbound foreign direct investment (all figures are in cumulative billion PZL, not adjusted for inflation).

Table #12
Cumulative Inbound FDI by Sector
(as of June 1993, billion PZL)

Sector	Number of Investments	Total Investments	Average Investment Size	
Trade	4,933	550	0.11	
Construction	981	190	0.19	
Group B Total	5,914	740	0.15	B PZL
Industry	4,070	2,020	0.50	
Transportation	451	180	0.40	
Finance and Securities	153	20	0.13	
Group B Total	4,674	2,220	0.34	B PZL

Source: *Agency for Foreign Economic Cooperation (PAIZ)*, various documents
Lista Wazniejszych Inwestorow Zagranicznych w Polsce, March 1994, List of Major Foreign Investors, Warsaw, PAIZ

While the two groups have had an approximately equal number of investments, investments into Group B have been more than twice as large, on average, as those into Group A.

Conclusions / Summary

This section has shown that when viewed from a sector level, the post-socialist transformation of the Polish economy has followed two very distinct paths. One group of sectors has followed the path envisioned by Balcerowicz' team of reformers. There has been a rapid shift toward market coordination of economic activity. Output and employment have quickly shifted from state to private control; following initial declines, both resumed growth quickly. These sectors have had high rates of entry and falling concentration ratios. Average firm size has fallen substantially, and there have been large numbers of foreign investments. These sectors have made a successful transition from central bureaucratic control to market coordination. As the process of creative destruction continues and strong firms continue to prosper, sector productivity should begin to rise.

The second group of sectors has been unable to escape its socialist heritage. It continues to be dominated by SOEs; output is stagnant; and employment continues to decline. Concentration ratios remain high and the rate of new firm formation is low. Foreign direct investment has occurred, but has been more selective than in Group A. The industrial organization of these sectors in 1993 is little changed from 1989.

The next two sections discuss the implications of the group profiles developed here. Section IV explores two possible explanations for the divergence of sector development. Section V discusses the implications for economic policy in Poland.

Section IV: Impediments to Firm and Industry Transformation

We have seen that some sectors underwent much greater shifts in industrial organization measures than did others. While it is difficult to identify a single cause for this dichotomy, several explanations appear promising. Restructuring has most often been considered a firm-level phenomenon, but industry transformation can also occur via the turnover of firms. If incumbent firms are restructured, sector statistics will directly reflect changes in these firms' organization and performance. It is also possible that sector statistics will change if incumbent firms are displaced by new firms even if the incumbents are never restructured.

The data presented in Section III suggest that Group A sectors and Group B sectors differ both in the extent that individual firms have been restructured and in their level of firm turnover. The data on both productivity and interviews with managers indicate that Group B firms have had great difficulty restructuring themselves. The difference in rates of entry has been perhaps even more important. Group A sectors have been characterized by high rates while Group B sectors have not. Entry increases the competitive pressure on incumbent firms, making them more likely to restructure. When the rate of entry is

high, incumbents who fail to adapt are swept aside. Because Group B sectors have experienced low rates of entry the pressure to restructure has been correspondingly less intense. Firms which failed to restructure have been less likely to suffer significant penalty than those in Group A sectors.

This section develops two complementary explanations for the divergence in sector development patterns. First, group membership is strongly predicted by a sector's average level of concentration in western countries. Sectors with high (low) concentration rates in the west are likely to be members of Group B (Group A). Second, a complementary conceptual framework is developed in which three conditions must be present for firm level restructuring to occur: signals from the competitive environment must indicate that restructuring is needed; managers must be capable of interpreting these signals and devising restructuring plans and; political interference must not prevent economically beneficial plans from being implemented. When entry rates are high, only the first condition is required for industry restructuring to occur via the turnover of firms. Generally, Group A sectors have been characterized by the latter combination, but Group B sectors have failed to meet either set of conditions.

Concentration Rates as an Indicator of Group Membership

Extensive research in the field of Industrial Organization has sought to identify barriers to entry and to analyze their effect on the competitive process. The logic of specific barriers to entry and their link to concentration ratios has been well developed in this literature. One consistent lesson from this research is that high barriers to entry and large sunk costs are associated with high industry concentration ratios and, in many cases, with high price-cost margins.[28] The social welfare implications of this well-established relationship are subject to debate. They have been the topic of a long-running discussion between the Cambridge and Chicago branches of the field since at least the 1970s.[29] My objective in this sub-section is not to draw either positive or normative conclusions, but rather to note a significant correspondence between an industry's measured level of concentration in the west and its group membership in the present analysis. The sub-section concludes with an interpretation of the data from each intellectual tradition.

