THE IMPACT OF NATIONAL HOLIDAYS ON ECONOMIC ACTIVITY: EVIDENCE FROM ITALY

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Abstract

The number of public holidays varies across countries and between years within the same country. It can be really interesting to understand the effect, ceteris paribus, of feast days on the whole economy and on firms' productivity. The idea of this study is due to the heated debate on the effect of the feast day established the 17th of March only for the year 2011. Its goal was to celebrate the 150th year after the Italian unification, despite the fact that the whole world is still facing a period of deep crisis and recession. Here it's developed an econometric analysis using data from the 1950 and the first differences model. It analyzes time series data, and it's needed to control for autocorrelation. Two periods are analyzed: before and after the 1977 reform. Findings show that national holidays have a small but positive impact on economic activities or at least no effect on it. This result is striking and unexpected but firms are not passive. They adjust their production during the year to satisfy the whole demand. Positive emotions and tourism can be other reasons which can justify the effect.

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1 Introduction

The main objective of this study is the impact, ceteris paribus, of national holidays on Italian economic activities. It is inspired by the Italian holiday celebrated the 17th of March 2011.

Firstly, we should understand the reasons behind holidays in general, that sometime can lead workers and firms to have some benefits not necessarily economic. Considering the specific case of the 17th of March, the feast day was established to celebrate the Italian unification. The single goal was to recreate, once every fifty years, the feeling of a national identity across Italians, that after 150 years from the process “ex pluribus unum”, still try to clear the remaining differences between regions. Indeed, the celebration of this holiday was addressed to validate the effort that our ancestors put, to allow us to live in a better country and to let citizens to awake their feeling for patriotism, trying to arouse the desire to participate also to the national political life. Someone argued that the holiday would have generated exactly the opposite effect because people were forced to celebrate it. In their opinion people should have worked instead of enjoying a day off. The province of Bolzano for example refused all celebrations. Others instead, stated that 150 years were not so much to assume that people should have gained a strong national identity. For them, it can be understandable that across the country there is still a multitude of dialects and different rates of unemployment and poverty.

In short, reasons for political decisions are not necessarily justified by efficiency or by other economic issues. We should take into account also the social, political and historical features of the country.

To validate this statement, which is true even for other countries, it’s important to mention an empiric study on the effect of a patriotic holiday on

the electoral participation in USA[1]. Indeed, its results show that an American between three and eighteen years old who, due to a storm, don't celebrate the 4th of July[2], reduces his probability by 9-10% to participate actively to the political life in his future. Moreover, a 4th of July without rain during a childhood, increases the likelihood for voting Republicans as an adult.
This is just an example of a non economic effect which can be implied by a national holiday. Usually the presence of rituals and celebrations, that cement the social structure of a country, promote citizen participation in public life.

Turning to economic effects caused by a holiday, a key role belongs to the institutions of the labor market that differ significantly across countries for objectives, mode of operations, interests to pursue and for the context in which they act. Indeed policy-makers have a big influence on the behaviors of firms and employees. In effect, when policy-makers, unions or government, establish a new holiday, they lower the annual number of worked-hours which is a measure for the labor supply on the intensive margin[3]. Some empiric evidences showed that assuming a reduction in the hours worked, wages go up which in turn reduce the demand of labor for firms implying an higher rate of unemployment[4]. Indeed work-sharing is not supported by empirical researches basically because of the not realistic assumption of lump sum of labor[5].

[1] The study conducted by A. Madestam from Bocconi University and D. Yanagizawa Drott from Harvard University is reported in: "Shaping the Nation: Estimating the Impact of Fourth of July Using a Natural Experiment".
[2] In that day, Americans celebrate the "Independence Day".
[3] The exact measure used by statistics for comparisons across countries is the annual average number of hours worked for an adult full-time worker who is occupied in the manufacturing industry and who receive an average wage (APW).
[4] Kapteyn, Kalwij and Zaidi (2004) found a positive and a statistically significant effect on the wage but a not statistically significant effect even if positive, on the employment. A. Schank and Simmons (2005) didn't find any effect in Germany.
[5] It assumes that for firms the only important fact is the total quantity of labor. How is shared the work is not in their interest. This assumption in the reality is too simplistic because it doesn't consider hiring and training costs, insiders power and the time needed to substitute workers in the work place.

Moreover in Italy, workers face a strong employment protection that leads firms to modify labor demand acting more on intensive margin rather than extensive margin. On the one hand, companies prefer to hire less workers who operate for more hours per day rather than hire more workers who operate for less hours, especially to reduce high costs due to EPL[6]. On the other hand, employers cannot take advantage from the possibility to exploit the efficiency of rested workers using the turnover mechanism. As a consequence, policy-makers, who modify the number of hours, can significantly affect the performance of firms and industries. Nevertheless, keeping fixed the level of employment protection, in some countries workers celebrate more holidays comparing with others and in turn they work fewer hours[7]. Then comparing countries, an identical policy can have different impacts on firms' choices and on the unemployment rate.

Even if the arguments mentioned briefly in the previous part of the section 1 are interesting, from now we will ignore all non-economic effects and those on the labor market. Instead we will concentrate specifically on holidays effect on firms outputs and their costs.

During the heated political debate, about the implications of an additional annual holiday, Mario Deaglio took a central role in the discussion. He stated that the feast day would have reduced the Italian GDP of 0.4-0.5% points despite the fact that employers would have paid their employees anyway. Indeed in his opinion, agreeing with Emma Marcegaglia, president of Confindustria and of the University Luiss Guido Carli, firms would have faced a large increase in costs.

