Universidade do Minho

Documentos de Trabalho

Working Paper Series

"Restructuring in privatised firms: a Statis approach"

Adelaide Figueiredo
Fernanda Figueiredo
Natália P. Monteiro
Odd Rune Straume

NIPE WP 16/ 2010

NÚCLEO DE INVESTIGAÇÃO EM POLÍTICAS ECONÓMICAS
UNIVERSIDADE DO MINHO

"Restructuring in privatised firms: a Statis approach"

Adelaide Figueiredo
Fernanda Figueiredo
Natália P. Monteiro
Odd Rune Straume

NIPE* WP 16/ 2010

URL:
http://www.eeg.uminho.pt/economia/nipe

* NIPE – *Núcleo de Investigação em Políticas Económicas* – is supported by the Portuguese Foundation for Science and Technology through the *Programa Operacional Ciência, Teconologia e Inovação* (POCI 2010) of the *Quadro Comunitário de Apoio III*, which is financed by FEDER and Portuguese funds.

Restructuring in privatised firms: a Statis approach

Adelaide Figueiredo* Fernanda Figueiredo† Natália P. Monteiro‡
Odd Rune Straume§

Abstract

We analyse the dynamics and evolution of the corporate restructuring process in the Portuguese banking sector, where 10 banks were privatised during the period 1989-1996. We apply a novel methodological approach in this context, using a multi-dimensional measure of restructuring that links product and labour market variables. We find evidence of considerable heterogeneity in the restructuring process, where firms adjust at different speeds and intensities. We also find that the wage level is by far the firm attribute that changed more, which is shown to reflect substantial changes in terms of composition, and not size, of the workforce. Our empirical evidence also suggests that privatisation is associated with a higher level of rent sharing.

Keywords: Statis, privatisation, Portuguese banking

JEL Classifications: C49, D21, L33.

*Faculty of Economics and LIAAD/INESC-Porto, University of Porto; Rua Dr. Roberto Frias, 4200-464 Porto, Portugal. E-mail: adelaide@fep.up.pt

†Faculty of Economics, University of Porto and CEAUL; Rua Dr. Roberto Frias, 4200-464 Porto, Portugal. E-mail: otilia@fep.up.pt

‡Corresponding author. Department of Economics and NIPE, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal. E-mail: n.monteiro@eeg.uminho.pt

§Department of Economics and NIPE, University of Minho, Campus de Gualtar, 4710-057 Braga, Portugal; and University of Bergen (Economics), Norway. E-mail: o.r.straume@eeg.uminho.pt

1 Introduction

One of the most important structural economic reforms taking place during the last three decades is the privatisation of state-owned enterprises in a wide range of industries all over the world. In the present paper we introduce a new methodological approach to study empirically the dynamics and evolution of the corporate restructuring process due to privatisation, using a multidimensional measure of the type and extent of restructuring, where we link product and labour market variables.

There is now a voluminous empirical literature evaluating the effects of various privatisation reforms. This literature can broadly be classified into two different categories. First, there is a huge body of literature studying the effects of privatisation on various measures of performance, firm-specific or economy-wide. Then, there is a much smaller but rapidly growing body of literature on the effects of privatisation on labour market outcomes, foremostly wages and employment.

The main bulk of the literature in the former category is summarised in four relatively recent surveys. Megginson and Netter (2001) provide an extensive review of privatisation effects worldwide, but focussing mainly on Western European (non-transition) countries, while Megginson and Sutter (2006) survey empirical studies of privatisation effects in developing countries. On the other hand, Djankov and Murrell (2002) and Estrin et al. (2009) concentrate on privatisation effects in (post-communist) transition economies and China. Although the results vary considerably across countries and industries, and according to different characteristics of the privatisation process, it is a widespread finding that privatisation leads to improved performance, measured either by firm-specific indicators like profits, productivity or value added, or by economy-wide indicators like economic growth or total factor productivity.

Apart from the effect of privatisation on the total employment level of the firm, which is sometimes used as an extra indicator of firm performance, the studies reviewed in the above-mentioned surveys are largely silent on the effect of privatisation on labour market outcomes. In the smaller (but growing) literature focussing on labour market effects of

privatisation, the most commonly studied causal relationship is that between privatisation and wages. Although results are not unanimous, the broad picture painted from these studies is that privatisation generally leads to higher wages for workers in the privatised firms. This finding is reported by Bishop and Kay (1988) and Parker and Martin (1996) for UK data, La Porta and Lopez-de-Silanes (1999) for Mexican data, Brainerd (2002) for Russian data, Ho et al. (2002) for Chinese data, Brown et al. (2006) for Ukrainian data and Monteiro (2010) for Portuguese data.[1] On the other hand, employment effects tend to be more ambiguous and are often found to be negligible (Brown et al., 2010) or negative (Haskel and Szymanski, 1993; La Porta and Lopez-de-Silanes, 1999).[2] One possible explanation for these observed labour market effects is that privatisation tends to increase labour productivity, which is also consistent with the often found result that privatisation enhances performance.

Studies that try to relate both product and labour market effects of privatisation are scarce, as most of the empirical literature on privatisation effects of firm performance builds on data obtained at firm level from company records. This type of data is usually very crude in terms of labour outcomes. On the other hand, studies that look at effects of ownership changes on wages – using data at individual level – usually have little or no information at firm level.[3] Thus, most privatisation studies are partial in the sense that they focus on a limited number of variables, related to either the product or the labour market. However, the corporate restructuring that takes place as a result of a transfer of ownership, from public to private, is arguably a highly dynamic, multi-dimensional and complex process. Motivated by this premise, our study departs from the existing empirical

[1] A decomposition of wage effects can often reveal more ambiguous results. For example, Brown et al. (2006) find that wages drop in privatised firms that are worker-controlled, while Monteiro (2010) find short-term wage losses for workers in privatised firms (that are more than compensated for by the long-term wage gains).

[2] There are also several studies focussing on the effect of privatisation on other labour market outcomes (besides average wages and total employment), such as wage discrimination (Liu et al., 2000; Peoples and Talley, 2001), wage inequality (Brainerd, 1998; Ho et al., 2002), returns to seniority or experience (Munich et al., 2005) and labour force composition (Chong and Leon, 2009).

[3] A related strand of the literature that relates product and labour markets is the literature on rent sharing between firm owners and their workers. However, this literature is largely silent on the effect of different types of firm ownership. A recent exception is Monteiro et al. (2010) who find that private firm ownership is associated with a higher level of rent sharing.

privatisation literature in two important ways.

First, we do not confine our analysis of the effects of privatisation to separate analyses with multiple measures of firm performance or labour market outcomes. Instead, we build a *multidimensional measure* of restructuring that simultaneously takes into account various aspects of both the product and the labour market. More precisely, for each point in time, we define an *object* that summarizes different aspects (related to labour and product markets) of the privatised firms. Our measure of corporate restructuring is then given by the RV coefficient that measures the distance between two objects defined at two points in time. Thus, compared to previous literature, our multidimensional measure constitutes a more complete summary of the restructuring process. Furthermore, as a separate contribution to the literature, the creation of this multidimensional measure also allows us to trace changes in the composition of privatised firms' workforce, an aspect that has been largely neglected in the privatisation literature.

Second, our methodological approach allows us to take directly into account the dynamics and evolution of the restructuring process following privatisation. The Statis methodology used in the present paper is a three-way exploratory technique based on Principal Components Analysis which includes two methods: the Statis and dual Statis. Both methods allow us not only to build an object and derive the corresponding RV coefficient, but also to decompose the deviations between two data tables across firms or variables. This means that we are able to assess and compare – at each point in time – the extent of restructuring in each firm and the magnitude of change in each variable measured. This approach is novel to the literature and we believe that it is particularly well suited to study the restructuring process of corporate privatisation.[4] Our approach also contrasts sharply with previous approaches. In particular, we do not aim to establish a causal relationship between privatisation and different measures of firm performance or

[4]As noted by Villalonga (2000, p. 51):

> "privatization is by definition a *change*, and needs to be addressed dynamically by looking at a given firm's evolution and transition between its private and public stages within a given firm."

labour market outcomes. Instead, we aim to capture the dynamics and understand the evolution and interrelation among the different dimensions of the restructuring process.

