Absenteeism and Peer Interaction Effects: Evidence from an Italian Public Institute

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1. Introduction

A number of empirical studies argue that absenteeism is a serious problem in many countries. Barmby, Ercolani and Treble (2002) show that sickness absence rates range from 1.78 for Switzerland to 6.31 for Sweden. There is also empirical evidence that public sector workers are usually more prone to taking sick leaves compared with similar employees working in the private sector (Winkelmann, 1999; Banerjee, Duflo, 2006).

In Italy, as frequently lamented in the press (for example Corriere della Sera, Agu 24th 2006; Dec 4th 2007; Sole24Ore, Mar 3rd 2008, Apr 16th 2007; The Economist, Agu 28th 2008), differences between private and public sector absenteeism are impressive: data from the Italian Economic Ministry (Ragioneria Generale dello Stato) show that in year 2006 the Italian public sector employees took 11 days off due to sick-leave, from 30% to 50% more than their private sector counterparts (according to a note of the public-administration minister Brunetta)[1].

Public sector absenteeism produces direct and indirect costs: the public administration sustains the costs of wage payment to the absent workers and in many cases it has to pay the wage costs due to their substitutes (for example, in public schools, temporary contracts are used to hire teachers replacing absent workers); indirect costs also play an important role, especially in terms of adverse effects on the quality of services offered. In a recent speech, the leader of the Italian employers' federation (Confindustria), Montezemolo, claimed that absenteeism in the Italian public sector costs the taxpayer the equivalent of one point of GDP.

In spite of the magnitude of the phenomenon, also due to the lack of suitable data, little economic research has been conducted to understand the determinants of absenteeism among public sector employees.

As suggested by previous studies, absenteeism can be related either to health factors or to shirking behaviour. Being able to disentangle these aspects and to distinguish between voluntary absence and involuntary absence is a crucial point to design adequate policy responses to absenteeism. In fact, the right to absence when sick is a central part of the 'contract' between employer and employee, and those who are off work, sick, have the right to expect sensitive treatment and support. On the other hand, since it is often very costly to ascertain individual health condition, people may be tempted to assume opportunistic behaviours taking days off also when they are not genuinely sick, imposing in this way

[1] Self reported data from the Bank of Italy's Survey of Household Income and Wealth (SHIW) point at a difference between absence rates in the private and public sector of 20%. According to other sources this difference is much higher, for example Giacalone (2008) argues that absenteeism is four times higher in the public sector than in private companies.

considerable costs on the organization employing them[2]. As a consequence, being able to identify drivers for absence frequency and to take the necessary actions would permit public administrations to save large amounts of money[3].

However, it is generally difficult to disentangle absence due to shirking behaviour from genuinely sickness leaves. Recently, some authors (Ichino, Maggi, 2000; Bradley et al., 2007) have looked at the existence of peer effects on individual absences as an indicator of shirking behaviour. A positive relationship between individual absenteeism and peer group absenteeism would suggest that absence is more likely to be due to shirking rather than to sickness.

In this study we follow a similar approach in trying to understand whether shirking behaviour plays a relevant role in shaping absence rates of public sector employees. We use a unique dataset on a sample of 329 workers, which are employed at the Italian National Social Security Institute, INSSI, (Istituto Nazionale della Previdenza Sociale). More precisely our data concern 8 units of the INSSI located in a province of the South of Italy. We explain absence rates both considering variables that may be related to individual health conditions and to variables that may hide shirking behaviour. Among these variables we especially focus our attention on the influence produced by social interactions and group behaviour.

While many other works on this subject rely on measures of absence that are based upon self-reported absence information, we have very accurate administrative data. This allows us to avoid problems related to misreporting[4] and to provide a very reliable analysis on the determinants of absenteeism in the public sector, which is particularly relevant given the little statistical work available on the subject.

The first part of the paper is devoted at analysing the determinants of public sector workers' absenteeism, focusing on personal and job characteristics. We show that a number of variables, which are typically not related to individual health condition, such as contractual form and agency size, are relevant in determining absence rates. This first evidence suggests that sickness absence is at least partially due to shirking behaviour.

In the second part of the paper, we investigate group interaction effects on absenteeism. More precisely, we analyse how the absence rate of employees is affected by the absenteeism behaviour of co-

[2] Psychological theories suggesting that absenteeism may enhance efficiency by providing workers in stressful situation with a temporary relief (Steers and Rhodes, 1978), do not seem relevant when absenteeism becomes such a diffuse phenomenon as in the Italian public sector.

[3] Renato Brunetta, the public-administration minister of the current Italian government, has recently (August 2008) imposed by decree a rule that, after the second absence in any year, only medical certificates issued by the public health service will be acceptable. In addition he has introduced productivity bonuses based in part on attendance records. Our data, concerning absences in 2007, do not allow to analyse the effect of this policy intervention.

[4] For example, Johns (1994) reports that employees tend to be absent more than twice as often as their self-reports indicate and individuals with higher actual absences tend to be more inaccurate in their self-reports than individuals with lower actual absence.

workers. We consider employees working in the same division as the relevant sphere of social interaction: on the one hand these workers are required to cooperate and communicate among them and by this way they contribute to the shaping of their working environment, on the other hand they interact on daily basis and tend to establish friendly relationships. Then, for each worker *i* we consider as members of his/her peer group all the workers employed in the same division and peer absence behaviour is calculated as the average of absence rates of individuals in the group.