Pryor (1972) analyzed concentration ratios in 12 countries. His analysis focused primarily on how well the concentration ratio for an industry in one country predicts that same industry's concentration ratio in another. He found that the rank order of concentration ratios by specific industries is roughly the same in all nations. Caves (1989, pp. 1233-34), commenting on Pryor's results, concludes that the factors determining an industry's concentration are strongly rooted in its production technology and how its product is used, not in national influences. I use Pryor's rank ordering as a signal of a sector's natural concentration rank. One shortcoming of using Pryor's analysis for comparison purposes is that he

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28 The original barriers to entry literature discussed production economies of scale, absolute size, access to inputs, and access to capital (Bain 1956). More recent analysis has focused on sunk costs (see particularly Dixit, 1980, Sutton, 1991, and Ghemawat, 1991). Sunk costs include investment in production assets (as in Dixit), but also intangible factors such as advertising, research and development, or investments in organizational resources. Sunk costs tend to lock incumbant firms into existing positions and patterns of behavior (their bets have been placed) but also deter entry because of their commitment value. See also, Baumol, Panzar and Willig (1982), Caves and Porter (1977), Schmalensee (1978), and Tirole (1978)

29 See, for example, Demsetz (1973), Mancke (1974), Caves, Porter and Gale (1977), and Mancke (1977)

analyzed only industrial sectors, so we are again restricted to considering our nine 'Industry' sub-branches.

The 20 industries Pryor analyzed match well to the nine industrial branches tracked by GUS. Table #13 lists Pryor's ranking of industries (in descending order of average concentration ratio), along with the corresponding Polish sector and its group membership.

Table #13
Rank Orderings of Average Concentration Ratios
From Highest to Lowest Average Concentration
12 Countries

	Pryor's Industries	Polish Counterpart	Group Membership	
1.	Tobacco	Food	A	
2.	Transport Equipment	Electro-Engineering		B
3.	Machinery Export, Electric and Transport	Electro-Engineering		B
4.	Petroleum and Coal Products	Fuel and Power		B
5.	Chemicals	Chemicals		B
6.	Rubber Products	Chemical		B
7.	Electrical Equipment	Electro-Engineering		B
8.	Printing and Publishing	Misc.	A	
9.	Miscellaneous	-		
10.	Stone, Glass, Glass Products	Mineral		B
11.	Metal Products, Export Machinery	Metallurgical		B
12.	Primary Metals	Metallurgical		B
13.	Food Processing	Food Processing	A	
14.	Paper Products	Wood and Paper	A	
15.	Beverages	Food Processing	A	
16.	Textiles	Light Manufacturing	A	
17.	Leather Products	Light Manufacturing	A	
18.	Clothing and Shoes	Light Manufacturing	A	
19.	Lumber Products	Wood and Paper	A	
20.	Furniture and Fixtures	Wood and Paper	A	

Source: Pryor (1982)

As you can see, Pryor's rank order table is an extremely good predictor of group membership in our population of Polish sectors. The breakpoint between sectors is an arbitrary, but obvious choice. With only two exceptions, industries high on Pryor's rank ordering are members of Group B. Industries low on Pryor's list are Group A sectors. The exceptions are easily explained. In the Polish data, tobacco is included in the food processing sector, and printing and publishing is included as miscellaneous.

The normative implications of this high correspondence are not clear, but at least two interpretations are possible. The first is that the Group B sectors are highly concentrated because they benefit from high barriers to entry or sunk costs, either of which would give incumbent firms market power (the Cambridge approach). Market power (or sunk costs) has two effects. It protects incumbents from entry by new firms. It also creates organizational inertia. The Group B firms are partially insulated from the incentives to restructure. They also find that restructuring is particularly difficult because of their size. The disparity in group-entry rates and average firm size are consistent with this. The interpretation of the cluster analysis groupings leads to the conclusion that Group B sectors are largely unreformed.

Another interpretation (the Chicago approach[30]) is that firm size and concentration ratios are determined by relative firm efficiency. High concentration rates are seen as merely an indication that a few firms are very efficient. Because optimal social organization may involve very large firms and high concentration ratios, the normative implications of high concentration ratios are not clear. Analysts in the Chicago tradition generally see high concentration measures as innocuous.