On the one hand, in case of normal situations, we should expect that GDP and costs are straight correlated and that they move in the same direction. An increase in costs can be due to a higher quantity of work and in turn a higher level of production. On the other hand, in case one more holiday is

[6] EPL stands for Employment Protection Legislation.

[7] This topic is argued in the book written by T.Boeri, M.C.Burda and F.Kramarz: "Working Hours and Job Sharing in the EU and USA. Are Europeans Lazy or American Crazy?".

established, costs can increase even if production does not. Indeed, Marcegaglia and Deaglio meant that firms would have faced a decrease in the ratio GDP-costs.

We should also consider all intrinsic costs linked with this type of holiday due to its events. Moreover the problem of increasing costs is amplified by the fact that Italy, as other countries in the world, is still dealing with a period of recession and firms can't afford the wasting of resources and money.

For these reasons beyond production which is the first variable in our interest, even costs will be analyzed carefully, to verify the validity of the statements made by Deaglio and Marcegaglia.

As it will be show later in the research, all the econometric analysis follow the same framework, and it will respond to our need of finding effects on economic activities, due to a variation in the number of national holidays. Obviously all regressions will present a really low R-squared. We can ignore this measure of goodness for the model. Indeed our goal is not to explain the dependent variables.

Moreover, we should clear up if the change in firms' costs is economically and/or statistically significant. It will be prominent to analyze if the eventual increasing costs balance the effects on GDP, or if it leads to a net loss for firms.

However, looking to the specific case of the 17th of March, workers have benefited of this additional holiday but employees had a more limited set of choices about their vacations. Indeed each year in Italy, each worker can choose four days to take a day off. In the 2011 instead, because of the added holiday, only three out of the four days were usable. It was a restriction because they were forced to take a day off exactly that date. Then the 17th of March didn't change the total number of days worked in 2011 and in turn the total amount of hours paid by firms. Anyway we should also take into account that the situation for firms would have been totally different if employees had taken a day off all together.

This holiday was only a pretext for this study. Once we understood the importance of the argument and that holidays can have also other reasons not strictly linked to economic activities, we can begin the real analysis. The research will focus on implications of a general holiday without making any distinction between ideology which stands behind it.

The study is organized as follows. A detailed description of data sources and of the methodology used to analyze effects generated by holidays is developed in section 2. Section 3 deals with all findings and the main reasons that can explain results. A final section concludes.

2 Data and methodology

First of all, to study the relation between economic activities and holidays, we needed to find variations between years, randomly caused, in the number of public holidays celebrated. We used the casualty implied by the fact that each year holidays can fall either during weekdays or weekends. Nevertheless, it is possible to divide fixed versus moving holidays. If this last type of feast days fall during the work week, these days are handled as actual holidays. Instead, if they fall during the weekend, holidays are no more considered actual because even if these were not celebrated, workers would enjoy days off at work. Fixed holidays instead, are celebrated each year the same calendar date without implying in turn any variation across years. The casualty, linked to the fact that some holidays can be celebrated each years in different week days, allows the effectiveness of this study. In other words, the heterogeneity in the distribution of national holidays across years stands at the core of the analysis. In this way it is possible to avoid the presence of any significant bias, and to analyze the real effects that holidays cause on the economic activities of the country. Moreover, the zero conditional mean assumption is totally verified: $E(u_t \mid x_{1,t}, x_{2,t}) = 0$ where, in this case, x_1 and x_2 are respectively *holiday_actual* and *holiday*. It means that there aren't other significant factors contained in the error term that can be

correlated with *holidays* and affect at the same time the dependent variable. In other words, there is no risk for a spurious correlation.

This is an important starting point for the analysis considering that its goal is to show what happen to the economy if it is established one more day off that otherwise would have been spent by working.

2.1 Distribution of holidays across years

Data for annual national holidays and for the number of annual actual holidays have been retrieved by checking each calendar from the 1950 and all laws and reforms about this issue. Indeed, regulations changed significantly the number of national holidays and in turn the number of actual holidays. Another variable has been obtained for leap months. It was needed to control for the fact that some year are one day longer. This day can fall either during the week or the weekend.

The two larger reforms in the last 60 years were made in the 1949 and in the 1977 when the number of national holiday decreased from 16 to 10. On the one hand, the enormous dimension of the reform is proved by the highest and the lowest number of public holidays reached in the whole period considered, i.e. respectively 16 and 10. On the other hand, the number of actual holidays varies from 4 to 14 and thank to this wide variation the analysis is reliable. Other limited laws took place during the years 1985, 1986 and 2000[8].

Public holidays considered in this study, in which the majority of people don't work and the majority of firms don't produce, are divided in civil and in religious. Furthermore Italy, until 1977[9], used to celebrate solemnities, feast days in which working hours are reduced only in public offices. In Tab.2.1 are shown numbers for total solemnities, actual holidays and

[8] For the legislation pre-reform of the 1977 (contained in the law of the 5th March 1977, n. 54), see the law of the 27th May 1949, n. 260. For the variation in the number of holidays post-reform, see the presidential decree of the 28th December 1985, n. 792; the law of the 22th May 1986, n. 200 and the law of the 20th November 2000, n.336.

[9] After the reform of the 1977 no more solemnities are celebrated. On the 4th of March 1958, the law n. 132 changed the number of total Italian solemnities from 2 to 3.

national holidays which are classified in civil and religious. Below are also considered moving holidays that fall by definition every year on the same week day but on different date as Easter which fall each year on Sunday.