As it is well known in the economic literature (Manski, 1993), empirical analyses trying to detect peer group effects face two main problems: one is related to the fact that individuals generally choose their peers (self-selection problem) and the choice can be related to unobservable individual factors; the other, known as reflection problem, emerges because members of the same group undertake interdependent behaviours, in our case the shirking behaviour of each member affects shirking of all other members, but at the same time it is influenced by how all other members behave. Different strategies have been adopted to overcome these problems: some works rely on situations in which peers are randomly assigned (for example Sacerdote, 2001; Zimmermann, 2003); other analyses use an instrumental variable approach trying to identify exogenous determinants of peer groups (Case and Katz, 1991; Gaviria and Raphael, 2001; Hanushek et al., 2003); some authors add group specific fixed effects (when more than one observation for group is available) to control for correlated unobservables.

Self selection problems are not a major concern in our analysis as our sample employees are not able to choose among different divisions or even among different units. In order to obtain a job at the Italian National Social Security Institute it is necessary to win a national competition. Once the job has been obtained the assignment to different units and within the same unit to different divisions is related to the particular needs of the Institute[5]. Employees during their career can change divisions due to career advancements, but also in this case the procedure is very formal and it is necessary to pass a competition for any place that becomes vacant. Only in very special cases workers can ask to change division, but the head of the personnel office explained us that this is very unusual and the few demands that were presented over time were all rejected.

To deal with reflection problems we use Two-Stage Least Squares estimation and instrument peer absences with the percentage of females in the division. We pointed at this particular predetermined feature of peer groups, since according to our analysis the gender variable has a strong impact on absence behaviour, while other personal characteristics play a minor role. This variable should not directly affect individual *i* absence rate, but may have a relevant impact on peer absenteeism. To be more concrete, we do not expect that working in a division characterized by a greater female presence directly affects the individual decision to be absent, but it may influence one's propensity to be absent mainly through the increased probability that one's peers are absent.

[5] This information has been provided by the head of the personnel office.

From our analysis it emerges that absenteeism is strongly influenced by peer group effects and that workplace absence norms produce a relevant effect on individual shirking. In our Instrumental Variable preferred specification, we find that an increase of one standard deviation in peer group absence rate produces an increase in individual *i* absence rate of 0.28 standard deviations (the OLS estimates show a smaller coefficient equal to 0.16).

As the higher absence rates observed in certain divisions may also be due to a contagion effect, we have tested the "social interaction assumption" analysing the effect produced by peer absences due to family-study leaves on individual sickness absences. From our analysis it emerges that individuals whose peers have higher absence rates due to family-study leaves tend to be more often absent due to sickness reasons, giving support to the idea that the higher absenteeism observed in certain divisions is likely to be due to social interaction effects rather than to contagion effects.

The paper is organized as follows. Section two discusses the related literature. In section three data are presented and some descriptive statistics are offered. In section four we estimate a simple OLS model to examine the effect of a number of personal and job characteristics on absenteeism. Section five investigates peer group effects and presents both OLS and 2SLS estimates. Section six concludes.

2. Related Literature

An increasing economic literature is devoting attention to absenteeism and many papers have analysed its determinants and costs. Browns and Sessions (1996) in their survey of the relevant theoretical and empirical research, discuss a large number of works, which highlight the influence of many variables on absenteeism.

Some of these variables are related to health factors (inabilities, gender, working conditions, etc), while others are related to incentives and contractual aspects (the availability of sickness benefits, employment protection, firm size, labour market conditions) or to job satisfaction and absence culture.

However, it is often difficult to distinguish among them, since some factors that may influence health conditions, may also be related to the employee shirking behaviour. For example, the gender effect may be due to biological differences between men and women, but it may also be related to differences in shirking propensity (see Ichino and Moretti, 2008).

Different strategies have been adopted in order to try to disentangle absences due to shirking behaviour. An early approach followed in the economic literature (Auditor General, 1997; Imants and van Zoelen, 1995) was based on the analysis of absence spell length: absence periods exceeding a given number of days were generally considered as involuntary and only shorter episodes were expected to be influenced by motivational and shirking variables. But criteria based on absence length are not free from

criticisms: as suggested by Driver and Watson (1989), they may produce unreliable predictions, since a long spell absence could be as voluntary as short spells and sequences of short absence spells may be due to recurring sickness instead of being related to shirking behaviour.

Other works, based on the principal-agent theory, have investigated the relationship between absenteeism and variables such as incentives, monitoring and firing costs, labour market conditions. From some of these works it emerges that employees have reduced rates of absenteeism when they experience a wage decrease upon absence, implying that shirking behaviour is influenced by the incentive structure. (Barmby et al. 1995, Johansson and Palme, 1996; Henrekson and Persson, 2004; Hassing and Koning, 2005). In addition, a number of empirical analyses shows that absence rates increase when monitoring costs increase. For example, Winkler (1979) and Winkelman (1999) show a negative relationship between firm size and absence rates, which can be explained in relation to the higher monitoring costs faced by larger firms. Other works have analysed the relationship between firing costs and absence behaviour (Ichino and Riphahn, 2005; Engellandt and Riphahn, 2005; Arai and Thoursie, 2005). They find that temporary workers and workers on probation are less likely to be absent and show lower absence rates. These results can be interpreted considering that shirking is particularly costly for these workers, since they work under contractual arrangements characterized by less severe firing restrictions.