This second interpretation leaves us without a conclusion regarding differences in the pace of reform between Groups A and B. If it is efficient for some sectors to have a few large firms and high concentration ratios, then 'reform' following the big bang may not imply large changes in industrial organization measures. We have seen in Section II that the pre-reform economy was heavily weighted toward heavy industry. Output and employment declines in these sectors are not necessarily welfare-reducing if they release resources to be utilized in other sectors of the economy. The interpretation issue could be addressed with additional industry data on changes in productivity and quality levels. This will be the subject of future research.

The Political Economy of Restructuring

One of the most striking findings in Section III is the wide disparity in average firm size between Group A and Group B sectors. For the moment, instead of focusing on why this disparity exists, I will focus on what it implies about restructuring at the firm level. Both the data from Section III and interviews in Poland suggest that firm size has important implications for restructuring.

At least three conditions must be present for restructuring to take place at the firm level. First, the signals from the competitive environment must be economically meaningful and indicate that restructuring is necessary. Second, managers must recognize these signals and develop a plan of action. Finally, the firm must be allowed to implement its restructuring plan. A wide range of interviews suggest that conditions two and three are rarely present in the large, state-owned firms typical of Group B. Although in many cases managers realize that restructuring is needed, they often have great difficulty developing a realistic plan of action. Even when managers are able to develop a realistic restructuring plan, political considerations often prevent its implementation.

The first condition -- that signals from the competitive environment indicate change is necessary -- was largely accomplished in 1990 when prices were freed and imports allowed to enter the Polish market. After 40 years of politically-determined prices, scarcity information was quickly reintroduced. Accounting and tax accounting procedures were changed to shift the emphasis from production objectives toward sales and profits.

A second necessary condition is that managers be capable of interpreting these signals correctly and formulating appropriate restructuring plans. When interviewed, senior managers in state-owned enterprises often indicate that they recognize the need for restructuring. It is clear, however, that these

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30 The Chicago approach is logically related to a Chandlerian view of big business. This view is that administrative coordination is often superior to market coordination. See for Example, The Visible Hand.

managers often lack the marketing, financial, production and administrative skills required to implement change. There is widespread agreement within Poland that moving from recognition to action is a major hurdle for SOE managers. Firm level restructuring often involves making very unpleasant decisions. In private firms managers and owners reap the benefits of restructuring and therefore have a strong incentive to overcome potential agency problems. State enterprise managers have no (legal) ability to capture the benefits of restructuring and are therefore unlikely to incur the potential costs of doing so. I have not had the opportunity to collect survey or performance data to support this point, but it has been confirmed as a major stumbling block in every interview in which the issue has been raised.

Pinto , et. al. surveyed 75 large SOEs and concludes that some managers have adjusted, but many have not. They write:

> A typical manager was an engineer... [A]s a specialist in production, he knew nothing about marketing and financial management.... Following the shock therapy... managers seemed overwhelmed by the changes they had to deal with. (BPEA, Microeconomics 2, 1993, p. 251)

Barbara Lundberg, General Director of Enterprise Investors, Poland's largest foreign financial investor, says:

> Our biggest challenge is not to identify companies with promising market positions. There are hundreds of these firms in Poland. In most cases, management also knows that restructuring is necessary. The problem is that they don't know how to make that change. The managers are like deer frozen in the headlights of an oncoming car. They know the situation is bad, but are unable to take constructive action. Our biggest challenge is to find managers with the skills to make a restructuring work. (Interview September 1, 1994)

Andrzej Kozakiewicz, undersecretary of state and assistant to the president for economic affairs, describes the situation as follows:

> In the state sector, the managers continue to report to clerks and bureaucrats. Debts, tariff levels, and contract disputes are all resolved politically, not based on economic principles. There is no longer any will to restructure in the management groups. It [*restructuring*] is too much trouble and it's something they don't understand.
>
> The political rulers will do their best to restructure, as best they know how. But these are politicians, not businessmen. What does restructuring mean for them? It means they hope the firm breaks even on an operating basis and doesn't have to lay anyone off. There is no plan to compete with the foreigners, or even to earn enough to finance investments out of profit. They want to do business the old way, avoid taking an unpleasant decision if at all possible. (Interview, September 6, 1994)

The third condition necessary for firm-level restructuring to occur is that management be allowed to control the firm. This rarely happens when restructuring involves layoffs at large SOEs. Janusz Sawicki, former deputy minister of finance in charge of debt negotiations, says that political interference at the micro-management level is largely confined to the very large state-owned firms:

> The government may feel bad about the plight of the textile factories in Lodz or the food cooperatives in Olsztyn, but there are too many factories with too many problems to get involved in the details. But if Ursus [*the state owned tractor factory*] or Nowa Huta [*the huge steel mill near Krakow*] wants to lay people off, or even to discontinue a product line,

there is likely to be a three day debate in the Sejm [*lower house of parliament*] and a six month study by the Ministry [*of Privatization*]. (Interview, August 31, 1994)