Our approach (to be described in detail later) is applied to the privatisation, and subsequent corporate restructuring, in the Portuguese banking industry between 1989 and 1997. We select this industry for different reasons. First, until the mid-1990s, the Portuguese privatisation programme was asymmetric and sectorally biased. Its major incidence – in terms of number of firms or total revenues generated – was in banking. The privatisation process comprised eleven companies, which accounted for more than 83% of banking employment in 1985 and raised 3,3 billions of euros, which constituted almost half of the total sales of state enterprises in Portugal until the second quarter of 1995. Moreover, in contrast with some other economic sectors, where privatisation is less advanced and still ongoing, privatisation of the entire industry was started and completed between 1989 and 1996.[5]

We use aggregate data at firm level provided by *Associação Portuguesa de Bancos*. This is an unexplored rich data set that, in addition to the standard financial information, contains a number of workforce attributes. In particular, besides information on average wage and total employment at firm level, we know the composition of the workforce in terms of job hierarchy, type of activity and seniority. We also have information on capital formation, profitability and productivity measures that are related to labour market aspects.

Our analysis produces three main findings. First, the restructuring process during the privatisation period is highly heterogeneous with different firms adopting adjustment processes with different speeds and intensities. Second, the variable with the largest contribution to the overall change in the industry is the pay level of workers. Third, we show that the wage increase during the privatisation period is associated with a substantial

[5]In addition to the more general privatisation literature mentioned above, there is also a separate recent literature on privatisation in banking. The Journal of Banking and Finance ran a special issue on the topic in 2005 (Volume 19, Issues 8-9), where main lessons from a wide range of countries are summarised by Megginson (2005) and Clarke et al. (2005). In line with the more general literature, privatisation in banking is generally (but not always) found to improve bank performance, particularly in terms of profitability. Studies of privatisation in banking that incorporates labour market effects are very scarce, an exception being the aforementioned study by Monteiro (2010).

change in the composition, but not the size, of the workforce.

The rest of the paper is organised as follows. In the next section we describe the institutional setting and the data used in our analysis. In Section 3 we give a brief, non-technical, description of the Statis methodology. The technical details are relegated to the Appendix. We present and discuss our empirical results in Section 4 before closing the paper with a few concluding remarks in Section 5.

2 Institutional background and data

The privatisation program was introduced in the banking sector as a further step in the successful reform of the Portuguese financial system (OECD, 1999). This reform started in 1983-84 with the introduction of laws that removed entry barriers while the interest rates and credit ceilings were gradually liberalised. Privatisation was only implemented when most of the price regulations were lifted. The first privatisation law was introduced in 1988 and only allowed partial privatisation of public firms, with the state retaining 51 percent of the equity. For this first phase of privatisation, the government selected four profitable firms. In April 1990, the law that regulates privatisation, *lei Quadro das Privatizações,* was passed allowing full privatisation of enterprises nationalised after 1974. The privatisation program was assumed to be an important mechanism for modernising, improving the performance and increasing the competitiveness of public economic units. In addition, it was a stated objective to widen the participation of Portuguese citizens in the ownership of enterprises, particularly among workers and small shareholders.[6]

The firms subject to privatisation were first transformed into corporations, with a prior evaluation being made by two independent entities. However, in contrast with the privatisation program in some other sectors (e.g., electricity and telecommunications), the government adopted a hands-off policy in the pre-privatisation period (Naumann, 1995, and Sousa and Cruz, 1995), leaving the economic restructuring for future private owners. The selection of firms for the partial privatisation phase was made based on

[6]Sousa and Cruz (1995) describe and discuss the economic and financial situation of public enterprises.

performance indicators (OECD, 1989). However, there was no predetermined schedule for subsequent privatisations (OECD, 1991). Instead, the timetable was largely determined by the economic and political domestic cycles, and by the international context.

By 1997, 10 out of 12 public banks became fully private: 2 were privatised in 1991, 3 in 1994, and each of the 5 remaining banks were privatised in 1989, 1990, 1992, 1993 and 1996, respectively.[7] Privatisations were mainly implemented by public offer, and in many cases ownership of the privatised banks returned to Portuguese groups who owned the banks prior to the nationalisation wave in 1974.[8] Due to this private-public-private ownership path, privatisation in Portugal is often referred to as reprivatisation.

In the empirical analysis, as we have mentioned before, we use aggregate data at firm level provided by *Associação Portuguesa de Bancos*. Given the restrictions imposed by the Statis methodology (see Section 3), we ended up with a balanced panel covering 10 privatised banks observed during 9 years (between 1989 and 1997), with information on 14 variables that describe both the labour and the product markets of the banking sector. Table 1 provides summary statistics (means and standard deviations in brackets) for all variables in the first and last years – 1989 and 1997 – and for the entire period. In addition to the wage variable (obtained as the ratio of labour costs and total employment), we also construct 4 product market variables: labour productivity (total sales divided by employment), capital-labour ratio (total assets divided by employment), market share (in terms of sales) and profits per employee (total sales net of worker costs divided by employment).[9] All monetary measures are expressed in 1997 real prices. We use the Consumer Price Index for converting wages per worker and the GDP deflator for the remaining variables (profits, market share and capital intensity).

Table 1 shows that privatisation in the Portuguese banking industry brought considerable changes in both labour and product markets. Between 1989 and 1997 banks became smaller. Each bank reduced, on average, by 800 workers, which correspond to an aver-

[7] According to the privatisation literature, the date of the first tranche sale of each firm is considered the date of effective privatisation.

[8] International investors could buy a limited share of the equity, ranging from 2 to 40 percent of sales.

[9] This particular definition of firm profitability is widely used in the rent sharing literature (see, e.g., Hildreth and Oswald, 1997).

age reduction of 100 workers per year. This downsizing implied substantial changes in the composition of the workforce. Managers and, in particular, workers in technical and specific occupations became relatively more abundant. On the other hand, the share of workers in administrative occupations reduced considerably (about 10 percentage points), although their share in the total workforce is still very large. The restructuring process also led to changes in terms of tenure of the workforce. The share of workers with tenure between 6 and 11 years dropped by 16 percentage points in favour of workers with less or more tenure. In addition, privatisation restructuring meant that banks reinforced the already major share of workers in commercial activities.

These compositional changes of the workforce were accompanied by an extraordinary rise in the average wage which almost tripled between 1989 and 1997. During this period, there was a general increase in the wage level in virtually all economic sectors, corresponding to the fast economic growth in Portugal after its membership in the European Union in 1986. Nevertheless, Monteiro (2009) finds that earnings in banking rose significantly also in relative terms, a result that is robust to the use of different control groups. Thus, this rise in wages reflects particularly the effects of the reforms (liberalisation and privatisation) in the banking sector which led to considerable improvements in terms of the performance of banks. For instance, the OECD (1999) survey reports a continuous increase in the productivity level (implying a reduction in operating/staff costs from 1.53 percent of average assets in 1991 to 0.98 percent in 1997) and also a remarkable improvement in the profitability rate (return to equity) after 1995. This global improvement in the efficiency level of the industry is also confirmed by Pinho (1999), who finds that the performance improvements are more pronounced among the privatised banks. Even though the privatised banks did not increase, on average, their market shares, the figures in Table 1 clearly show that labour productivity, capital per worker and profitability increased remarkably between 1989 and 1997, with average annual growth rates ranging from 12% to 28%.

Table 1: Summary statistics by year.

Variables	1989	1997	All
Employment per firm	3816	2992	3454
	(2173.9)	(1459.2)	(1768.3)
Share of workers by occupation			
Managerial	0.150	0.209	0.175
	(0.027)	(0.030)	(0.037)
Technical	0.117	0.168	0.143
	(0.042)	(0.055)	(0.059)
Administrative	0.733	0.623	0.682
	(0.034)	(0.065)	(0.072)
Share of workers by main activity			
Commercial	0.521	0.595	0.564
	(0.094)	(0.097)	(0.098)
Other	0.479	0.405	0.436
	(0.094)	(0.097)	(0.098)
Share of workers with tenure			
Below 6 years	0.086	0.141	0.136
	(0.062)	(0.104)	(0.101)
Between 6 and 11 years	0.282	0.119	0.141
	(0.120)	(0.076)	(0.106)
Greater than 11 years	0.631	0.740	0.723
	(0.150)	(0.141)	(0.139)
Wage (Prices=1997)	19.771	58.633	34.910
	(1.694)	(57.491)	(28.558)
Labour productivity (Prices=1997)	187554	459517	316438
	(141802.2)	(331809.6)	(238036.7)
Capital labour ratio (Prices=1997)	6797	49907	23310
	(8778.0)	(77768.0)	(35876.0)
Market share	0.058	0.047	0.051
	(0.031)	(0.036)	(0.034)
Profit per worker (Prices=1997)	13492	63591	36979
	(16663.7)	(50386.4)	(33856.9)

3 The Statis methodology

The Statis methodology is a three-way exploratory technique based on Principal Components Analysis (PCA), commonly used in multivariate data analysis, that enables us to analyse several data tables of individuals (in our case: banks) described by quantitative variables, evaluated in different moments in time or circumstances. This methodology includes two methods: the Statis method, which focuses on the distances between individuals and requires that individuals are the same in all data tables (although the variables may differ), and the dual Statis method, that focuses on the relations between variables and requires that variables are the same in all data tables (although the individuals may differ).