As far as labour market conditions are concerned, the empirical literature highlights that absenteeism is inversely related to the unemployment rate (Leigh, 1985). According to the standard efficiency wage model (Shapiro and Stiglitz, 1984), this may depend on the fact that the threat of being fired, if the employee is discovered to shirk, is more effective when unemployment is high.[6]

Particularly relevant for this paper are some recent works examining peer group effects on individual shirking behaviour. Group interaction effects have been extensively studies in relation to educational outcomes and social phenomena, such as crime, alcohol, drug use, etc. (Case and Katz, 1991; Sacerdote, 2001; Gaviria and Raphael, 2001; Kremer, 2008). As regards shirking, these kind of effects can operate among co-workers via different mechanisms mainly based on monitoring and stigma channels: in fact, both peer monitoring and stigma are lower when shirking represents a diffuse and acceptable behaviour. Following this type of reasoning, Ichino and Maggi (2000), in a paper studying regional absenteeism differentials within a large Italian bank, show that peer group interaction effects play a relevant role in explaining these differentials. A similar result has been obtained by Bradley et al. (2007) analysing the impact of group interactions on the absence behaviour of primary and secondary school teachers.

[6] However, it is worthwhile to say that the negative relationship between unemployment rate and absences may also depend on employers' dismissal decisions. If employer can choose whom to lay-off, workers with higher absence rates will be those who are fired first in a recession, this results in a change in workforce composition over the business cycle (Arai and Thoursie, 2004).

3. Institutional framework, data and descriptive statistics

Our analysis uses personnel data obtained from 8 units of the Italian National Social Security Institute (INSSI). These units are located in a Southern Italian province and employ 329 workers. Our data refer to year 2007 and offer detailed information on a number of personal characteristics (such us gender, number of sons, place of residence, education, age, number of hours contracted to work, tenure, wage etc.), on a number of work-place characteristics (such as place of work, unit-size, occupational codes, work division etc) and on different measures of absence (absence due to sickness, absence due to family-study leaves, time off due to the participation to union assemblies, leaves to blood donors and leaves to persons with disabilities or to individuals with family members who have a handicap).

We focus our attention mainly on absences due to sickness. However, we also provide some descriptive statistics considering the other measures of absenteeism we have at hand.

According to the National Collective Employment Contract of public sector workers (C.C.N.L) absences for sickness must be justified by a doctor's certificate (within the first two day of sickness). The employer can ask for an additional "official medical check", which has to be performed by doctors who are not chosen by workers, but autonomously appointed by subjects involved in monitoring sick absences. However, since health conditions are difficult to ascertain even for competent doctors, sickness absence may hide shirking behaviour. This also because employees are generally fully-insured against earning losses due to sickness, and as a consequence they may be induced to take days off and obtain their wage without providing any effort. This aspect is particularly relevant for the workers considered in this study, since Italian public sector employees, until August 2008, were entitled to full replacement of wage income (including all allowances or emoluments of a fixed, continuative nature" and "all other ancillary economic benefits") for the first nine months of sickness[7].

Our data-set does not provide information on absence spell length and for each type of absence, we only have information of the total number of hours the worker has been away from work during the year 2007. The measure of absence we use is the ratio of the number of hours absent to the number of hours contracted to work. As in Barmby et al. (1999) and Barmby et al. (2002) we define the absence rate R_i as the ratio of the total number of hours of absence (due to sickness, to study-family leaves etc.), A_i,

[7] A note signed in June 2008 by the minister (approved by decree in August 2008), Renato Brunetta, to all branches of the public administration, points out that official medical checks "are always mandatory". For each period of illness, the first days of absence will incur a reduction in pay, regardless of duration, although not all elements of salary will be affected. Cuts will apply to "all allowances or emoluments of a fixed, continuative nature" and "all other ancillary economic benefits". In addition, productivity bonuses will be earned "only in proportion to work actually performed and the results achieved".

recorded by the administrative office in year 2007, to the total number of contracted hours, T_i, for the same year, then: $R_i = A_i / T_i$ [8].

Table 1 reports absence rates considering different measures of absence based on different type of leaves. The average absence rate due to sickness is of about 5%, corresponding to an average of about 12 days of sick leave. The absence rates due to family-study leaves and related to handicaps are also quite high, respectively 2.7% and 2%, while the absence rates due to other causes are negligible. The total absence rate is on average of 10.5%, which corresponds to 25 days off work during the year.

These descriptive statistics show the existence of a substantial amount of heterogeneity in the absenteeism behaviour of workers. On average, 22% of them are never absent due to sickness reasons, while at the opposite end of the distribution, 10% of our sample employees accumulate more than 22 days of absence over the year. Sharper differences emerge when we consider absences due to family-study reasons: 32% of workers never take this type of leave, while workers in the top 10% of the distribution show about 50 days of absence. When we look at the total absence rate it emerges that only about 8% of workers are never absent, workers in the lower 50% of the distribution show on average a total absence rate of 2%, while those in the upper 50% of the distribution present an average total absence rate of 18%.

Table 1. Absence rates

Absence Rate	*Mean*	*Std. Dev.*	*Min*	*Max*
Leaves due to illness	0.050	0.067	0	0.383
Family and study Leaves	0.027	0.094	0	0.849
Leaves due to union activities	0.003	0.014	0	0.175
Leaves to blood donors	0.0003	0.002	0	0.016
Leaves related to handicaps	0.020	0.045	0	0.266
Total leaves	0.101	0.124	0	0.853

In Table 2 we report some descriptive statistics on the employees subject to this study. They are on average in their fifties, about 50% of them are female and 36% have obtained a university degree. 81% of workers have at least one son, while the average number of sons is of 1.58. Unfortunately we do not have information on the age of sons.