Tab.2.1 - Holidays and solemnities across years

Year	Civil	Religious	Total holidays	Actual holidays	Solemnities	Actual solemnities
1950	4[10]	12[11]	16	12	2[12]	2
1951	4	12	16	11	2	2
1952	4	12	16	12	2	1
1953	4	12	16	11	2	1
1954	4	12	16	10	2	2
1955	4	12	16	11	2	2
1956	4	12	16	12	2	2
1957	4	12	16	12	2	2
1958	4	12	16	14	3[13]	3
1959	4	12	16	11	3	2
1960	4	12	16	12	3	3
1961	4	12	16	11	3	2
1962	4	12	16	12	3	2
1963	4	12	16	11	3	2
1964	4	12	16	11	3	2
1965	4	12	16	10	3	3
1966	4	12	16	11	3	3
1967	4	12	16	12	3	2
1968	4	12	16	11	3	1
1969	4	12	16	13	3	1
1970	4	12	16	11	3	2
1971	4	12	16	10	3	3
1972	4	12	16	12	3	3
1973	4	12	16	11	3	2
1974	4	12	16	11	3	2
1975	4	12	16	13	3	1
1976	4	12	16	10	3	3

[10] In the 1950 four civil holidays were celebrated: the 25th of April to celebrate the liberation from fascism; the 1st of May to celebrate workers; the 2nd of June that is the Republic Day and the 4th of November to celebrate the end of the 1st World War.

[11] In the 1950 twelve religious holidays were celebrated: 1st of January; Epiphany; St Joseph; Easter; Easter Monday; Ascension; 29th of June; 15th of August; 1st of November; 8th of December; Christmas and 26th of December.

[12] In the 1950 two solemnities were celebrated: the 11th of February and the 28th of September.

[13] In the 1958 the 4th of October, to celebrate St Francis of Assisi, was proclaimed solemnity.

1977	2[14]	9[15]	11	7	1[16]	1
1978	2	8	10	8	0	0
1979	2	8	10	8	0	0
1980	2	8	10	8	0	0
1981	2	8	10	5	0	0
1982	2	8	10	4	0	0
1983	2	8	10	6	0	0
1984	2	8	10	7	0	0
1985	2	8	10	8	0	0
1986	3[17]	9[18]	12	10	0	0
1987	2	9	11	6	0	0
1988	2	9	11	8	0	0
1989	2	9	11	9	0	0
1990	2	9	11	8	0	0
1991	2	9	11	8	0	0
1992	2	9	11	5	0	0
1993	2	9	11	5	0	0
1994	2	9	11	7	0	0
1995	2	9	11	9	0	0
1996	2	9	11	9	0	0
1997	2	9	11	9	0	0
1998	2	9	11	7	0	0
1999	2	9	11	6	0	0
2000	2	9	11	9	0	0
2001	3[19]	9	12	8	0	0
2002	3	9	12	8	0	0
2003	3	9	12	10	0	0
2004	3	9	12	6	0	0
2005	3	9	12	8	0	0
2006	3	9	12	10	0	0
2007	3	9	12	8	0	0
2008	3	9	12	8	0	0
2009	3	9	12	7	0	0
2010	3	9	12	5	0	0

[14] In the 1977 two civil holidays were abolished: the Republic Day and the 4th of November.

[15] In the 1977 four religious holidays were abolished: Epiphany, the 19th of March to celebrate Saint Joseph; the 29th of June to celebrate the Apostles and the Ascension that was celebrated 39 days after Easter. When the law entered into force, this last holiday was already celebrated.

[16] In March 1977 three solemnities were abolished: the 4th of October; the 28th of September that celebrated the insurrection in Naples and the 11th of February that celebrated Lateran Pacts. When the law entered into force, this last solemnity was already celebrated.

[17] In the 1986 the Republic Day was celebrated una tantum.

[18] In the 1986 the Epiphany was reintroduced as a religious holiday.

[19] In the 2001 the Republic Day was reintroduced as a civil holiday.

2.2 Collected data and groups of industries

Once the variable for the number of annual actual holidays was built, we looked for time series data for Italian economic activities[20]. Data set under examination comes from the Eurostat, Istat and OECD.stat database.

We used a multitude of aggregate data as the ones for productions, total GDP[21], added values, costs, hours worked[22] and tourism.

Production consists in the value of all products made by firms during the accounting period and in this study it is expressed at basic prices i.e. it is calculated net of taxes and inclusive of subsidies on products. Added value is given by the value of the production net of intermediate costs. It allows to measure the growth of the economy in terms of new goods and services available for final use. Also this index is expressed at basic prices. Costs instead consist of compensations of employees, salaries and social contributions.

Data have been found either for the total economy and for individual industries. Unfortunately, not all of them, especially the ones about single industries and hours worked, are available from the 1950[23]. However when data will be used, their measures will be clarified to get better interpretations of the findings.

Moreover, it's really interesting to study the ceteris paribus effects in different sectors. Indeed, it can happen that some of these sectors are impacted in a different way. For example on the one hand we can expect that the production and the consumption of fished and cultivated or cigarettes don't change significantly because of the feast day. The same argument is valid, in

[20] A time series is a sequence of observations for the same variable which is measured over time at uniform intervals. We used annual data, to be consistently with the previous analysis on the number of actual holidays.

[21] GDP is calculated at constant US $ and PPPs, base year 2000, millions, estimated values.

[22] The index represent the average number of hours worked in all sectors per each worker. Part-time workers and overtime are covered as well as full-time workers and standard hours.

[23] Data for individual sectors are available from the '70 and the index for hours worked is available only from the 1980.

Italy, also for non market activities. On the other hand we can expect that restaurants, hotels, and in general the tourism industry produce more during a holiday. Due to the individual study of different sectors, we can also understand the reasons, the magnitude and the direction of the total effect caused by an holiday, on our dependent variables.