The Statis (dual Statis) method involves three steps. In the first step, termed *interstructure*, we define an *object* representative of each data table that describes the structure of the individuals (variables) in the table. The series of data tables are then globally compared. In the second step, termed *intrastructure*, we define a *common structure* of the individuals (variables) in all the tables, called the *compromise*, that summarizes the information included in all data tables. In the last step of the method, we identify the individuals (variables) responsible for the deviations between the series of data tables, and we determine which individuals (variables) contribute the most (or least) to the observed differences among the series of tables. In the Appendix we offer a more elaborate and technical description of these methods. See also L'Hermier des Plantes (1976), Lavit (1988) and Lavit et al. (1994) for further details.

4 Results

We use the Statis methodology to explore two different issues regarding the restructuring process of the banking sector. The first issue is to identify a pattern of total changes – across years and across individual banks. Juxtaposing this information with bank-specific privatisation dates enables us to say something about the timing, speed and extent of the

restructuring process. We will refer to this as the *dynamics of restructuring*. The second issue is to decompose the total changes observed and identify which variables made the largest contributions to the restructuring process. We will refer to this as the *content of restructuring*.

4.1 Dynamics of restructuring

We start by identifying the points in time (i.e., years) in which the banks restructure more (less). For this purpose, we compute the matrix of RV coefficients, which allows to measure the level of similarity (or the global association) between two data matrices.[10] In our setting, the RV coefficient measures the level of similarity, and thus distance, between two objects that summarise the structure of banks in any two points in time. The RV coefficient varies between 0 and 1, where a higher value means a higher closeness between the two objects being compared. The magnitude of the RV coefficient depends on the number of individuals (banks), on the number of variables and on the dimensionality (the covariance structure) of each data set (Josse et al., 2008). Since the individuals and the variables are constant throughout our analysis, this means that changes in the RV coefficient can be attributed exclusively to changes in the dimensionality of the data set. Thus, we can interpret a higher (lower) RV coefficient as a lower (higher) level of restructuring having taken place.

In terms of computation, due to the enormous difference in the magnitude of variables from Table 1, the RV coefficients shown in Table 2 are obtained after normalising the referred variables. Regarding the variables that characterise the employment structure (in terms of occupation, main activity and seniority) and which together sum to one, we follow the econometrics tradition of selecting only two variables describing the occupational and seniority categories and one variable describing the main activity of workers.[11] In the end we use 11 variables: 7 labour and 4 product market variables.[12]

The RV coefficient compares globally the structure of banks between the years defined

[10] Initially Escoufier (1973) introduced the RV coefficient as a measure of similarity between squared symmetric matrices. If we need to compare rectangular matrices, as it happens in our setting, the first

Table 2: Matrix of RV coefficients.

	89	90	91	92	93	94	95	96	97
89	1.000								
90	0.945	1.000							
91	0.953	0.969	1.000						
92	0.937	0.926	0.953	1.000					
93	0.883	0.858	0.859	0.931	1.000				
94	0.899	0.861	0.859	0.931	0.965	1.000			
95	0.835	0.857	0.804	0.845	0.838	0.882	1.000		
96	0.828	0.861	0.805	0.864	0.872	0.892	0.981	1.000	
97	0.776	0.828	0.773	0.844	0.850	0.837	0.913	0.940	1.000

by the first row and column. For instance, focussing on the first column, we observe that the RV coefficient is gradually reduced (except for 1994), implying that, compared to 1989, banks become more dissimilar, and thus restructure more, over time. In terms of dynamics, we focus on the figures immediately below the diagonal, which compare the level of similarity/restructuring between each year and the preceding year. Table 2 shows that the RV coefficient is high in any pair of consecutive years. This suggests a continuous adjustment to the privatisation reform. Nevertheless, we can identify two 'peaks' in the restructuring process. The largest differences in the RV coefficients, compared to preceding years, are observed in 1993 and 1995. Interestingly, this is consistent with the aforementioned findings reported by OECD (1999), referring to the year 1995 as a turning point in the performance of the banking sector. In contrast, in 1991 and 1996 we observe the strongest similarities between two pairs of consecutive years. Therefore, the graphical representation of the centered interstructure (Figure 1), where the axes of plane 1-2 explain 71.4% of the total variance, allows us to identify three distinct periods of the restructuring process.[13] The three periods are 1989-1992, 1993-1994 and 1995-1997, and they are identified by the fact that total changes across banks are larger between than

step is to transform them into square matrices. The exact transformation is described in the Appendix.

[11]Results do not qualitatively depend on the exclusion or inclusion of these three variables.

[12]We classify variables that include information about sales as product market variables (e.g., labour productivity).

[13]Figure 1 is a two-dimensional representation of the degree of (dis)similarity across years, where a larger distance between two points (years) indicate a stronger dissimilarity between these two years.

within these periods.

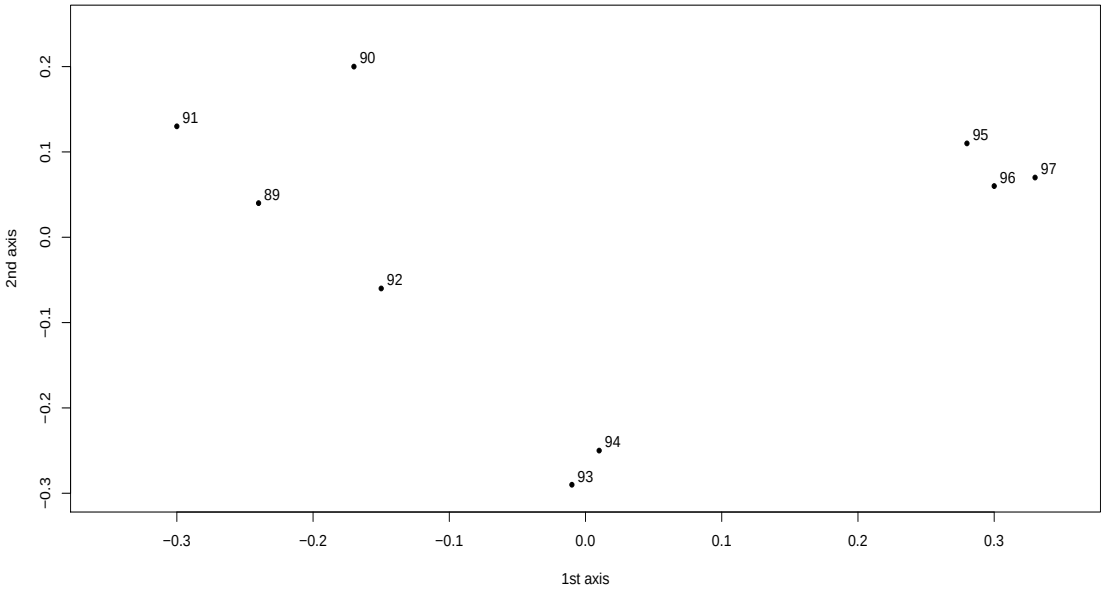

Figure 1: Euclidean image of the interstructure (Statis).

Are these changes directly related with the privatisation reform? Are banks homogeneous in terms of speed of restructuring? Do banks mainly adjust before or after the reform? Is the adjustment immediately after (before) the reform or is it delayed for some time after privatisation? In order to answer these questions, we proceed by identifying how much of the total changes can be explained by each bank, and relate these individual contributions to the respective privatisation dates. The decomposition of the squared distances across the banks allows us to identify which banks experienced the largest changes and at which points in time. Table 3 indicates for each bank the year of privatisation (column 1) and the respective contribution to the total variation between two consecutive years (columns 2 to 9) or between the most diverging years 1989 and 1997 (column 10). Column 11 shows the contribution of each bank to the total variation considering all years. Naturally, all columns sum to 100%. In order to facilitate the reading of the table, we highlight in bold the largest contributions of each bank, provided that the contributions

are larger than 10 percent.[14] We then interpret the contribution of each bank considering the global size of the RV coefficient (from Table 2) and the date of privatisation.