Table 2. Summary Statistics

	Mean	*Std. Dev.*	*Min*	*Max*	*Observations*
Female	0.523	0.500	0	1	329
University Degree	0.362	0.481	0	1	329
Number of sons	1.583	0.944	0	4	329

[8] However, since 95% of the employees have the same number of contracted hours, this measure is not very different from that based on the total number of absence hours.

Age	49.607	7.091	29	66	329
Age^2	2513.97	696.296	841	4356	329
Dummy for workers travelling to work	0.526	0.500	0	1	329
Km distance from workplace	28.613	116.266	0	1071	329
Dummy for residence in a different province	0.030	0.171	0	1	329
Tenure	20.263	10.622	0	39	329
Yearly Gross Wage	38448	15283	7281	182081	329
Dummy for employees hired in year 2007	0.030	0.171	0	1	329
Dummy for division manager	0.078	0.269	0	1	329
Unit size	184.055	100.948	4	243	329
Division size	14.214	4.781	1	22	329
Divisions sharing the same supervisor	0.229	0.421	0	1	329
Blood donors	0.042	0.202	0	1	329
Union	0.305	0.461	0	1	329
Handicap	0.193	0.395	0	1	329
Peer-absence rate due to sickness	0.053	0.028	0	0.135	329

About 47% of workers live in the same town in which the unit employing them is located; on average the distance from the place of residence to the workplace is of 28 kilometres. The 3% of the sample workers have been hired in 2007 and, according to National Collective Employment Contract of public sector employees, for the first six months after hiring were on probation[9]. It is worthwhile to notice that during this period the employer is allowed to dismiss the worker without reason or warning.

As far as occupational variables are concerned, the workers we consider are mainly employed in administrative jobs, which can be classified along three main levels: at the lower occupational level is employed the 13% of the workers, 75% of workers have a job classified at the intermediate level, while 12% of them have a top level job. The average tenure is of 20 years and the average yearly gross wage is of about 38,400 euros.

73% of the sample workers are employed in a large unit (employing 243 workers), while the remaining work in small units with an average size of 15 workers. Within the same unit workers are organized along different divisions. The average size of a division is of 13 employees. Each division generally deals with a particular type of activity, for example family support, income support, self-employed pensions etc. Tasks managed by employees of different divisions are quite similar.[10] We consider as peers of employee *i* all the workers employed in the same division in which individual *i* is employed. The peer average absence rate is of 5.3%, ranging from 0 to 13.5%.

Using data from leaves due to union activity participation and blood donations we have defined two dummy variables, *Union* and *Blood_donors*, taking value one when workers have obtained leaves

[9] The Italian legislator set an upper limit to the length of probationary periods at the beginning of a labour contract of six months. This is also the length of probation established for public sector employees.

[10] The smaller units are not always organized along divisions and in these cases the unit is treated as a division.

motivated respectively by union activity participation and by blood donations. Similarly, we infer information on personal or family disabilities from the information we have on leaves due to these reasons and define a dummy *Handicap* taking value one when the worker has obtained this kind of leave. It emerges that 19% of workers have obtained leaves in relation to personal or family disabilities, while 30% of them have participated to some union activity and 4% of them are blood donors.

As far as peers are concerned we choose divisions as the relevant sphere of interaction. As a consequence, we consider

3. The Effect of Personal and Job Characteristics on Absence Rates

In this section we analyse the effect of personal and job characteristics on public sector absenteeism, focusing on absences due to sickness. The dependent variable, F_i, is formulated in two ways: as the ratio $R_i = A_i / T_i$ and as a log-odds ratio $\ln[R_i /(1-R_i)]$, since the distribution of R_i is not normal, being restricted between 0 and 1 and with a mass on 0[11]. We then estimate by OLS the following simple model:

[1] $$F_i = \alpha P_i + J_i + D_k + \varepsilon$$

where P_i is a vector of individual characteristics, J_i is a vector of job characteristics and D_k is a dummy variable to capture unobserved unit effects, with $k = 1....8$.

Table 3 reports estimates of Eq. (1). In all specifications, standard errors (reported in parentheses) are corrected for heteroskedasticity. Since the treatment is occurring at the division level, we cluster standard errors at this level to correct for serial correlation within divisions across time. All variables have been standardized to render the interpretation of marginal effects more straightforward.

The main personal characteristics we consider are: sex, age, education, number of sons, a dummy for employees travelling to work[12] and a dummy for those whose residence is different from the province in which the units providing data are located. Among the job features, we observe: tenure, yearly gross wages, unit size and a dummy variable for workers who in 2007 were under probation.

In columns (1) and (2) are reported OLS estimates, including unit fixed effects, when we consider as dependent variable respectively the absence rate due to sickness R_i and $\ln[R_i /(1-R_i)]$.

[11] We have used the approximation $\ln[0/(1-0)] = -5.8$ to account for the indeterminacy of the extreme of the distribution.

[12] In an alternative specification we control for the distance to workplace, but results remain substantially unchanged.