Jacek Siwicki, former chief of staff to Prime Minister Bieleski and deputy minister of privatization, describes the situation as follows:

> Restructuring in these firms [*large SOEs*] can only happen when they are on the verge of collapse. If there is even the smallest chance that layoffs can be avoided, the Ministry will not let them happen. Many of these firms are the only large employers in their town. The downside of restructuring is very visible: people at the unemployment office, protests at the Ministry. Without a gun at the firm's head, it is easier to give it a few more subsidies, defer a few more loans, or to raise tariffs. Anything to avoid the problem for at least one more day. When these firms are state owned, they can avoid the tough decisions almost forever. There is always some excuse, or plan, or big order just around the corner which gives the bureaucrats an excuse to wait another day. (Interview, September 6, 1994, Warsaw).

This three-conditions framework highlights a key distinction between the two paths to industry restructuring. When industry restructuring takes place via the turnover of firms, only the first condition is necessary, if combined with low barriers to entry. When barriers to entry are high, industry restructuring becomes closely tied to firm level restructuring and all three of the conditions presented in the framework must be present.

The most vigorous debate about policies concerning restructuring and privatization is implicitly about different views of the second and third hurdles. Advocates of a go-slow approach express confidence that, given time and subsidies, SOE managers will overcome the second hurdle. Further, they generally view political oversight of restructuring decisions as welfare enhancing, not as postponing difficult but necessary decisions.

Advocates of aggressive reform take contrary views. They recognize that many SOE managers do not have the skills necessary to implement restructuring on their own. Further, they focus on the difficult but necessary restructuring decisions which do not occur because of the final political hurdle. Political supervision of restructuring decisions always keeps alive the seductive option of avoiding competition through political connections. Recent experience has demonstrated that SOE managers have vigorously pursued such political options. This will be discussed in more depth in Section V.

Section V: 1994 - Is Poland Moving Forward or Backward?

Looking back from 1995, it is clear that Poland has made substantial progress on its journey toward a market economy. More than 50% of GDP and nearly 60% of employment are now private.[31] Less than 5% of prices are controlled, and shortages and queues are extremely rare. Poland enjoyed Europe's highest rate of GDP growth in both 1993 and 1994, and the world's best stock market performance in 1993.[32]

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31 Both estimates are official. Unofficial estimates are that more than 60% of GDP and almost 70% of employment are private.

32 GDP growth was 4.5 and 5% in 1994, stock market was up 950% in PZL, about 790% in USD, The Economist, April 16, 1994

Nevertheless, several policy hurdles remain. This section argues that the current government's approach does not address the primary challenge the Polish economy still faces: *changing the game for the large state enterprises*. These firms continue to employ a political paradigm in response to competitive pressures. We have seen that Group A sectors are largely reformed, either through firm restructuring or turnover. It appears that neither restructuring nor turnover has occurred in the Group B sectors. The Group B sectors are still dominated by a small number of large state-owned firms. This state segment continues to be characterized by falling output, employment, and productivity. While it is difficult to demonstrate conclusively that restructuring has not occurred in the Group B sectors, there are few symptoms of feverish competition.

By late 1994, government economic policy had clearly shifted back toward intervention. The government's economic program did almost nothing to reduce political interference in the economy. A policy of 'fragmented intervention' had led to a series of proposals to re-establish producer cartels and political guidance for declining industries. The Mass Privatization Program (MPP) had been repeatedly delayed and politicized. As implemented, the program contained so many restrictions and perverse incentives that many businessmen and even participants now argued that the MPP might actually slow restructuring.

Fragmented Intervention

When the post-communists returned to power in September 1993, the level of government intervention rose dramatically. Agricultural tariffs were increased. The MPP, whose implementing legislation had been passed in April 1993, was repeatedly delayed. The number of capital and liquidation privatizations declined sharply.[33] By the summer of 1994, there were a series of proposals to re-establish cartels in many sectors, including sugar, tobacco, oil, alcohol, electronics, and chemicals.[34] The prime minister personally intervened to ban the import of used combines.[35] Perhaps most symbolic was a proposal to re-establish the foreign-trade organizations which had served as exclusive conduits for foreign trade in the communist era. This proposal suggested establishing four holding companies to take over control of all foreign trade in 'strategic sectors.' The proposal was justified by the need to "prevent Polish-Polish