Table 3: Decomposition of the distance between two years across banks in percentage.

Banks		90	91	92	93	94	95	96	97	89-97	Mean
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
BTA	89	**25.6**	8.7	8.1	**10.1**	**31.8**	4.7	**12.9**	**14.5**	**12.0**	8.3
BPA	90	7.9	5.2	**14.4**	**16.4**	**17.6**	8.8	**16.7**	**14.5**	7.3	9.4
BES	91	3.3	5.5	3.0	**15.6**	0.6	2.8	6.0	7.0	4.6	5.5
BFB	91	2.8	9.5	5.7	8.2	9.8	4.9	6.4	2.0	6.9	6.8
CPP	92	4.6	**17.3**	4.1	7.3	4.6	2.7	8.5	9.1	5.7	5.6
UBP	93	**13.5**	6.4	2.9	4.1	**13.8**	7.2	7.4	**11.3**	5.8	6.3
BPSM	94	**21.0**	**14.0**	6.5	4.2	2.3	**40.2**	3.4	6.2	**15.3**	**16.8**
BFN	94	8.1	**15.2**	**15.3**	9.4	6.0	**20.8**	**24.8**	**20.7**	**16.8**	**15.1**
BBI	94	7.4	1.8	4.8	2.2	2.1	3.7	**10.6**	5.5	5.9	4.4
BCA	96	5.8	**16.4**	**35.1**	**22.6**	**11.4**	4.2	3.3	9.2	**19.6**	**22.0**

Some interesting conclusions can be reached. First, it is difficult to establish a clear relationship between the date of privatisation and the starting point (in time) of restructuring. There is a clear pattern for some banks, such as BTA, BPSM and BFN. These three banks are responsible for a considerable fraction of all changes that occurred in the year immediately after their respective dates of privatisation. Moreover, for BPSM and BFN, the contribution reached 61% of the largest change that occurred throughout the period of analysis. For other banks, such as BCA, the major adjustments occurred a considerable amount of time before the reform was implemented (3 to 5 years). For yet other banks, such as BPA and BES, restructuring took more clearly place 2 to 3 years after the reform was implemented. For the remaining banks, in particular BBI and BFB, it is not possible to detect any discernible relationship between the reform and the extent of restructuring. Nevertheless, regarding the banks for which it is possible to relate restructuring to the privatisation date, the results appear to suggest different speeds of adjustment. Some banks, such as BTA and BPSM, seem to have adjusted rapidly (one year after the ownership change), while BFN and BPA seem to have adopted a more

[14] This threshold is obtained by dividing 100% by the number of banks (10).

prolonged and even delayed adjustment process.

In addition, banks did not contribute equally to the total restructuring process. When we compare the most diverging years – 1989 and 1997 – 4 out of 10 banks explain more than 60% of the total changes between these two years. Moreover, if we consider all years, a similar picture is painted: 3 out of the 4 aforementioned banks explain a large proportion (53.9%) of all changes between any two years. This finding suggests that the privatised banks constituted a heterogeneous group before the implementation of the reform and therefore adjusted at different timing, speed and intensity. The same conclusion can be reached by inspecting Figures 2 and 3, which represent the trajectory of each bank around its *compromise* position in planes 1-2 and 1-3 (the first three axes explain 78.5% of the total variance).[15]

For each bank, each dot represents one year (with the years 1989 and 1997 being explicitly indicated). The bold and big dots represent the compromise (average) position in the period of analysis. The first axis is positively correlated with the variables *profits per worker*, *labour productivity* and *share of workers in technical occupations* while negatively correlated with the variable *share of workers in commercial activities*.[16] The second axis is positively correlated the variables *bank employment*, *market share* and *labour productivity*.[17] Finally, the third axis is positively correlated with *labour productivity* and negatively correlated with the *share of workers in managerial occupations*.[18] The banks that exhibit a larger trajectory or movement across both axes in the two planes correspond to the banks that restructured more. A narrower trajectory shows a lower level of adjustment.

[15]We show the trajectory of each bank in three planes in order to maximise the share of total variance explained. The first two axes explain 68.4% of the total variance, while 78.5% is explained by the addition of the third axis.

[16]A bank like BFN, that has high profits and labour productivity and a high share of technical workers appears on the positive side of the axis, while banks like BPSM and BBI, that have a large share of workers in commercial activities appear on the negative side of the first axis.

[17]Banks like BPA, BES and BPSM, that are recorded with high values of these three variables appear on the positive side of the second axis.

[18]Banks with high (low) figures on labour productivity and low (high) figures on the share of workers in managerial occupations, such as BPSM and BCA (BTA and BFB), appear on the positive (negative) side of the third axis.

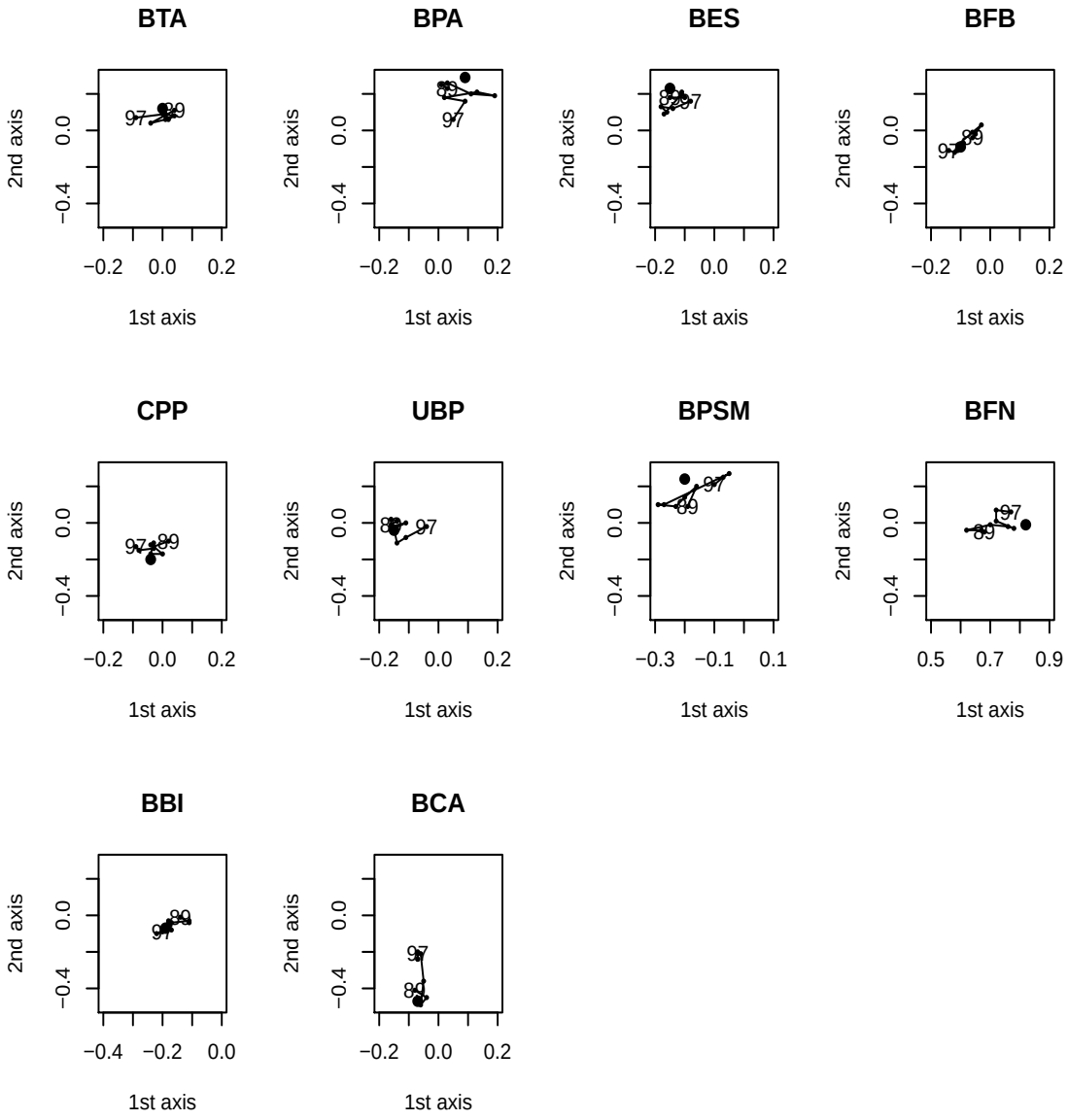

Figure 2: Trajectory of each bank around its compromise position (plane 1-2).