The dummy female is positive and statistically significant in both specifications (respectively at 5% and at 1% level in the two specifications) implying that female employees are more absent from work. This result can be related either to the gender division of household work, to a weaker attachment to work of females (Viscusi, 1980; Leigh, 1983) or to biological differences between males and females (Ichino and Moretti, 2008).[13]

Age produces a positive effect on absenteeism due to sickness, which may be due to the fact older individuals tend to have worst health conditions or to be less attached to their job. As it is possible to see in columns (1) and (2) the effect is statistically significant (at 10% level) only when we measure our dependent variable with the absence rate R_i. We have also considered the possibility of a non-linear relationship between age and absenteeism by including an age squared term in our regressions. The quadratic term shows the expected negative sign, but it is statistically significant only in the first specification (at 10% level).

The number of sons has a negative but not statistically significant effect. The negative coefficient shown by this variable can be due to the fact that in the Italian public sector, employees can use special leaves for family needs.[14] Employees with a university degree have a lower propensity to be absent due to sickness reasons, however, the effect is not statistically significant in both specifications[15].

Table 3. The effects of personal and job characteristics on absence rates. OLS estimates

	$R_i = A_i / T_i$	$\ln[R_i /(1-R_i)]$	$R_i = A_i / T_i$	$\ln[R_i /(1-R_i)]$
Female	0.299**	0.486***	0.258**	0.446***
	(0.126)	(0.109)	(0.126)	(0.106)
University Degree	-0.206	-0.149	-0.213	-0.164
	(0.124)	(0.109)	(0.122)	(0.109)
Number of sons	-0.001	-0.026	-0.004	-0.035
	(0.027)	(0.037)	(0.028)	(0.035)
Age	0.659*	0.674	0.631*	0.601
	(0.334)	(0.404)	(0.314)	(0.387)
Age^2	-0.645*	-0.646	-0.631*	-0.576
	(0.379)	(0.432)	(0.356)	(0.411)
Dummy for employees travelling to work	0.102	0.137	0.102	0.148
	(0.125)	(0.107)	(0.126)	(0.111)
Dummy_different_ province	-0.167	-0.160	-0.125	-0.127
	(0.207)	(0.367)	(0.201)	(0.371)
Tenure	0.069	0.036	0.088	0.075
	(0.098)	(0.096)	(0.099)	(0.090)

[13] However, since the female dummy is positive and statistically significant also when we consider measures of absences that are not related to health conditions, for example absence due to family or study leaves, the higher absenteeism of females cannot be exclusively related to biological aspects.

[14] In fact, when we consider the total absence rate or the absence rate due to family and study leaves it emerges that employee with sons have a higher rate of absence.

[15] The negative impact of an higher level of education on absenteeism may be related to the fact that better educated individuals tend to devote more attention to health problems and to prevention schemes or it may be due to motivational issues, since more educated people generally perform better jobs, which are usually associated with a higher degree of job satisfaction.

Yearly Gross Wage	-0.114*	-0.138**	-0.106*	-0.114**
	(0.065)	(0.025)	(0.061)	(0.048)
Probation	-0.653***	-1.802***	-0.596***	-0.958***
	(0.200)	(0.190)	(0.188)	(0.192)
Unit size	0.292***	0.327***	0.280***	0.314***
	(0.049)	(0.065)	(0.049)	(0.067)
Handicap			0.261*	0.380***
			(0.041)	(0.125)
Union			-0.021	0.160
			(0.119)	(0.127)
Blood donors			-0.256	-0.084
			(0.177)	(0.248)
Constant	-0.215*	-0.397**	-0.219*	-0.500***
Observations	329	329	329	329
R-squared	0.103	0.150	0.115	0.174

Standard errors (corrected for heteroskedasticity) and incorporating clustering grouped by division are reported in brackets. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at 1, 5, and 10 percent levels.

Nor the dummy variable for individuals travelling to the workplace neither that for being resident outside the province in which the units we consider are located show a statistically significant effect.

As far as job characteristics are concerned, from our estimates it emerges a negative relationship between yearly gross wage and absenteeism, which is statistically significant in both specifications (respectively at 10% and 5% level). An increase of one standard deviation in yearly gross wages produces a reduction of the absence rate going form 0.11 to 0.14 standard deviations, according to the specification. Similar results are been found by Drago and Wooden (1992) and Chaudhury and Ng (1992), while Leigh (1991) finds no impact of wages and paid sick leave on individual absenteeism.[16] On the other hand, once we control for wages and age, tenure does not produce any statistically significant effect.

In addition, it emerges that the size of the unit is relevant for employees absence behaviour and an increase in the unit size produces an increase in the rate of absence. The effect is statistically significant in both specifications at 1% level. This corroborates previously reported findings. For example Winkelmann (1999) finds that workers in large firms (with 201 to 2000 employees) have 1.8 more absence days than workers in smaller firms (with 21 to 200 employees).

Finally, from our analysis it emerges that employees who in year 2007 where on probation take significantly fewer days of absences than their colleagues (the effect is statistically significant in both specifications at 1% level). This is in line with findings obtained by works investigating the relationship between employment protection legislation and workers' shirking behaviour. For example, Ichino and Riphahan (2005), analysing the behaviour of the employees of a large Italian bank during and after probation find that absenteeism is significantly lower during the probationary period.

[16] We have also experimented including among regressors a dummy variable for employees who are division manager. The effect is negative but statistically insignificant, while no other substantial effects emerge.