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33 There has been a significant slowdown in the pace of 'regular' methods of privatization. The Ministry of Privatization emphasizes commercialization statistics, but these are misleading in that the SOEs emerge from commercialization as still 100% state owned. If we compare actual termination of state ownership, we see a slowdown (source: *Rzeczpospolita*, August 11, 1994, p. 6 and *Zycie Gospodarcze*, September 25, 1994, p. 42

	First Half 1993	First Half 1994	Δ Percentage
Capital Privatization	26	17	-35%
Privatization via Liquidation	78	44	-44%
Bankruptcy Proceedings	111	89	-20%
Total	215	150	-30%

34 This was a regular feature of Sejm debate during the summer and fall of 1994. The following is a short list of articles about debates in the Sejm about reestablishing government run cartels in the following industries:

- sugar, *Gazeta Wyborcza*, July 1, 1994, p. 17 and August 27-28, 1994, p. 16;
- chemicals *Rzeczpospolita*, August 26, 1994, p. 9;
- the oil industry, *Nowa Europa*, August 16, 1994, p. 3;
- the electronics industry, *Nowa Europa*, August 26, 1994, p. 2,
- alcohol, *Rzeczpospolita*, August 23, 1994, p. 7;
- tobacco, *Gazeta Wyborcza*, July 5, 1994, p. 1, *Rzeczpospolita*, August 30, 1994, p. 9

35 The Polish combine manufacturer Ursus had sold only 200 combines in 1993 at prices between 400 million and 900 million Polish zloty ($20,000 - $45,000). Polish farmers had imported 3,815 used harvesters from the west at an average cost of 20 million zloty, $943. The Prime Minister disrupted the entire import operation to save approximately 1,000 jobs. *Gazeta Wyborcza*, July 21, 1994, p. 1

competition in foreign markets."[36] Although this proposal was never implemented, it provides an insight into just how far the locus of economic debate has shifted since Balcerowicz' resignation. While the government's general comments favored reform, its actions revealed a strong bias toward renewed central control.

Marek Dabrowski, a well known Polish macroeconomist, a former member of the Sejm, and a former Deputy Minister of Finance, is currently the Chairman of the Privatization Commission. Dąbrowski describes the fragmented intervention as follows:

> It is easier for the ideologues [*speaking of the Balcerowicz group, of whom he was a member*] to fight off this pressure [*from declining industries*] than the pragmatists, who end up debating every bad idea forever. The government appears to like these industrial groups [*cartels*], but this type of logic is a very great danger. When the government plays games with the SOEs, the private sector will also develop an unhealthy relationship with the state. Will these firms pursue what the market is telling them and what is economically efficient, or will they continually react to the political game that the state has constructed for them?
>
> The problem with the recent trend [*toward intervention*], is that the logic and justifications they are using are exactly like the socialists used to use to justify central control. No one says they want to return to central control, but whenever a decision is required, they choose the option with more control, not more freedom. (Interview, September 3, 1994)

The observer need not be a great admirer of Hayek to conclude that the recent intervention in Poland appears to be efficiency-reducing. The cartels and tariffs have not been constructed along lines traditionally advocated by industrial policy proponents.[37] The policies are generally justified on the basis that restructuring is difficult, and these sectors should be spared the pain of adjustment.

Sawicki foresees a dangerous acceleration of the intervention:

> the unreformed [*Group B*] sectors are much more important politically than they are economically. The workers in these sectors were the heart of the solidarity movement. The workers who caused the revolution are now the ones suffering from the reform which followed. The government sees a few businessmen driving Mercedes and thinks it is a good idea to transfer this 'excess' wealth to the troubled sectors. But the private sector is still very fragile. They could confiscate all the Mercedes in Poland and it wouldn't keep Ursus alive for even a week. Most of these firms are very small, with little capital. If the government tries to transfer even more 'excess' wealth to the unreformed sectors, many private firms will disappear, and we could see capital flight. Poland could easily end up like Latin America in the 1970s. (Interview, August 30, 1994)

The focus of this intervention has not been on facilitating restructuring or on gaining access to new technologies. Instead, it has been on postponing adjustment costs. An unwanted side effect is that it appears this intervention is becoming more common. Policymakers under Balcerowicz generally adhered to well-specified rules, forcing firms to change their politics-centered business heuristic to an economic one. As Dabrowski points out, the rules of the game have again changed. Increasingly, the central government occupies a major role in distributing economic benefits, and since these benefits are allocated based on political criteria and lack of restructuring, the shift in firm focus is predictable.

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36 *Gazeta Wyborcza*, August 23, 1994, p. 13. The quotes are from a government memo produced by the Ministry of Foreign Economic Relations.