4.2 Content of restructuring

A further decomposition of the restructuring process allows us to explore which variables contribute more to the overall magnitude of restructuring. Table 4 replicates Table 3 by decomposing the squared distances between the correlation matrices across years according to the variables used in the study. For clarity of exposition, we include in bold

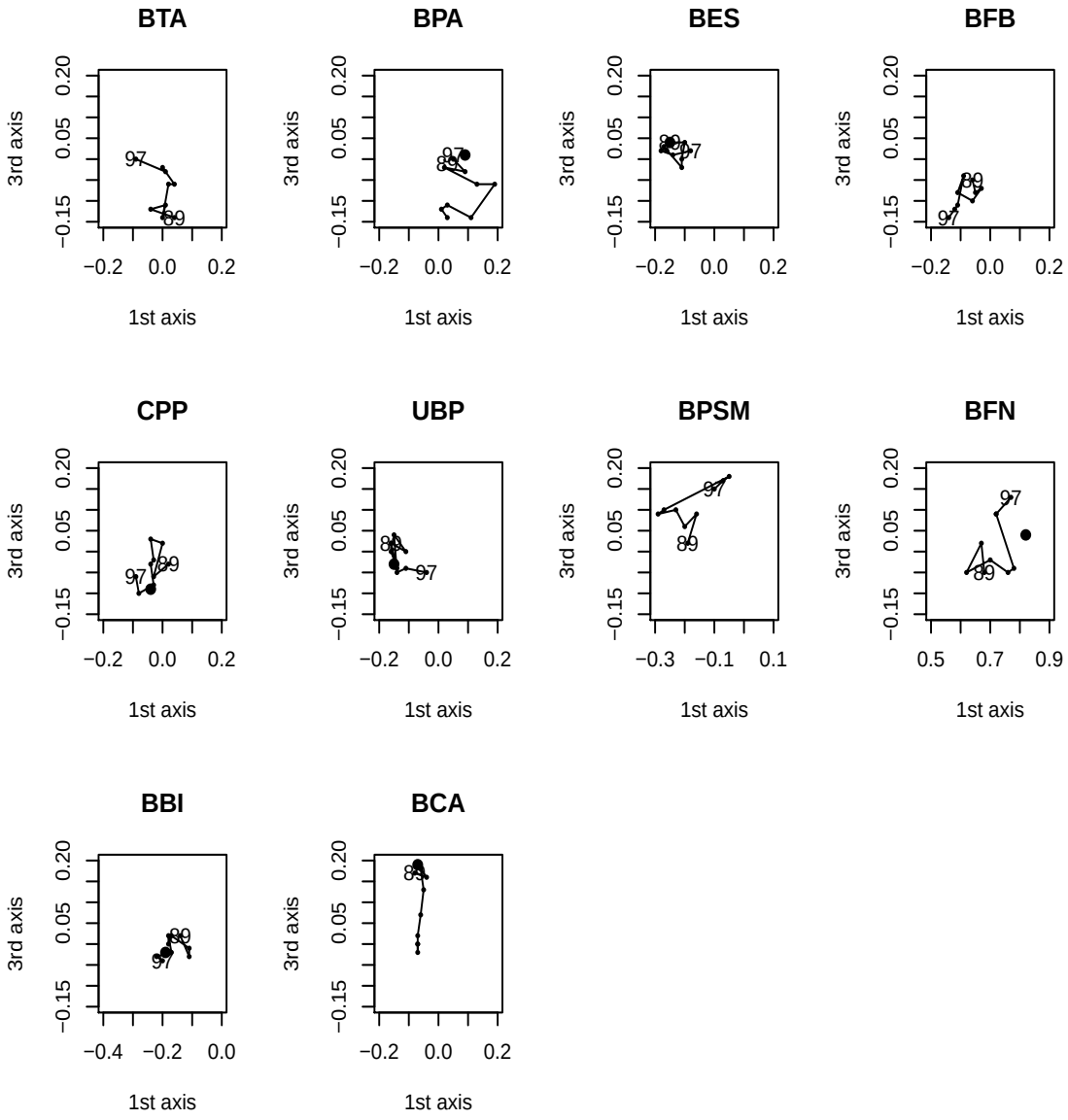

Figure 3: Trajectory of each bank around its compromise position (plane 1-3).

figures variables whose contribution to the overall changes is above 9%, which corresponds approximately to the division of 100% by 11 variables.

Considering all years (column 11), the variables that explain most of the restructuring are *wage per worker*, *share of workers with tenure between 6 and 11*, *capital labour ratio* and *workers in managerial occupations*. Notice that this type of information cannot be reached by inspecting the usual summary statistics shown in Table 1. The pay level in

Table 4: Decomposition of the distance between two years across variables in percentage.

Variables	90	91	92	93	94	95	96	97	89-97	Mean
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Employment per firm		6.0	5.1	3.5	7.8	3.2	3.9	7.6	**9.3**	3.4
Share of workers by occupation										
Managerial	**18.5**	**12.8**	**20.4**	7.6	**9.2**	**18.4**	**16.0**	**9.3**	**10.5**	**10.4**
Technical	7.5	5.7	8.3	4.7	6.0	**14.9**	5.4	8.2	**11.8**	6.5
Share of workers by main activity										
Commercial	4.4	8.0	8.3	7.6	3.4	8.4	**10.4**	7.4	7.0	5.8
Share of workers by tenure										
Below 6 years	8.8	8.5	3.2	7.1	1.4	4.7	8.2	**11.2**	6.1	6.7
Between 6 and 11 years	3.0	**12.3**	4.9	7.2	**37.6**	2.4	**30.9**	**15.8**	**14.4**	**12.5**
Wage	**30.4**	**16.8**	4.2	**32.0**	5.1	**10.2**	3.1	8.1	**10.5**	**17.7**
Labour productivity	4.1	6.5	**9.0**	3.0	7.9	**12.2**	3.5	4.7	**10.4**	8.4
Capital labour ratio	**9.0**	**12.6**	**24.5**	**12.0**	6.6	2.9	**9.9**	**11.6**	8.5	**10.7**
Market share	3.4	7.6	6.2	8.0	**12.5**	**13.5**	2.0	**9.0**	8.2	8.9
Profit per worker	5.1	4.1	7.7	2.9	7.0	8.4	3.1	5.4	**9.3**	7.1

the banking industry is by far the variable that changed the most, with a contribution of 17.7% of the total variation. Interestingly, this variation reflects mainly substantial changes in the quality, and not quantity, of the workforce, either in terms of seniority or occupational category. In particular, the correlation matrices[19] across years show that in the period 1993-1994, higher wages are associated with a larger share of workers with tenure below 6 years, a larger share of workers in technical occupations and a lower share of workers in commercial activities, while in the subsequent period 1995-1997, higher wages are associated with a larger share of workers with tenure below 6 years, a lower share of workers in managerial occupations and a lower share of workers in commercial activities. The magnitude of pay level changes might also to reflect gains in terms of labour productivity, profits and capital per worker, in particular after 1992. In fact, the correlations between wages, profits, labour productivity and capital per worker become substantially stronger and positive over the period 1993-1997. This finding suggest that wages might be responding to the increased profitability of the banks, possibly explained

[19]Not shown in the paper but available upon request.

by more rent sharing in privatised banks. This result is consistent with findings of Monteiro et al. (2010) for the whole Portuguese economy.