In column (4) and (5) we have included among regressors the dummy variables *Handicap*, *Union* and *Blood_donor*s. As expected, it emerges that absence is higher among persons with disabilities or individuals with family members who have a handicap (the effects is statistically significant at 10% and 1% level according to the specification). Being a blood donor produces a negative but statistical insignificant effect on absence rates. Finally, being involved in union activities produces an ambiguous effect since the sign of the dummy variable *Union* changes from negative to positive according to the measure of absence adopted (it is never statistically significant).

The pseudo R2 measures are low in all specifications, but they are comparable with those found in other studies (eg., Allen, 1981, and Barmby and Treble, 1991). Overall, the estimates are generally well defined and of the expected sign.

4. Peer effects on absence behaviour

In this section we examine the effects produced by group interactions on individual absence behaviour. We firstly describe our econometric methodology and then we present both OLS and 2SLS estimates.

4.1. Empirical Methodology

Our analysis is now devoted at establishing whether the individual absence rate is affected by the absence behaviour of his peers. The definition of the relevant sphere of interaction poses a number of problems, since it is not clear whether individuals are mainly influence by their friends, by people from their place of residence, or by co-workers. Our definition of peer group is based on workers employed in the same division. We think that subjects working together, interacting on daily basis, tend to establish friendly relationships and as a consequence the division in which the employee works may represent the relevant sphere of interaction.

Our empirical specification follows Case and Katz (1991) and Gaviria and Raphael (2001). We extend the simple model represented by equation [1] as follows:

[2] $$F_i = \alpha P_i + J_i + D_K + \overline{A}_i + \varepsilon$$

where $\overline{A}_i$ is the average incidence of absenteeism among co-workers of individual *i*. More precisely peer absence behaviour is calculated as the average of absence rates of workers employed in the same division employing worker *i*: $\overline{A}_i = \frac{1}{N_d}\sum_{n=1}^{N_d} F_n$ where F_n measures absences of individual *n* working in division *d* with subject *i* and N_d is the number of peers in the division *d*.

According to the specification proposed in equation [2], the absence behaviour of individual is influenced by the behaviour of his/her peers, but it is not directly affected by the average predetermined characteristics of his/her peer group, $\overline{P_i}$, which are assumed to affect his/her absences only indirectly through peer interactions.

The estimation of equation [2] poses a number of econometrics problems. First, we have to deal with the so-called reflection problem, in fact on the one hand the average behaviour of peers influences individual behaviour, but on the other hand individual absence behaviour also affects group absenteeism. Second, employees may sort according to some personal unobservable characteristics in different divisions generating relevant endogeneity problems. Third common shocks or correlated effects may influence individuals belonging to the some group. For example, in our case, certain divisions may involve more unpleasant tasks.

We are confident that the second bias is not relevant for our estimates since, as explained in detail in section one, the assignment of workers to divisions depends exclusively on the needs of the INSSI. Individuals are assigned to a division instead than to another at the beginning of their career in relation to the opening of a vacancy in that particular division, due for example to the retirement decisions of older workers, etc. Employees are not able to choose and the assignment is random conditional on the fact that the employee meets some formal requirements, generally in terms of level and type of education acquired[17]. During their career employees can move from a division to another only in very special cases, defined by a law[18]. According to the head of the personnel office these cases are extremely rare.

The correction for the second source of bias is based on the assumption that contextual effects are not relevant and, as a consequence, there is no direct relationship between subject i's absence behaviour and the average pre-determined characteristics of his/her co-workers, $\overline{P_i}$. These variables should not produce a direct influence on the absence behaviour of individual *i*, but may have a relevant impact on peer absenteeism. In fact individuals working in a division characterized by a greater female presence or by a larger proportion of graduate colleagues should not be directly influenced by these aspects in their absence decisions, while they may result indirectly affected since these pre-determined peer group characteristics tend to influence peer group absences.

[17] The Italian law offers a high level of protection in terms of equal opportunities among different types of workers.
[18] "Regolamento organico del personale", November-1990.

We have experimented using different set of average pre-determined peer characteristics, however only the proportion of females in the division turns out to be relevant in explaining peer average absence behaviour. Then, we have instrumented peer absence behaviour with the proportion of females in the division. We think that, since contextual effects should not be relevant in our case, this instrument, *f*, comply with the usual conditions: the instrument is correlated with the endogenous variable, $Cov(Peer\_absence\_rate, f) \neq 0$ and it does not affect directly individual *i* absence behaviour $Cov(f, \varepsilon) = 0$.

The use of the proportion of females as an instrument also helps at avoiding problems deriving from common shock bias.

In the next section we present both OLS and 2SLS estimates of equation [2].

4.2. OLS and 2SLS Estimation Results

Table 4 presents OLS estimates of alternative specifications of our model considering as dependent variable $R_i = A_i / T_i$ and $\ln[R_i /(1 - R_i)]$.