To allow that study, we have grouped different sectors. Otherwise it would have led to a very difficult interpretation of results. We maintained in the data set only one single industry because we used it as a "proxy variable" for tourism. Indeed this variable represent the GDP in the sector of restaurants and hotels and it's part of the total production for the fourth group. Otherwise it would be difficult to find a perfect variable that measure tourism activities. In any case, we used also other variables to capture the effect on tourism which hypothetically we expect that increase in response to a higher annual number of national holidays celebrated. They are represented by the annual number of nights spent in hotels by residents and by non residents, the annual number of arrivals in hotels for an accommodation shorter than three days, and the total expenditure in goods and services produced for tourism activities.

Groups of industries follow the classification of economic activities made by ATECO 2007. In particular, we divided the total Italian production in seven groups[24]:

1. Agriculture, hunting and fishing.
2. Manufacturing and utilities.
3. Constructions.
4. Trade, repairs, hotel and restaurants, transport and communications.
5. Monetary and financial intermediations, real estate and business activities.

[24] In the future analysis and in tables in section 3, the subgroup for hotels and restaurants is shown as $y_t\_group\_4\_a$ where y_t is the dependent variable in interest.

6. Services activities of public administrations.
7. Non market activities.

Some of these groups are central to the analysis, others instead are less important. We put much effort and attention analyzing the second group of industries because it's the largest in Italy and because it should be the one more affected by the number of holidays. Indeed it's the sector in which the major of employees are hired and in which them, most definitely, take a day off during a holiday because they don't have any incentives to don't do it. In other smaller sector instead someone can still have incentives to work even during a holiday. Others groups which are analyzed more carefully are the fourth and the seventh.

Furthermore we obtained annual data for the Industrial Production Index (IPI)[25] which is really similar to the one that represents the production of the second group of industries and so it gives us the possibility to verify the consistency of results found with the other indicator. We don't expect the two indicators to be affected exactly and perfectly in the same way. Indeed these indexes are estimated, and each year there could be small errors in excess or in deficiency. We assume that this process is random, not causing any problem to the analysis.

Part of the study is extended also to European indexes. In particular, are used indicators for GDP and IPI for both Eur15[26] and OECD's[27] countries. However these indexes don't have a central role in the Italian analysis but them can tell us what are the effects of a feast day in other countries and in general if there are effects on trade due to foreign holidays. To really estimate the effect on economic activities for these countries, there should be

[25] it is an economic indicator that measures real production output and includes manufacturing, mining, and utilities. It is indexed to 2005. Observation for 2005 is 100. This is true for Eur15, OECD's countries and Italy.

[26] 15 countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom. All this countries entered in the Europe Union before 1995.

[27] There are two groups of countries related to OECD. OECD(Total) that consists of all OECD countries and OECD(Europe) that comprehends the 25 European countries that are members of the OECD.

available annual holidays for each of these countries. However Italian actual holidays can be a proxy variable, even if weak, for the number of European holidays. Indeed the majority of feast days recur in more than one country contemporaneously even if the law in each of these country is different and even if there are differences in the way they celebrate holidays. Others are instead country-specific. Moreover, these variables are used as well to understand if the number of holidays in one country can influence the production of other countries which are characterized by a strong partnership for trade.

2.3 Econometric strategy

As stated at the beginning, the basic framework for all multiple regressions follow the first differences model which means that they are composed by series of changes from one period to the next. If y_t denotes the value of the time series y at period t, then the first difference is equal to $y_t - y_{t-1}$.

We get:

$$y_t - y_{t-1} = \beta_1(x_{1,t} - x_{1,t-1}) + \beta_2(x_{2,t} - x_{2,t-1}) + u_t - u_{t-1}, \quad t = 1950,...,2010 \tag{2.1}$$

Writing this multiple regression procedure in a compact form,

$$\Delta y_t = \beta_1 \Delta x_{1,t} + \beta_2 \Delta x_{2,t} + \Delta u_t, \quad t = 1951,...,2010 \tag{2.2}$$

and replacing x_s with the independent variables in our interests we obtain:

$$\Delta y_t = \beta_1 \Delta holiday\_actual_t + \beta_2 \Delta holiday_t + \Delta u_t, \quad t = 1951,...,2010 \tag{2.3}$$

where $\Delta holiday_t$ is used as a control. Loosely speaking, it allowed us to observe the ceteris paribus effects on economic activities taking into account that during different years can be celebrated different numbers of holidays because of laws and other political decisions. The control for this variable is not necessary for all regressions that will be presented in the analysis of the

next section. Indeed some of them refer to the all sample of the data set i.e. from 1950 to 2010. Others refer to just a share of it. In particular the sample is divided into two parts. The first one uses data until 1976 and the other instead, uses data from 1977 onwards. As it was showed in Tab.2.1, before the big reform of the 1977, the number of national holidays have never changed. When we considered data before 1977, it was not necessary to control for holiday because it was a constant[28]. Otherwise obviously it would have revealed the problem of collinearity for the independent variable.

However, in model (2.3), we should notice that because of the first differences, we lost one observation. Indeed, it would be impossible to subtract from the value of the year 1950, the one of the previous year because that data is not available. Furthermore, y_t doesn't represent always the same variable. It changes in each single regression. It could represent: production indexes for each group indicated in section 2.2; GDP; added values for each group; average hours worked per worker; employees' costs for each group; various EU indexes and different measures for tourism.