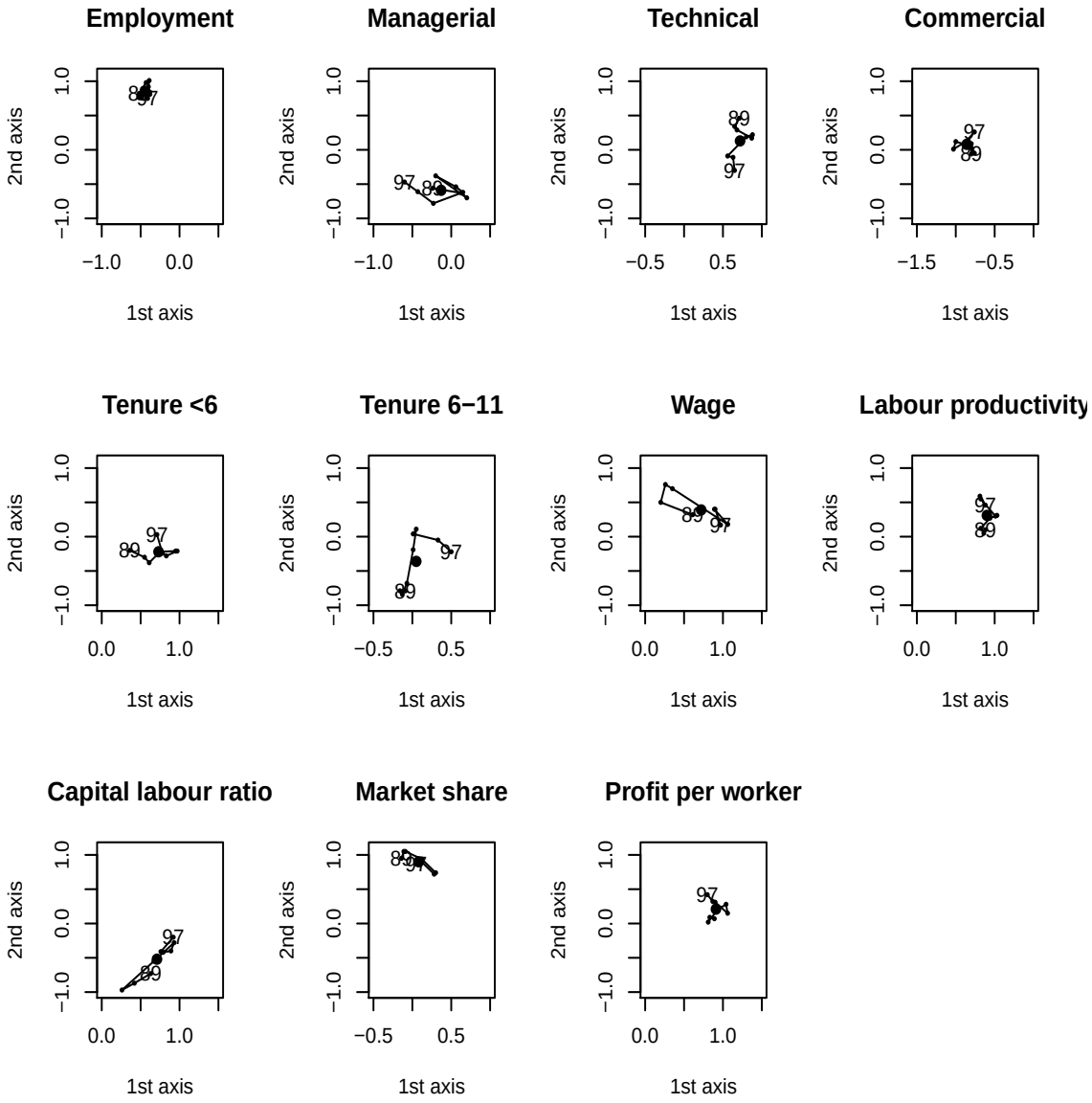

Figure 4: Trajectory of each variable around its compromise position (plane 1-2).

Table 4 also suggests that the initial phase of the banks' restructuring process consisted mainly of changes in the workforce composition and investment in capital equipment. These changes led after 1994 to important changes in product market variables – profits,

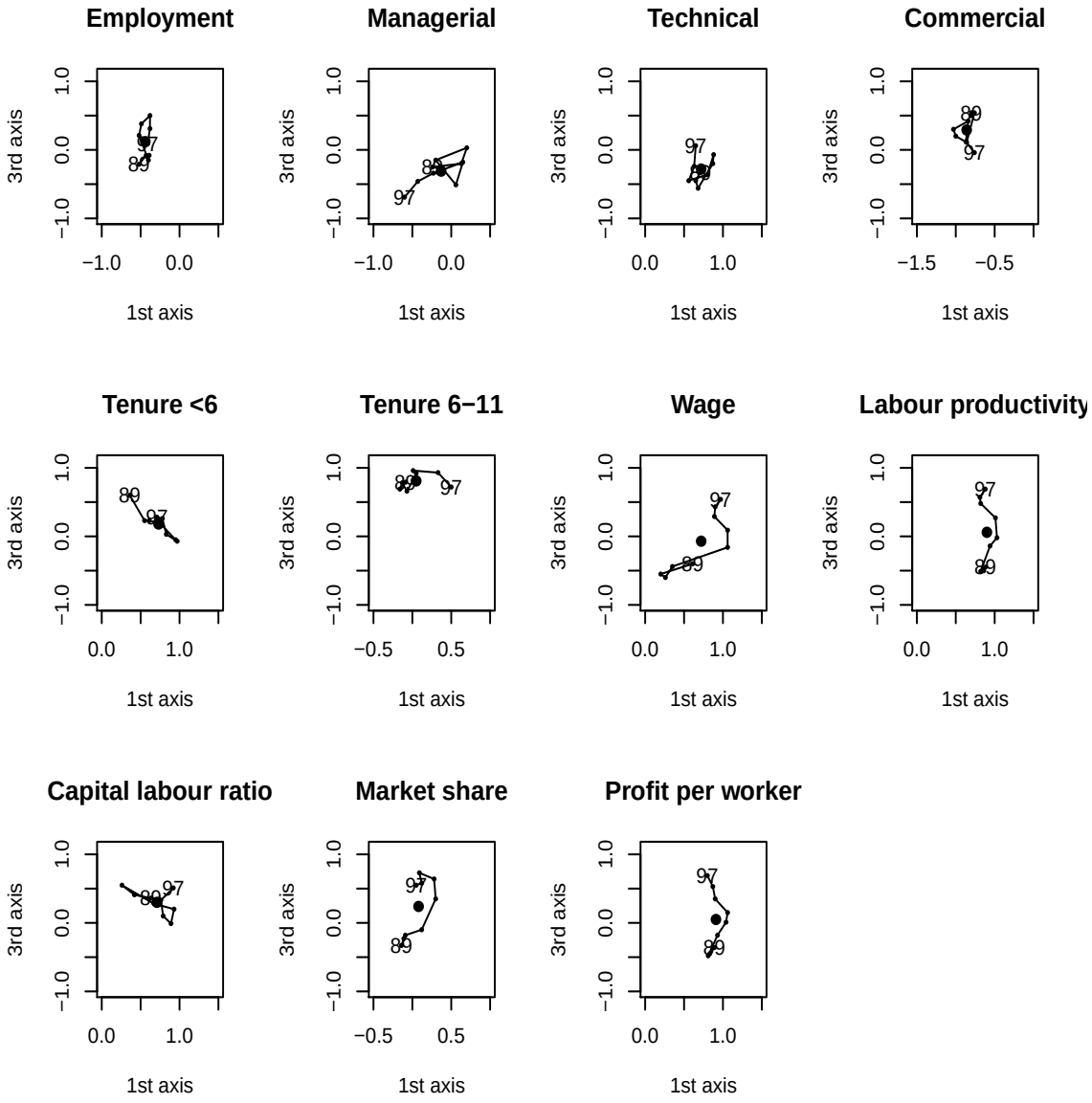

Figure 5: Trajectory of each variable around its compromise position (plane 1-3).

market share and labour productivity – which fed further changes in wages and in employment structure. As before, it is possible to inspect visually which variables changed the most. The trajectory of each variable around its compromise position in planes 1-2 and 1-3 is presented in Figures 4 to 5. The three axes explain 71.7% of total variance.[20]

[20]The first axis represents correctly the variables *profits per worker*, *labour productivity*, *share of workers with tenure below 6 years*, *wage per worker*, *capital labour ratio*, *share of workers in technical occupations* and *share of workers in commercial activities*. Together, these 7 variables explain 96% of the first axis.

In accordance with Table 4, the variables *wage per worker*, *managerial occupation*, *tenure between 6 and 11 years* and *capital labor ratio* exhibit ample trajectories across one or both axes, implying sizeable changes in the variables over time.