In estimates shown in columns (1) and (2) we have not included among our controls the three dummy variables *Handicap, Union, Blood_donor*. It emerges that, controlling for personal and job characteristics, peer effects appear positive and significant. An increase in the absence rate of the peer group of individual *i* leads to an increase in his absenteeism. As shown in column (1) an increase in peer absence rate of one standard deviation leads to an increase in individual absence rate of 0.16 standard deviations. The coefficient is significant at 5% level. A positive and statistically significant effect (at 5% level) emerges also when we measure the dependent variable using $\ln[R_i /(1 - R_i)]$. No relevant changes are observed when we include among regressors additional controls for union participation, blood donations and handicaps (columns 3 and 4).[19]

Table 4. OLS regressions relating individual absenteeism to peer group behaviour

	$R_i = A_i / T_i$	$\ln[R_i /(1 - R_i)]$	$R_i = A_i / T_i$	$\ln[R_i /(1 - R_i)]$
Peer absence rate	0.161**	0.192**	0.157**	0.176**
	(0.069)	(0.087)	(0.069)	(0.086)
Female	0.287**	0.466***	0.245**	0.437***
	(0.127)	(0.105)	(0.109)	(0.104)
University Degree	-0.225*	-0.164	-0.228*	-0.174
	(0.121)	(0.107)	(0.118)	(0.106)
Number of sons	0.009	-0.021	0.005	-0.029
	(0.022)	(0.036)	(0.022)	(0.034)
Age	0.527*	0.512	0.513**	0.465
	(0.267)	(0.408)	(0.247)	(0.392)

[19] The other explanatory variables have approximately the same level of significance as in Table 3.

Age^2	-0.519	-0.481	-0.519*	-0.438
	(0.328)	(0.446)	(0.305)	(0.425)
Dummy for employees travelling to work	0.084	0.121	0.085	0.134
	(0.129)	(0.111)	(0.130)	(0.114)
Dummy_different_ province	-.154	-0.134	-0.106	-0.096
	(0.224)	(0.391)	(0.214)	(0.394)
Tenure	0.076	-0.046	0.090	-0.078
	(0.096)	(0.087)	(0.099)	(0.085)
Yearly Gross Wage	-0.104*	-0.123**	-0.100*	-0.104**
	(0.061)	(0.050)	(0.058)	(0.043)
Probation	-0.532***	-0.923***	-0.498***	-0.838***
	(0.178)	(0.233)	(0.179)	(0.253)
Unit size	0.186***	0.194**	0.174**	0.191**
	(0.069)	(0.087)	(0.072)	(0.089)
Handicap			0.239*	0.354***
			(0.139)	(0.117)
Union			-0.065	0.111
			(0.117)	(0.116)
Blood donors			0.229	-0.058
			(0.178)	(0.255)
Constant	-0.166	-0.321***	-0.153	-0.411***
Observations	329	329	329	329
Number of clusters	28	28	28	28
R-squared	0.123	0.179	0.134	0.199

Standard errors (corrected for heteroskedasticity) and incorporating clustering grouped by division are reported in brackets. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at 1, 5, and 10 percent levels.

However, coefficients deriving from OLS estimates are subject to the reflection problem and cannot be interpreted as casual. On the other hand, they show the degree of correlation in peer absence behaviour.

Table 5 displays 2SLS estimates using as instrument the proportion of females in the division in which individual *i* is employed. In estimates presented in this Table we have excluded among our controls the dummy variables *Handicap, Union* and *Blood_donors,* but results are not influenced by this choice.

The effects of personal and job characteristics are for the most part very similar to the OLS estimates. The 2SLS estimates of peer effects are higher compared to OLS estimates, suggesting that simultaneity problems produce a downward bias on the estimates of peer influence (similar results are obtained by Gaviria and Raphael, 2001). For example, when we measure absence behaviour using the absence rate R_i, from 2SLS estimates we find that an increase of one standard deviation in peer group absence rate produces an increase in individual i absence rate of 0.29 standard deviations, while the OLS estimates pointed to a smaller effect, of about 0.16.

In columns (3) and (4) are reported estimates on a smaller sample including only workers employed at the larger unit. As already explained workers are not able to select among different units, however, if any selection is possible we think that it could be at unit level, since workers may try to get a job in a unit that is located near to their place of residence. To avoid problems that may derive from this type of selection, we focus only on the main unit employing the majority of our sample workers. In columns (3) and (4) are shown estimates for this sub-sample, using as dependent variable respectively R_i

and $\ln[R_i/(1-R_i)]$. The main results remain substantially unchanged, the peer effect is only slightly higher in the first specification and slightly smaller in the second compared to estimates referring to the full sample.

Finally, since in divisions in which workers are often sick the influence of peer absenteeism on individual absence behaviour may also be due to a contagion effect, in column (5) are reported estimates of the effect produced by the peer absences due family-study reasons on the sickness absence rate of individual *i*. Our measure of peer absence behaviour is now represented by the proportion of peers taking family-study leaves. As shown in column 5, where the dependent variable is $\ln[R_i/(1-R_i)]$, it emerges that individuals whose peers are more likely to be off of work due to family-study leaves tend to be more often absent due to sickness reasons. The same holds true when we measure absences through R_i (estimates are not reported to avoid clattering the Table).

F-statistics, reported at the bottom of Table 5, for the test of whether the instrument coefficient is equal to zero are always well above the threshold value of 10 suggested by Stock and Watson (2003).