The main reason that induced me to use the model of first differences is to remove the likely highly persistence (or strongly dependence) in time series data. More precisely, all observations, y_t ,are correlated each other across years. Indeed, taking for example the GDP, its value each year is obviously not random but it's strictly correlated with the level of GDP of the previous year. It will never happen that the "case", randomly, chooses the level of GDP. It implies that the assumption of random sampling is not respected. For these reasons a normal multiple regression, with usual OLS inference procedures would have implied misleading results.

In a simple time series regression model as:

[28] We tried to divide even the period after the 1977 in three smaller periods, 1978-1985; 1987-2000; 2001-2010, with constant number of national holidays to obtain a stronger control. However it was useless because results were not significantly different between periods and because the total result didn't change. This analysis is omitted.

$$y_t = \beta_0 + \beta_1 x_t + u_t, \quad t = 1,2,...,n \tag{2.4}$$

it could happen that:

$$y_t = \rho_1 y_{t-1} + \varepsilon_t, \quad t = 1,2...,n \tag{2.5}$$

where the stability condition is not violated, $|\rho_1| < 1$. This model is an AR(1)[29] in which is in force the assumption of weak dependence.

An extreme case, not rare in time series data, is when $\rho_1 = 1$ and we can write:

$$y_t = y_{t-1} + \varepsilon_t, \quad t = 1,2,...,n \tag{2.6}$$

This process is also called a random walk and this is the problem that we want to solve in our analysis. For this reasons we chose to take the first differences model (2.2).

At this point, it is important to remind that our goal is to study the annual variation in actual holidays using the casualty provided by the fact that holidays can randomly fell during weekend or weekdays. Knowing that, somebody could ask himself why we were so worried about autocorrelation if variables each year are in effect randomly assigned. Indeed fortunately, we do not seem to have highly persistent data concerning the two predictor variables showed in the model (2.3). The reason why we adopted the model of first differences is due to the strong persistence for almost all the dependent variables used in different regressions.

Nevertheless, other typologies of regressions were tested for their use but without any success because they didn't lead to different results. Indeed we tried to control for the time cubic polynomial, which is another way to remove the autocorrelation in time series data, but anyway this model would not be as good as the model we decided to use because it wouldn't have captured

[29] It is an autoregressive process of order 1.

completely the bias caused by the time. In any case, results were really similar to the ones obtained with the first differences method and so we omitted from the study[30], this other type of control.

In the study are also used models with quadratic forms which contain squares for an explanatory variable, to capture diminishing or increasing effects on it.

$$y_t = \beta_0 + \beta_1 holiday\_actual_t + \beta_2 holiday\_actual_t^2 + \beta_3 holiday_t + \beta_4 T + \beta_5 T^2 + \beta_6 T^3 + u_t, \quad t = 1950,...,2010 \quad ; \quad T = year - 1977 \tag{2.7}$$

In other words, the idea that we want to test with this further model is that few holidays can imply some effects whereas a lot of them can generate effects that go in a different direction. Moreover, hypothetically it could be possible, and certainly it would be interesting, to try to find a perfect number of annual holiday which can maximize firms' production or minimize its costs. For this type of model we have chosen to control for the time polynomial instead of using the first differences method to make easier the interpretation of coefficients. Results in the other case wouldn't have been different.

For a correct OLS inference and analysis, this study will use the robust standard error procedure to avoid the influence of the presence of heteroskedasticity of unknown form i.e. $Var(u \mid x_{1,},..., x_k) \neq \sigma^2$. This adjustment is needed especially when the number of observations for a variable is low. In particular this procedure prevents the risk often imposed by outliers.

3 Empirical evidence

Since all the methodology has been examined, the analysis now focuses on the main aftermath obtained and their likely explanations. The econometric analysis will be different for the period pre-reform and the period post-reform.

[30] Even other regressions with other methods were implemented. An example is the log-level model. Also in this case, it's omitted from the analysis because its presence is useless due to the similarity with other findings.

In Tab.3.1 are shown results from the study conducted with data retrieved until the 1977.

Tab.3.1 - Results from the analysis before the reform (1977)

The model used is specified in (2.3). It tests the significance of the explanatory variable *holiday_actual,* controlling for the variable *holiday.* Then, all values listed in columns refer to the variable in our interest *holiday_actual.* They measure its partial effect on dependent variables which for each regression are different. All the explained variables are listed in the first column of the following table. Their definitions are shown in the Appendix.

		Before 1977				
Dependent variable	Coef.	Robust Std. Err.	t-statistic	P-value	95% Conf. Interval	
delta_prod_ita	-0.763514	0.4259012	-1.79	0.089*	-1.654936	0.1279075
delta_prod_tot	-3049.893	2240.384	-1.36	0.245	-9270.197	3170.411
delta_prod_2	-1907.225	990.7823	-1.92	0.127	-4658.078	843.6275
delta_prod_7	-127.5832	126.5717	-1.01	0.37	-479.0024	223.8361
delta_added_v_tot	-1412.805	1094.736	-1.29	0.266	-4452.279	1626.668
delta_added_v_2	-865.6368	361.5412	-2.39	0.075*	-1869.436	138.1623
delta_added_v_7	-134.4434	88.87501	-1.51	0.205	-381.1999	112.3132
delta_manuf	-0.7619565	0.4646023	-1.64	0.117	-1.73438	0.2104674
delta_gdp_ita	-9904.115	4511.511	-2.2	0.093*	-22430.08	2621.849
delta_prod_4_a	-50.45148	83.35999	-0.61	0.578	-281.8959	180.993

* P-value < 0.10. ** P-value < 0.05. *** P-value < 0.01.