37 For example, the use of reciprocity relationships Amsden describes in Korea (1989), or Japanese industrial policies discussed by Johnson or Komiya, Okuno, and Suzumura (1988).

Recent developments with the MPP also reduce the likelihood that it will succeed. First, the program, which was originally proposed in Spring 1991, has been repeatedly delayed. The implementing legislation was passed in April 1993, but it contained several provisions which are very unattractive to management companies. The worst of these was that management contracts would have a maximum duration of two years [Ch. 3, article 19], and could be terminated for cause without notice or recourse, and without recourse for any reason with six months' notice [Ch. 3, article 24]. Further, the management firm was fully liable to the state for "damage or loss caused to the NIF by negligence or mismanagement of the management firm." [Chapter 3, article 23] Other cases involving privatization of state assets have shown that the government often interprets the "negligence or mismanagement" clause to its benefit.

Interviews with senior managers at several firms who won bids for management contracts confirm that their enthusiasm for the program has been severely diminished. One summarizes, "the Sejm has taken out any incentive to make tough decisions. If everything stays quiet, we collect our management fee [*2% of assets*]. If we do anything controversial, the old time factory managers with whom they have stacked the Supervisory Boards will find a way to cancel our contracts. What would you do? Certainly not put any of your own money on the line."

A second executive, a Pole at a U.S. accounting firm, says that "the only option left for us to add value is to keep costs flat and then get together with the other NIFs to lobby the Ministries for higher tariffs. Profits will go up and we collect our bonuses. I don't think this is what Balcerowicz had in mind when he designed a reform program."

He confirms that the program leaves collusion as an attractive way to add value. "The game now is a tight embrace with the government. With these firms' size, political linkages, and clever arguments for political solutions, we are still be very far from market coordination . . . What the law has done is to encourage the NIF managers to get together and recreate the old Ministry of Industry, and you know how that turned out."

Section VI: Conclusions

Poland has emerged as a leader in the process of post-socialist economic reform. The country's resumption of economic growth is frequently used as an argument for pursuing a shock therapy approach to reform. The Balcerowicz plan focused primarily on removing barriers to private commercial activity and introducing proper incentives. The government's role in building economic institutions was acknowledged, but not emphasized, in the initial stages of reform. The analysis in this paper shows that this approach to reform has been strongly reflected in the pattern of sector development. The 17 sectors analyzed have followed two divergent transformation paths. In the first group, measures of industrial organization have shifted sharply toward those of a classically competitive industry. These sectors have experienced: a large shift of activity from the state to the private sector; rising output and employment

levels; high rates of new firm entry; and falling concentration ratios. The incentives established by the microeconomic liberalization appear to have worked very well in these sectors.

A second group of sectors shows few signs of restructuring. With the exception of falling output and employment, these sectors look very much like they did before economic reform. There has been little entry, concentration ratios remain high, and foreign direct investment has been selective.

The policy challenge in Poland is now much different than it was in 1990. The challenge at that time was to establish macroeconomic stability and introduce microeconomic liberalization. These aims have been largely accomplished. Today, reform must focus on the second group of sectors. These sectors are characterized by high concentration ratios in other countries and the firms are, on average, very large. These factors indicate that restructuring is less likely to occur via firm turnover, that firm restructuring may be particularly difficult because of large average firm sizes , and that the potential for political interference is greatest. Demonopolization in these industries may not be a realistic policy goal. Effective regulation and economic institutions, such as well-functioning capital markets and financial institutions, will be more important for restructuring this second group of sectors than it was for the first.

The recent policy approaches pursued by the Polish government are unlikely to promote restructuring in these sectors. The implicit policy of fragmented intervention has reduced firms' incentive to restructure and has reintroduced political bargaining as a major determinant of firm success. The Mass Privatization Program has been severely politicized and now contains a set of perverse incentives which may inhibit -- rather than promote -- restructuring. At a time when government policy should focus on institution building, it has instead softened the incentives for reform established in 1990.

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Appendix A:
Cluster Analysis Procedure

Cluster analysis is a multivariate procedure for detecting natural groupoings in data. The procedure classifies a set of objects into subgroup when neither the number, nor the members of the subgroups are known.

There are two main types of cluster analysis, hierarchical and partitioned. Both methods returned similar results on the Polish sector data.