5 Concluding remarks

This paper examines the restructuring process of 10 privatised banks during a 9-year period, using the Statis and the dual Statis approach. Our empirical findings pinpoint some important lessons. First, the analysis of privatisation effects using data aggregated at industry level can potentially be a dangerous exercise as it might obscure diverse adjustment processes occurring at individual firm level. Furthermore, apart from identifying wages as the most important variable in the restructuring process, our results also indicate significant skill compositional effects of privatisation, a dimension almost absent in the literature concerning the labour market effects of privatisation. Finally, we also provide empirical evidence suggesting that privatisation is associated with a higher level of rent sharing, a topic that deserves further research.

6 Appendix: Statis and dual Statis

Let $(X_k)_{n\times p_k}$, $k = 1, \ldots, K$, be the data table associated with the kth point in time or circumstance, where n refers to the total number of individuals and p_k is the number of variables in the kth data table.

The Statis method: Let Q_k be the metric in the individuals space (in general defined by the identity matrix or by a diagonal matrix whose main elements are the reciprocal of the variance of variables) which enables us to determine the distance between two individuals and let D be the metric in the variables space (in general defined by a diagonal matrix whose elements are the weights associated to the individuals) which

The second axis is explained mainly (81%) by the variables *market share*, *bank employment*, *workers in managerial occupations* and *capital labour ratio*. The variables *share of workers with tenure between 6 and 11*, *share of workers in managerial occupations* and *capital labour ratio* explain 76% of the third axis.

enables us to determine the correlation between two variables. In the interstructure step we associate to each X_k a matrix W_k of the scalar products between individuals, the *object* representative of each data table, given by $W_k = X_k Q_k X_k^T$, where X_k^T denotes the transpose matrix of X_k. The distance between *objects* at stages k and k' is given by the scalar product of Hilbert-Schmidt, $\langle W_k, W_{k'} \rangle_{HS} = Tr\left(W_k D W_{k'} D\right)$, where Tr denotes the trace operator of a matrix, being $\|W_k\| = \sqrt{\langle W_k, W_k \rangle_{HS}}$. The vectorial correlation coefficient RV proposed by Robert and Escoufier (1976) is equivalent to the scalar product of Hilbert-Schmidt between normed *objects* and is defined by $RV\left(k, k'\right) = \left\langle W_k^*, W_{k'}^* \right\rangle_{HS} = Tr\left(W_k D W_{k'} D\right) / \sqrt{Tr\left(W_k D\right)^2 Tr\left(W_{k'} D\right)^2}$, where W_i^* denotes the ith normed *object* $W_i / \|W_i\|$. The RV coefficient varies between 0 and 1, meaning that the higher it is the closer are the two *objects* being compared. The distance between the normed *objects* is given by $d_{HS}\left(W_k^*, W_{k'}^*\right) = \left\|W_k^* - W_{k'}^*\right\| = \sqrt{2 - 2RV\left(k, k'\right)}$. Denoting by S the matrix of coefficients RV and by Δ the diagonal matrix of weights π_k associated to each table, a principal component analysis based on the matrix $S\Delta$ gives us the euclidean image of the series of data tables. The coordinates of the points A_k associated with the data tables on the ith axis, are the components of the vector $\sqrt{\tau_i}\boldsymbol{\gamma}_i$, where τ_i represents the ith largest eigenvalue of $S\Delta$ associated with the eigenvector $\boldsymbol{\gamma}_i$. Notice that if the weights π_k are equal, it is enough to base the PCA on the matrix S. For obtaining a centered euclidean image of the data tables, we base the PCA on the matrix $\widetilde{S} = \left(I_K - \mathbf{1}\mathbf{1}^T\Delta\right) S \left(I_K - \Delta\mathbf{1}\mathbf{1}^T\right)$, where I_K is the identity matrix of order K and $\mathbf{1}$ is a vector of dimension K with all components equal to 1. In the intrastructure step, the *compromise* is the *object* W, defined by the weighted mean $W = \sum_{k=1}^{K} \alpha_k W_k^*$, where the coefficients α_k are given by $\alpha_k = \pi_k \gamma_1^k \,/\sqrt{\tau_1}$ and γ_1^k is the kth coordinate of the vector $\boldsymbol{\gamma}_1$. A PCA based on the matrix W enables us to obtain the euclidean image of the *compromise*. The coordinates of the points B_i, $i = 1, \ldots, n$, associated with the individuals on the kth axis of the euclidean image of the *compromise* are the components of the vector $\sqrt{\mu_k}\boldsymbol{\varepsilon}_k$, where μ_k denotes the eigenvalue of the matrix WD associated with the eigenvector $\boldsymbol{\varepsilon}_k$. The correlations of the variables with the *compromise* axes, enable us

to interpret the *compromise* axes and the *compromise* positions of the individuals. In the last step of the method, we identify the individuals responsible for the deviations between the series of data tables, through the decomposition of the squared distances between two pairs of *objects* into percentages of individuals' contributions, i.e., we calculate the quantities $C_{ind\,i,d^2_{HS}} = (d_{ii}/d^2_{HS}(W_k, W_{k'})) \sum_{j=1}^{n} d_{jj} \left[W_k^{ij} - W_{k'}^{ij}\right]^2$, where $C_{ind\,i,d^2_{HS}}$ represents the contribution of the ith individual to the squared distance d^2_{HS}, d_{ii} denotes the ith diagonal element of the matrix D and W_k^{ij} denotes the ij-element of the matrix W_k. For visualizing graphically the individuals responsible for the deviations between the series of data tables, we represent the different positions of the individuals for each *object* on the *compromise* euclidean image, i.e., their trajectories. The coordinates of the points $B_1^k, ..., B_n^k$, $k = 1, ..., K$ on ith axis are given by $W_k D\varepsilon_i/\sqrt{\mu_i}$.

Dual Statis method: Let Q and D_k be the metrics in the individuals and variables space, respectively, defined as in the Statis method. The object representative of each data table is defined by either the covariance or correlation matrix (in case of standardized data), given by $V_k = X_k^T D_k X_k$. The scalar product of Hilbert-Schmidt between two *objects* at stages k and k' is defined by $\langle V_k, V_{k'}\rangle_{HS} = Tr(QV_kQV_{k'})$. The diagonalization of the matrix $Z\Delta$, where Z denotes the matrix of the scalar products between the *objects*, allows us to obtain the euclidean image of the series of data tables. The *compromise* is the *object* given by $V = \sum_{k=1}^{K} \beta_k V_k$. The diagonalization of the matrix VQ enables us to obtain the euclidean image of the *compromise*. Finally, we decompose the squared distances between two pair of *objects* into percentages of variables' contributions, i.e., we calculate the quantities $C_{var\,i,d^2_{HS}} = (q_{ii}/d^2_{HS}(V_k, V_{k'})) \sum_{j=1}^{p} q_{jj} \left[V_k^{ij} - V_{k'}^{ij}\right]^2$, where $C_{var\,i,d^2_{HS}}$ represents the contribution of the ith variable to the squared distance d^2_{HS}, q_{ii} denotes the ith diagonal element of the matrix Q and V_k^{ij} denotes the ij-element of the matrix V_k. We also represent the variables' trajectories on the *compromise* euclidean image.

References

[1] Bishop, M, Kay, J., 1988. Does privatisation work? London: London Business School.

[2] Brainerd, E., 1998. Winners and losers in Russia's economic transition. American Economic Review, 88, 1094–1116.

[3] Brainerd, E., 2002. Five years after: the impact of mass privatisation on wages in Russia, 1993-1998. Journal of Comparative Economics, 30, 160–190.

[4] Brown, J., Earle, J., Vakhitov, V., 2006. Wages, layoffs, and privatisation: evidence from Ukraine. Journal of Comparative Economics, 34, 272–294.

[5] Brown, D., Earle, J., Telegdy, J.Á., 2010. Employment and wage effects of privatisation: evidence form Hungary, Romania, Russia and Ukraine. Economic Journal, forthcoming.

[6] Clarke, G., Cull, R., Shirley, M., 2005. Bank privatisation in developing countries: a summary of lessons and findings. Journal of Banking and Finance, 29, 1905–1930.

[7] Chong, A., Leon, G., 2009. Privatised firms and labour outcomes in emerging markets. Journal of Development Studies, 45, 1513–1525.

[8] Djankov, S., Murrel, P., 2002. Enterprise restructuring in transition: a quantitative survey. Journal of Economic Literature, 40, 739–792.