Table 5. 2SLS regressions relating individual absenteeism to peer group behaviour

Panel A: Two Stage Least Squares					
	(1)	(2)	(3)	(4)	(5)
	$R_i = A_i/T_i$	$\ln[R_i/(1-R_i)]$	$R_i = A_i/T_i$	$\ln[R_i/(1-R_i)]$	$\ln[R_i/(1-R_i$
Peer absence rate	0.286**	0.320***	0.296**	0.310***	0.314 **
	(0.136)	(0.098)	(0.133)	(0.095)	(0.142)
Female	0.278**	0.452***	0.288*	0.523***	0.092***
	(0.130)	(0.107)	(0.167)	(0.131)	(0.105)
University Degree	-0.240*	-0.174	-0.362**	-0.290**	-0.184
	(0.123)	(0.106)	(0.161)	(0.134)	(0.110)
Number of sons	-0.016	-0.018	-0.033	0.019	-0.001
	(0.020)	(0.036)	(0.026)	(0.039)	(0.039)
Age	0.425	0.402	0.728	0.392	0.309
	(0.310)	(0.452)	(0.458)	(0.505)	(0.469)
Age^2	-0.422	-0.371	-0.648	-0.311	-0.288
	(0.372)	(0.490)	(0.508)	(0.534)	(0.497)
Dummy for employees travelling to work	0.070	0.111	0.070	0.150	0.132
	(0.133)	(0.117)	(0.133)	(0.142)	(0.110)
Dummy_different_ province	-0.027	-0.117	-0.027	-0.400	-0.162
	(0.031)	(0.410)	(0.031)	(0.644)	(0.387)
Tenure	0.082	0.053	0.082	0.022	0.048
	(0.096)	(0.085)	(0.096)	(0.124)	(0.083)
Yearly Gross Wage	-0.097	-0.114**	-0.089	-0.114**	-0.125**
	(0.065)	(0.052)	(0.059)	(0.041)	(0.047)
Probation	-0.438**	-0.817**	-0.528*	-0.752**	-0.685*
	(0.206)	(0.301)	(0.221)	(0.026)	(0.381)
Unit size	0.103	0.105			0.205**
	(0.193)	(0.087)			(0.090)

Panel B: First Stage Regressions					
	Peer absence rate	Peer absence rate	Peer absence rate	Peer absence rate	Peer absence rate
Proportion of females in the peer group	0.063***	3.074***	1.982***	3.182***	3.133***
Female	0.128	0.191	0.115	.182	0.070
University Degree	0.085	0.022	0.090	-.026	0.056
Number of sons	-0.056	-0.028	0-.059	-.034	-0.092
Age	0.417	0.207	0.705	.231	0.509
Age^2	-0.361	-0.190	-0.586	-.165	-0.461
Dummy for employees travelling to work	0.127	0.104	0.147	.124	0.037
Dummy_different_ province	-0.075	-0.122	-0.362	-.584	-0.017
Tenure	-0.075	-0.097	-0.151	-.197	-0.083
Yearly Gross Wage	-0.019	-0.010	-0.018	-.001	0.025
Probation	-0.797**	-0.899***	-1.503***	-1.735***	-1.335***
Unit size	0.639***	0.660***			0.355**
Observations	329	329	243	243	329
R-Squared	0.111	0.166	0.142	0.188	
F-statistics	25.22	46.85	24.26	47.83	40.90

Notes: Panel A reports the Two-Stage Least Squares estimates, instrumenting . Panel B reports the corresponding first stage. Standard errors, corrected for heteroskedasticity, are reported in brackets. The symbols ***, **, * indicate that coefficients are statistically significant, respectively, at 1, 5, and 10 percent levels.

Concluding Remarks

In this paper we have analysed the absence behaviour of public sector employees using a unique dataset on a sample of 329 workers, which are employed at the Italian National Social Security Institute, INSSI, (Istituto Nazionale della Previdenza Sociale). The availability of accurate administrative data allows us to avoid problems related to misreporting and to provide a very reliable picture of the determinants of absenteeism in the public sector, which is particularly relevant given the little statistical work available on the subject.

From our analysis it emerges that absenteeism is a function of personal and job characteristics such as gender, yearly gross wages, contractual arrangements and unit-size. Females and individuals obtaining lower wages show higher absence rates, while subjects under probation and working in smaller units tend to be less absent. While some of these variables may be related to individual health conditions and then suggest that absences occur for valid reasons, others, such as unit-size and contractual arrangement, may hide employee shirking behaviour.

To better investigate the relationship between sickness absences and shirking we have looked at the existence of peer effects on individual absences. A positive relationship between individual absenteeism and peer group absenteeism suggests that absence is more likely to be due to shirking rather than to sickness.

We have considered division as the relevant sphere of social interactions, since individuals who work in the same place and have daily interactions are more likely to influence each other. Thanks to the fact that employees were assigned to different divisions and units exclusively in relation to the institute needs and individuals were not in the condition to choose, we have not to deal with self selection problems. On the other hand, we deal with reflection problems using as instrument of peer absence behaviour the proportion of females in the division. This variable should not directly affect the individual i's absence decisions, but may influence it through group interaction effects.

Our analysis suggest that peer group effects play a crucial role in determining individual absence rate. From OLS estimates it emerges that an increase of one standard deviation in peer group absence rate produces an increase in individual i absence rate ranging from 0.16 to 0.19 standard deviations, according to the specification adopted. 2SLS estimatespoint to higher effects, suggesting that simultaneity problems produce a downward bias on the estimates of peer influence.

These results are in line with those emerging from the previous literature on the subject, showing that individual absence behaviour is related to the absenteeism of co-workers (Ichino, Maggi, 2000; Bradley et al., 2007). In addition, we show that the influence of peer absenteeism on individual absence behaviour is not due to contagion effects. In fact, we find relevant peer effects on sickness absences also when we measure peer absenteeism behaviour considering absences due to family-study reasons.

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