The data used to perform the cluster analysis fall into 7 categories. The following data were collected for each of the 17 sectors (all measures of change are for the period 1989 through 1993):

Output Measures
1. % change in total sector output
2. % change in private output
3. Change in the private share of sector employment
4. Change in that sector's share of total GDP (measured as a % of total output)

Employment Measures
5. % change in total sector employment
6. % change in private employment
7. Change in the private sector share of total output
8. Change in that sector's share of total employment (measured as a % of total employment)

Concentration Measures
9. Change in C6 ratio
10. Change in Lorentz (Gini) ratio

Number of Firm Measures
11. Log of the change in the # of firms
12. % change in the number of SOEs

Privatization Measures
13. Log of the number of privatizations

Profitability
14. Change in net profits as a % of revenues

Relative State / Private Productivity
15. Sales/employee private vs. state sector

The following procedure was then applied to the data.

1. The data were normalized using each data series mean and standard deviation.

2. A partitioned cluster analyses was performed. I started with two clusters and then tested three. The result for two clusters was unsatisfactory in that agriculture was specified as its own group, with the other 16 sectors grouped together. The sector split with 3 groups appeared to be more reasonable.

	Cluster #1 Count	Cluster #2 Count	Cluster #3 Count
2 clusters	16	1	-
3 Clusters	6	10	1

The results for the 3 group, partitioned analysis are presented on the following page. In the text, I refer to Cluster #1 as Group A, and Cluster #2 as Group B. Data for the Agricultural sector (Cluster #3) is not used for the group comparisons in Section III.

3. A hierarchical analysis was run using correlations between data series. The number of groups need not be specified in this analysis. The results are returned in the form of a hierarchical tree. This tree is shown on the page following the partitioned results. The branches of the tree (on the left) join the sectors which are most alike. The sectors least alike join near the trunk of the tree (on the right). The results corresponded very well to the non-hierarchical clusters returned for three clusters. All of the Cluster #1 (Group A) sectors appear near the top of the tree and generally join each other before they join the Cluster #2 (Group B) sectors. The only exceptions are the Electro-Engineering, Mining, and Chemical sectors which join the Cluster #1 branches before the Cluster #2 branches.

Partitioned Cluster Analysis Results:
3 Clusters

SUMMARY STATISTICS FOR 3 CLUSTERS

VARIABLE	BETWEEN SS	DF	WITHIN SS	DF	F-RATIO	PROB
V01	1.180	2	15.818	14	0.522	0.604
V02	11.074	2	5.921	14	13.092	0.001
V03	12.909	2	4.093	14	22.080	0.000
V04	5.905	2	11.096	14	3.725	0.050
V05	0.578	2	16.422	14	0.246	0.785
V06	13.374	2	3.625	14	25.822	0.000
V07	13.532	2	3.471	14	27.293	0.000
V08	9.993	2	7.004	14	9.987	0.002
V09	13.262	2	3.737	14	24.843	0.000
V10	10.318	2	6.682	14	10.810	0.001
V11	3.712	2	13.287	14	1.956	0.178
V12	3.295	2	13.706	14	1.683	0.221
V13	3.006	2	13.999	14	1.503	0.256
V14	2.208	2	14.791	14	1.045	0.378
V15	1.520	2	15.481	14	0.687	0.519

CLUSTER NUMBER: 1

MEMBERS		STATISTICS				
CASE	DISTANCE	VARIABLE	MIN.	MEAN	MAX.	ST.DEV.
IND01FOR	0.59	V01	-1.29	0.02	2.26	1.11
IND03MNE	0.93	V02	-1.19	-0.58	0.67	0.56
IND04F&P	0.95	V03	-1.33	-0.72	0.09	0.54
IND05MET	0.58	V04	-1.10	-0.01	1.96	0.88
IND06EE	0.82	V05	-1.12	0.11	2.73	1.06
IND07CH	0.45	V06	-1.17	-0.62	0.25	0.47
IND08MIN	0.67	V07	-1.31	-0.73	-0.11	0.47
IND14TSP	0.67	V08	-1.12	0.03	0.75	0.48
IND15COM	1.02	V09	-0.01	0.73	1.50	0.43
IND17EK	0.97	V10	-0.00	0.65	2.20	0.63
		V11	-1.26	0.27	2.37	1.02
		V12	-2.14	-0.36	0.99	1.14
		V13	-2.23	-0.20	0.88	0.84
		V14	-1.01	0.30	2.01	1.15
		V15	-1.22	0.25	1.78	1.05

