

3.3. *T-Test to countercheck the results*

The variable number of publications in 2000 and 2004 has normal distribution that makes it possible to carry out the inference correctly. The idea in this section is to evaluate the performance of the research bodies in relation to their size from a different point of view. In particular we would like to check, at the probability level  $p=0.99$ , the null hypothesis that the arithmetic mean of the research performance, measured by number of publications, in the period 2000 is equal to those of 2004 period, against the alter-

native hypothesis that the arithmetic mean of the number of publications, in the 2004 is higher than the 2000 due to Italian research policy based on the concentration among the institutes. In symbols  $H_0 : \bar{x}_{2000} = \bar{x}_{2004}$ . The most feasible alternative hypothesis is that research performance increased due to the merger operations  $H_0 : \bar{x}_{2000} < \bar{x}_{2004}$ . T-test is conducted on the left-hand tail of the  $t$ -distribution. More precisely the rejection region will be that  $t$  assumes values above  $t_{\infty,0.01}$ ;

The results are shown in the following tables (9-10).

**Table 9: One-sample Statistics (T-Test)**

	<i>N.</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>
Number of publications 2000	310	31.926	26.059	1.480
Number of publications 2004	108	87.222	58.929	5.671

**Table 10: One-sample Statistics (T-Test)**

	<i>Test Value = 0</i>					
	<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>	<i>Mean Difference</i>	<i>99% Confidence Interval of the Difference</i>	
					<i>Lower</i>	<i>Upper</i>
Number of publications 2000	21.571	309	0.000	31.926	28.090	35.762
Number of publications 2004	15.382	107	0.000	87.222	72.351	102.093

Therefore:

$$t = \frac{31.9258 - 87.2222}{42.4941 \cdot \sqrt{\frac{1}{310} + \frac{1}{108}}} = -11.646$$

The degree of freedoms are:  $n_{2000} + n_{2004} - 2 = 416$ . The theoretical value of

$t_{\infty,0.01} = 2.576$ . The  $t$  calculated is considerably higher than 2.576 and therefore falls within the rejection region. In other words, at the probability level  $p=0.99$ , the research performance of the research institutes in the 2004 period (with larger size) is higher than the research performance of laboratories in 2000 and with smaller size. It is reasonable to think that the difference in research performance between the two years