These results are consistent with the usual opinion about the effect caused by a holiday and with the view expressed by Deaglio and Marcegaglia on the direction of this effect. On the one hand, the correlation between dependent variables, which are all measure of economic activities and production, and the number of actual holidays, seems to be negative. On the other hand, coefficients are not consistent with the idea that one more holiday causes a decrease in the GDP close to 0.4-0.5%. According with the study for the period before 1977, GDP, which is marginally significant, should decrease by 1.2%[31], if one more annual holiday is established. The value of the coefficient is indeed negative and equal to 9904.115. Anyway it's not so simple to calculate this effect. These evidences demonstrated that the prevision made by Deaglio was not completely true even for years before the oil crisis,

[31] This result is obtained by taking the average for the GDP for all years before 1977 and dividing the coefficient for this average.

because they don't support the idea of a fixed reduction of GDP. In other words, it's incorrect to just obtain the daily GDP to calculate the effect of one more holiday. Its cost isn't fixed due to one work-day lost. However, only three out of the ten coefficients listed above are statistically significant different from zero[32]. It means that there isn't strong evidence in favor of the direction of this effect but there isn't neither an evidence that can support the opposite effect. Moreover P-values for these three coefficients, which are statistically significant and apparently economically significant too, are only lower than 0.1. They are significant only at 10% level and even at this level they are border line[33].

The variable which is more statistically significant, even if in the limit of 10%, between the three showed above is *delta_added_v_2. Its* P-value is 0.075*.* This variable refers to the variation between periods in the added value for industries which belong to the second group, as explained in section 2.2. The evidence show that one more actual holiday, keeping the other variable fixed, has a negative partial effect on the dependent variable that can be quantified in 865.6368. If this result is analyzed individually, it can support the idea of a reduction in the GDP for industries engaged in manufacturing and utilities sectors. However there are other indexes that can refer to economic activities for these type of industries as *delta_prod_2* and *delta_manuf.* These two other variables are both statistically insignificant and it demonstrates that even for this industry, and even in the period examined, the negative effect is not strong enough. In other words we would be sure of that effect if all dependent variables used for that group had consistent results.

Concerning industries included in group seven, they are not statistically significant and we could expect it. Italy is indeed a county in which people work, on average, less hours compared with other countries and in turn they

[32] In the Tab.3.1 as in the following, P-values refer to the two-tailed test with the null hypothesis $H_0 : \beta_1 = 0$. In our specific case, it means that keeping *delta_holiday* constant, the variation in the number of actual public holidays has no effect on our dependent variables. The two-side alternative is $H_1 : \beta_1 \neq 0$. It means that the partial effect of actual holidays on dependent variables is different from 0 but without specifying if it is positive or negative.

[33] Indeed, 0.093 and 0.089 are close to not be statistically significant even at 10% level.

can spend much more time in house work. They do it constantly and so no effect, caused by holidays, occurs for this group. During those days, workers prefer to relax also because they don't need to work more at home [T. Boeri et al. (2008)].

For this period no more data are so interesting to be studied individually. We are just interested in the general trend. Moreover, data for firms' costs and worked hours are no shown in Tab.3.1 because they are available only for years subsequent the examined period in this part. Indeed, now we will focus on the second part of the analysis for which we have more information and more data. Its striking results are showed below.

Tab.3.2 - Results from the analysis after the reform (1977)

The table have the same characteristics as Tab.3.1. Variables' definitions are shown in the Appendix.

		After 1977				
Dependent variable	Coef.	Robust Std. Err.	t-statistic	P-value	95% Conf.	Interval
delta_prod_ita	0.7555241	0.3163412	2.39	0.024**	0.1085338	1.402514
delta_prod_tot	7258.873	5637.437	1.29	0.208	-4270.98	18788.73
delta_prod_2	3838.75	2289.324	1.68	0.105	-850.717	8528.217
delta_prod_7	-119.3786	298.7333	-0.4	0.692	-730.3568	491.5995
delta_added_v_tot	928.0984	1360.952	0.68	0.501	-1855.362	3711.558
delta_added_v_2	667.711	661.1111	1.01	0.321	-684.413	2019.835
delta_added_v_7	53.62071	222.064	0.24	0.811	-400.5511	507.7925
delta_costs_tot	-564166.2	798020.5	-0.71	0.531	-3103824	1975491
delta_costs_2	-312196.5	309495.8	-1.01	0.387	-1297150	672757.1
delta_hours_tot	-43138.63	45500.85	-0.95	0.413	-187942.7	101665.4
delta_hours_ita	-2.506125	1.297145	-1.93	0.064*	-5.172445	0.1601948
delta_hours_2	-13335.81	22994.09	-0.58	0.603	-86513.26	59841.64
delta_manuf	0.6887254	0.3324379	2.07	0.047**	0.0088136	1.368637
delta_gdp_ita	2928.716	1852.867	1.58	0.125	-860.8221	6718.253
delta_arrivals_r_tot	231912	137480.1	1.69	0.126	-79089.64	542913.7
delta_nights_r_tot	0.0339218	0.0167819	2.02	0.074*	-0.0040415	0.0718851
delta_prod_4_a	108.1748	201.8535	0.54	0.596	-305.3035	521.653
delta_exp_tot	189089.1	137665.3	1.37	0.207	-128367.7	506545.9

* P-value < 0.10. ** P-value < 0.05. *** P-value < 0.01.