CLUSTER NUMBER: 2

MEMBERS		STATISTICS				
CASE	DISTANCE	VARIABLE	MIN.	MEAN	MAX.	ST.DEV.
IND02AG	0.00	V01	-1.03	-1.03	-1.03	0.00
		V02	-0.79	-0.79	-0.79	0.00
		V03	1.59	1.59	1.59	0.00
		V04	-2.24	-2.24	-2.24	0.00
		V05	-0.65	-0.65	-0.65	0.00
		V06	-0.96	-0.96	-0.96	0.00
		V07	1.70	1.70	1.70	0.00
		V08	-2.97	-2.97	-2.97	0.00
		V09	-0.61	-0.61	-0.61	0.00
		V10	-0.62	-0.62	-0.62	0.00
		V11	-1.67	-1.67	-1.67	0.00
		V12	0.23	0.23	0.23	0.00
		V13	1.61	1.61	1.61	0.00
		V14	-0.68	-0.68	-0.68	0.00
		V15	-0.42	-0.42	-0.42	0.00

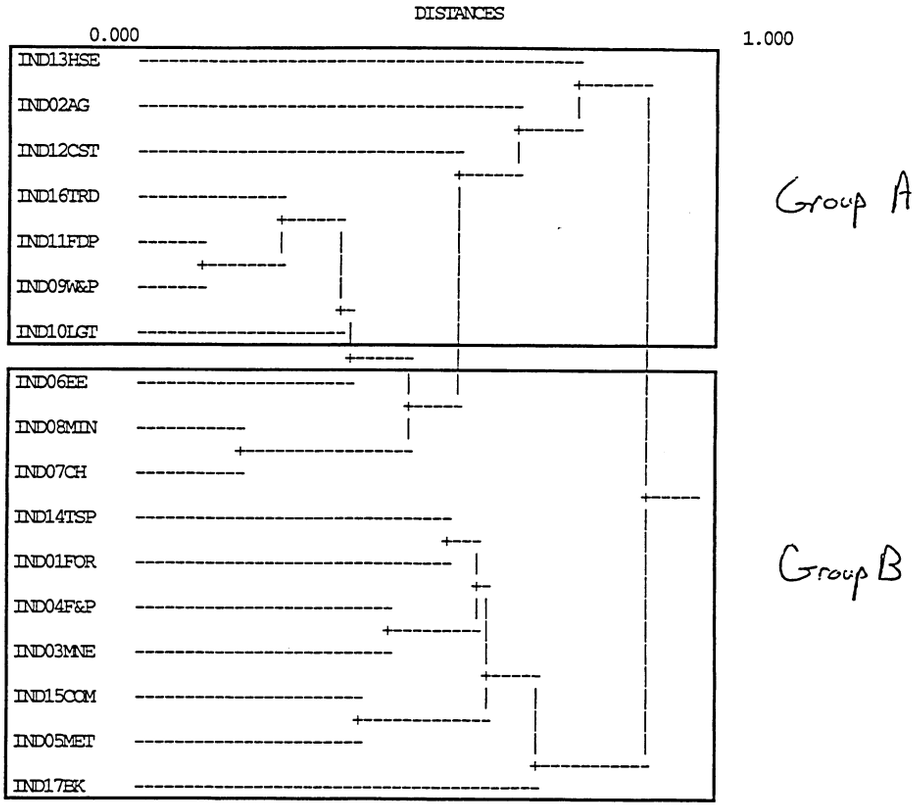
CLUSTER NUMBER: 3

MEMBERS		STATISTICS				
CASE	DISTANCE	VARIABLE	MIN.	MEAN	MAX.	ST.DEV.
IND09W&P	0.39	V01	-1.17	0.13	1.47	0.77
IND10LGT	0.63	V02	-0.25	1.09	1.83	0.68
IND11FDP	0.59	V03	0.27	0.93	1.50	0.45
IND12CST	0.66	V04	-1.08	0.39	1.21	0.76
IND13HSE	0.98	V05	-1.80	-0.07	0.93	0.92
IND16IRD	0.77	V06	0.70	1.20	2.17	0.48
		V07	0.49	0.94	1.65	0.46
		V08	-0.49	0.44	2.20	0.88
		V09	-2.14	-1.12	-0.61	0.56
		V10	-2.39	-0.98	-0.27	0.68
		V11	-1.38	-0.18	0.55	0.71
		V12	0.04	0.57	0.90	0.32
		V13	-2.23	0.06	1.15	1.08
		V14	-1.43	-0.38	0.03	0.51
		V15	-0.98	-0.35	1.51	0.87

Hierarchical Cluster Results:

DISTANCE METRIC IS 1-PEARSON CORRELATION COEFFICIENT
SINGLE LINKAGE METHOD (NEAREST NEIGHBOR)

TREE DIAGRAM



Group A

Group B