[9] Escoufier, Y., 1973. Le traitement des variables vectorielles. Biometrics, 29, 751–760.

[10] Estrin, S., Hanousek, J., Kocenda, E., Svejnar, J., 2009. The effects of privatisation and ownership in transition economies. Journal of Economic Literature, 47, 699–728.

[11] Haskel , J., Szymansky, S., 1993. Privatization, liberalization, wages and employment: theory and evidence for the UK. Economica, 60, 161–181.

[12] Hildreth, A.K., Oswald, A.J., 1997. Rent-sharing and wages: evidence from company and establishment panels. Journal of Labor Economics, 15, 318–37.

[13] Ho, S., Dong, X., Bowles, P., MacPhail, F., 2002. Privatisation and enterprise wage structures during transition: evidence from rural industry in China. Economics of Transition, 10, 659–688.

[14] J. Josse, Pagès J., Husson, F., 2008. Testing the significance of the RV coefficient. Computational Statistics & Data Analysis, 53, 82–91.

[15] La Porta, R., López-de-Silanes, F., 1999. The benefits of privatisation: evidence from Mexico. Quarterly Journal of Economics, 114, 1193–1242.

[16] Lavit, C., 1988. Analyse conjointe de tableaux quantitatifs. Editions Masson.

[17] Lavit, C., Escoufier, Y., Sabatier, R., Traissac, P., 1994. The ACT (Statis method). Computational Statistics and Data Analysis, 18, 97–119.

[18] L'Hermier des Plantes, H., 1976. Structuration des tableaux à trois indices de la statistique. Thèse de 3 ème cycle, Université de Montpellier.

[19] Liu, P.-W., Xin, M., Zhang, J., 2000. Sectoral gender wage differentials and discrimination in the transitional Chinese economy. Journal of Population Economics, 13, 331–352.

[20] Megginson, W., 2005. The economics of bank privatisation. Journal of Banking and Finance, 29, 1931–1980.

[21] Megginson, W., Netter, J., 2001. From state to market: a survey of empirical studies on privatisation. Journal of Economic Literature, 39, 321–389.

[22] Megginson, W., Sutter, N., 2006. Privatisation in developing countries. Corporate Governance, 14, 234–265.

[23] Monteiro, N. P., 2009. Regulatory reforms and labour earnings in Portuguese banking. Empirical Economics, 36, 557-574.

[24] Monteiro, N. P., 2010. Using propensity matching estimators to examine the effect of privatisation on wages. Applied Economics, 42, 1293–1313.

[25] Monteiro, N. P., Portela, M., Straume, O. R., 2010. Firm ownership and rent-sharing. Nipe working paper 13/2010.

[26] Munich, D., Svejnar, J., Terrel, K., 2005. Returns to human capital under the communist wage grid and during the transition to a market economy. Review of Economics Statistics, 87, 100–123.

[27] Naumann, R., 1995. Privatizações e reestruturações. O desafio para o movimento sindical em Portugal, Fundação Friedrich Ebert, Lisboa.

[28] OECD, 1989. OECD Economic Surveys, Portugal, 1988-89, OECD, Paris.

[29] OECD, 1991. OECD Economic Surveys, Portugal, 1990-91, OECD, Paris.

[30] OECD, 1999. OECD Economic Surveys, Portugal, 1998-99, OECD, Paris.

[31] Parker, D., Martin, S., 1996. The impact of UK privatisation on employment, profits and the distribution of business income. Public Money & Management, 16, 31–37.

[32] Peoples, J, Talley, W., 2001. Black-white earnings differentials: privatisation versus deregulation. American Economic Review, 91, 164–168.

[33] Pinho, P. 1999. Reprivatizações e eficiência no sistema bancário Português. Documento de trabalho n^o 13 (Lisboa: Direcção Geral de Estudos e Previsão, Ministério das Finanças)

[34] Robert, P., Escoufier, Y., 1976. A unifying tool for linear multivariate statistical methods: the RV coefficient. Applied Statistics, 25, 257–265.

[35] Sousa, F. and Cruz, R., 1995. O Processo de Privatizações em Portugal, Associação Industrial Portuense, Porto.

[36] Villalonga, B., 2000. Privatization and efficiency: differentiating ownership effects from political, organizational, and dynamic effects. Journal of Economic Behavior and Organization, 42, 43–74.

Most Recent Working Paper

NIPE WP 16/2010	**Figueiredo, Adelaide, Fernanda Figueiredo, Natália Monteiro e Odd Rune Straume,** "Restructuring in privatised firms: a Statis approach", 2010
NIPE WP 15/2010	**Sousa, Ricardo M.,** "Collateralizable Wealth, Asset Returns, and Systemic Risk: International Evidence", 2010
NIPE WP 14/2010	**Sousa, Ricardo M.,** "How do Consumption and Asset Returns React to Wealth Shocks? Evidence from the U.S. and the U.K", 2010
NIPE WP 13/2010	**Monteiro, Natália., Miguel Portela e Odd Rune Straume,** "Firm ownership and rent sharing", 2010
NIPE WP 12/2010	**Afonso, Oscar, Sara Monteiro e Maria Thompson.,** "A Growth Model for the Quadruple Helix Innovation Theory ", 2010
NIPE WP 11/2010	**Veiga, Linda G.,**" Determinants of the assignment of E.U. funds to Portuguese municipalities", 2010
NIPE WP 10/2010	**Sousa, Ricardo M.,** "Time-Varying Expected Returns: Evidence from the U.S. and the U.K", 2010
NIPE WP 9/2010	**Sousa, Ricardo M.,** "The consumption-wealth ratio and asset returns: The Euro Area, the UK and the US", 2010
NIPE WP 8/2010	**Bastos, Paulo, e Odd Rune Straume,** "Globalization, product differentiation and wage inequality", 2010
NIPE WP 7/2010	**Veiga, Linda, e Francisco José Veiga,** "Intergovernmental fiscal transfers as pork barrel", 2010
NIPE WP 6/2010	**Rui Nuno Baleiras,** "Que mudanças na Política de Coesão para o horizonte 2020?", 2010
NIPE WP 5/2010	**Aisen, Ari, e Francisco José Veiga,** "How does political instability affect economic growth?", 2010
NIPE WP 4/2010	**Sá, Carla, Diana Amado Tavares, Elsa Justino, Alberto Amaral,** "Higher education (related) choices in Portugal: joint decisions on institution type and leaving home", 2010
NIPE WP 3/2010	**Esteves, Rosa-Branca,** "Price Discrimination with Private and Imperfect Information ", 2010
NIPE WP 2/2010	**Alexandre, Fernando, Pedro Bação, João Cerejeira e Miguel Portela,** "Employment, exchange rates and labour market rigidity", 2010
NIPE WP 1/2010	**Aguiar-Conraria, Luís, Pedro C. Magalhães e Maria Joana Soares,** "On Waves in War and Elections - Wavelet Analysis of Political Time-Series", 2010
NIPE WP 27/2009	**Mallick, Sushanta K. e Ricardo M. Sousa,** "Monetary Policy and Economic Activity in the BRICS", 2009
NIPE WP 26/2009	**Sousa, Ricardo M.,** " What Are The Wealth Effects Of Monetary Policy?", 2009
NIPE WP 25/2009	**Afonso, António., Peter Claeys e Ricardo M. Sousa,** "Fiscal Regime Shifts in Portugal", 2009
NIPE WP 24/2009	**Aidt, Toke S., Francisco José Veiga e Linda Gonçalves Veiga,** "Election Results and Opportunistic Policies: A New Test of the Rational Political Business Cycle Model", 2009
NIPE WP 23/2009	**Esteves, Rosa Branca e Hélder Vasconcelos,** " Price Discrimination under Customer Recognition and Mergers ", 2009
NIPE WP 22/2009	**Bleaney, Michael e Manuela Francisco,** " What Makes Currencies Volatile? An Empirical Investigation", 2009
NIPE WP 21/2009	**Brekke, Kurt R. Luigi Siciliani e Odd Rune Straume,** "Price and quality in spatial competition", 2009
NIPE WP 20/2009	**Santos, José Freitas e J. Cadima Ribeiro,** "Localização das Actividades e sua Dinâmica", 2009
NIPE WP 19/2009	**Peltonen, Tuomas A., Ricardo M. Sousa e Isabel S.Vansteenkiste** "Fundamentals, Financial Factors and The Dynamics of Investment in Emerging Markets", 2009