In this case, results were not expected at all and they are much more important because they refer to a more current period compared with ones

obtained before. Moreover, they are more reliable because of a higher number of observations. They totally contradict what we stated in that previous part. It means that some factors have changed between periods to make the effect, for the period after the 1977, positive. Maybe before, work in terms of production couldn't be recovered because of the way people and firms worked. Indeed, before the 1977 jobs were done more by hands and people had a central role in the production process. They worked at any time putting the maximum physical effort and there was in turn no time to recover days lost. In actual periods instead, the time lost due to a holiday can be recovered also because of the high degree in the use of computers and automated mechanical systems. Now, the human capital, especially in some industries, is less important, obviously not generally speaking but compared with the work done by machines nowadays. Firms can respond to decisions made by external agents and they can adjust their daily level of production. This is just one of the reasons that we identified as the cause of the positive sign of the effect. It is a sort of inventory adjustment process (IAP)[34]. It occurs even when firms face seasonal demand for their products which implies a large variation in the output requested by consumers. Companies should know how to manage production peaks and declines. Another reason which can explain the positive effect is due to emotions at the workplace. Indeed, they can lead to favorable outcomes[35]. An important cause for a productive work is due to psychological factors. Obviously it's true in general and not for every job. In [B.M.Staw et al. [1994)] it is present the example of police investigators who must be rude with criminals. In that case indeed, it seem that negative emotions have a direct effect on work outcomes. However, they should be friendly with their superiors and their colleagues. Concluding, positive psychological factors and emotions can imply better performances for workers. In our case, definitely, on average, a holiday leads people to be friendlier at the workplace, due to the favorable mood around it

[34] A similar process can be analyzed also for financial markets as demonstrated by F.J. Fabrozzi, C.K. Ma and J.E. Briley in "Holiday Trading in Future Markets" (1994). The effect found in this paper is consistent with positive holiday sentiments.

[35] A positive correlation between positive emotions and outcomes is analyzed by B.M. Staw, R.I. Sutton and L.H. Pelled in "Positive Emotions and Favorable Outcomes at the Workplace" (1994).

which stimulates positive emotions and allows a pause from the outside world to spend with their family. Moreover, people can be more productive after no-work days because they are rested and eager. The third reason, which makes the correlation between our variables positive, is due to shops, hotels, restaurants and more in general tourism. Indeed we expect that during holidays people spend their time in these activities.

Since we have analyzed the general econometric outcome for the period after the 1977, now it can be interesting to assess individual regressions. In this case four of them are statistically significant. First of all, annual hours worked are significant at a level of 10%, almost 5%, with a negative coefficient equal to 2.506125[36]. This is important because it means that, effectively, workers spend less time at work due to the holiday. Nevertheless, total production increases. It is indeed, statistically significant at 5% level. These two results showed together are really striking because they demonstrate that people working less can still produce more. It seems that there is no evidence for the fixed cost effect predicted by Deaglio. On the one hand, there isn't a positive adjustment for working hours (overtime work), but on the other hand, there is an adjustment for the level of production, as explained with AIP. However, another measure for hours worked is regressed in the analysis[37] as also another index for the total production level and none of them is statistically significant. Even the GDP increase but it's insignificant. Turning to the variable *delta_prod_ita*, its coefficient, 0.7555241, show that one more holiday, other factors fixed, increases the production of an amount close to 1%[38]. The effect for this variable seems to be also economically significant. The other dependent variables which are affected in a significant way from the number of actual holidays are *delta_manuf* and *delta_nights_r_tot.* The first one is another measure for the manufacturing

[36] It means that for one more actual holiday, the average number of hours worked per worked is reduced by about two hours and half.

[37] It's *delta_hours_tot* which is obtained as the sum of worked-hours in each industry. Fewer observations are available for this index compared with *delta_hours_ita and so* it's not enough reliable.

[38] The way we estimated this reduction in terms of %, is the same explained and used before for GDP.

industry. The effect is positive and statistically significant at 5% level even if it's border line. Other indexes for this industry, as *delta_prod_2*, are always affected in a positive way but are not significant.

Our hypothesis about one of the reason which can explain the positive total effect on economic activities is confirmed by the estimated effect of *actual_holiday* on *delta_nights_r_tot . It* represents the number of nights spent by residents in hotels and in other type of lodgings and it's a proxy for tourism. This activity increases due to more holidays as showed in Tab.3.2 and it can be one of the causes for the striking and positive general result. All other coefficients, which capture the partial effect on tourism, are still positive but far apart to be significant. Their null hypothesis indeed, can't be rejected. Other variables instead are not even marginally significant and some of those are not even showed in tables because are secondary in our analysis. An example can be *leap_month* which is a dummy variable capturing if the year was leap or not. Actually, one added day every four year can't be enough significant for justifying a change in the level of production. To calculate more precisely this effect it can be useful to have more observations.

However, this part of the econometric analysis showed us that sometime, expected results are not demonstrated by empirical evidences.

To have a general view of our results, below in Tab.3.3, are shown some of the results obtained analyzing the entire sample, since the 1950 until the 2010. None of the coefficients are statistically significant but each of those shows a positive correlation between economic activity and actual holidays. Effects occurred in the two periods analyzed in the previous part were cancelled each other. Definitely, there is no negative effect.

Tab.3.3 - Results from the analysis: all sample[39]

The table below have the same characteristics as Tab.3.1 and Tab.3.2. Variables' definitions are shown in the Appendix.

	All sample				
Dependent variable	Coef.	Robust Std. Err.	t-statistic	P-value	95% Conf. Interval
delta_prod_ita	0.2611422	0.2795051	0.93	0.355	-0.2999876 0.8222721
delta_prod_tot	5984.72	5432.325	1.1	0.278	-5032.546 17001.99
delta_prod_2	2992.426	2195.454	1.36	0.182	-1464.583 7449.435
delta_added_v_tot	784.506	1583.086	0.5	0.623	-2426.142 3995.154
delta_added_v_2	454.6421	582.0782	0.78	0.44	-725.8673 1635.151
delta_manuf	0.2144589	0.2952321	0.73	0.471	-0.3782443 0.807162
delta_gdp_ita	894.1959	1911.092	0.47	0.643	-2981.679 4770.071
delta_gdph_ita	18.28157	36.11641	0.51	0.616	-54.9659 91.52905
delta_prod_4_a	103.1744	205.8726	0.5	0.619	-314.7691 521.1179

* P-value < 0.10. ** P-value < 0.05. *** P-value < 0.01.

5 Concluding Remarks

The number and the distribution of actual holidays during the years have recently entered the policy debate also because of the establishment of the 17th March despite the financial and macroeconomic recession. It has been argued that feast days can have a strong and negative impact on national economic activities. In this study we investigate if this is the case, using a data set which contains observations from the 1950 to the 2011, because we were really interested in capturing effects.

This type of study is however not simple for all countries around the world. For some country it could be not enough to just repeat the analysis already done here for Italy[40].

[39] As mentioned in section 2.3, for all sample, between other types of models, we used the one showed in (2.7) which could have attracted someone. Some vertexes of parabola have been calculated, giving all results in a narrow range. $V^* = |\beta_1/(2\beta_2)|$ gives an output, on average, equal to 10.5. In this non linear relationship between coefficients, we found a hypothetical perfect number of holidays which can maximize Italian production. However it is difficult to believe this result. Indeed the measure of 10.5 falls after the average number of actual holidays celebrated in Italy which is 9.2 considering that the entire interval goes from 5 to 14, as showed in Tab.2.1.

[40] The big and significant difference come from the fact that some countries belong to the Latin system; others to the Orthodox system and others to the Anglo-Saxon system. USA, for example,

Moreover, one must be very careful about making comparisons across countries.

Anyway, we didn't find robust evidences supporting a clear effect of public holidays. In particular, using a first differences model, we analyzed two different periods and we found divergent results. It appears odd but it seems that, keeping other factors constant, before the 1977 the effect is negative and after the 1977 the effect becomes positive. These impacts are statistical significant only for some indexes. Using data for all sample instead, it seems that holidays have no effects, on average, on production. These results, however, stand only for a variation of a single actual holiday. In this situation, it is feasible for a firm and for workers to recover the time lost. The effect is different if we consider a higher number of established holidays across the year. To capture this non linear relation between holidays and economic activities, we should analyze the model (2.7) with the quadratic form.

However, we found strong evidences which don't support the fixed effect caused by one more annual holiday. This result is striking because firms seems to respond to exogenous decisions. Indeed they can adjust their production level between days, avoiding to suffer passively. Firms use the same adjustment process even, for example, when they face a seasonal demand.

Furthermore, we have justified the unexpected result with the fact that workers, during the day after an holiday, are more productive and efficient because they are rested and relaxed and because of positive emotions. A third explanation concerns the positive effect that a holiday can have on tourism activity which in turn can have a positive impact on the general level of production.

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belongs to the Anglo-Saxon system which is characterized by bank holidays. In other words, workers take a day off in any case, even if the holiday fall during the weekend. Indeed in that case, they celebrate the feast day the prior Friday or the next Monday. This behavior don't allow us to use the variation of actual holidays across year. Indeed, they celebrate the same number of holidays each year. Moreover USA is marked by discretion across States. In each of them, government and owners' firms have the possibility to choose how many days people have to work. In this way there isn't even a homogeneity across States.

Concluding, we do should take in consideration some limits of this analysis. This research used aggregate data which don't allow an impeccable study. It would be preferable to use micro data to capture, more precisely, real effects. Moreover, it's now important and useful for future researches to consider and in turn to capture even effects caused by extended holidays i.e. when holidays fall on Tuesday and on Thursday allowing workers to take a day off even on Monday or on Friday[41]. Indeed, this situation is often verified in Italy.

In our view, as far as we can see, the number of public holidays hasn't a strong and significant effect on economic activities. The main reasons that should drive the annual number of feast days celebrated in Italy are not economic but religious and cultural.

[41] This effect could be captured with dummy variables that indicate the week day in which the holiday is celebrated.

5 Appendix

In this part are described all the meanings for variables showed in tables and in prior sections.

*delta_* in front of each variable means that it has been calculated as the difference between its value in the year *t* and its value in the year *t-1*.

variable added_v_2: "Italian added value for industries in group=2"

variable added_v_7: "Italian added value for industries in group=7"

variable added_v_tot: " italian added value, all industries"

variable arrivals_r_tot: "number of residents' arrivals in all facilities"

variable costs_2: "Italian costs for employees, industries in group=2"

variable costs_tot: "Italian costs for employees, all industries"

variable exp_tot: "residents' tourism expenditure, all periods' lenght, all facilities"

variable gdp_ita: "gdp constant $ and PPP, expenditure aproach"

variable gdph_ita: "gdp per head, constant $ and PPP, base year 2000"

variable holiday: "annual number of national holidays"

variable holiday_actual: "annual number of national holidays which fall on work days"

variable hours_2: "index for italian hours actually worked, industries in group=2"

variable hours_ita: "Italian annual average of hours actually worked"

variable hours_tot: "index for italian hours actually worked, all industries"

variable manuf: "index of industrial production, manufacturing, 2005=100"

variable nights_r_tot: "number of nights spent by residents in all facilities"

variable prod_2: "production for industries in group=2"

variable prod_4_a: "production for industries in group=4_a"

variable prod_7: "production for industries in group=7"

variable prod_ita: "index of industrial production, total industry, 2005=100"

variable prod_tot: "total italian production, sum of all industries"

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