The Evaluation of Job Tax Incentives: An Analysis of a Regional Tax

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PRÉCIS

On utilise souvent la déduction d’impôt à l’emploi comme outil de politique publique pour stimuler la croissance et la relance économique. L’analyse de l’incidence des dispositions de ce genre qui ont été adoptées dans un passé récent peut éclairer les effets des politiques fiscales actuelles. Cet article vise à étudier les effets d’une déduction fiscale de l’imposta regionale sulle attività produttive (impôt régional sur les activités productives), ou IRAP, accordée par l’Italie aux entreprises qui ont augmenté leur personnel entre 2005 et 2007. Les principaux objectifs de l’analyse sont d’évaluer l’augmentation et la permanence des nouveaux emplois, de discerner tout changement dans la structure de l’emploi des entreprises bénéficiaires, et d’évaluer l’efficacité des différents montants de déduction accordés aux entreprises des régions défavorisées afin de réduire l’écart d’emplois.

Selon les résultats de l’analyse effectuée à l’aide d’un modèle de différence dans la différence, les entreprises qui ont bénéficié des incitations de l’IRAP ont enregistré des changements plus importants et plus durables des indicateurs sélectionnés par rapport aux entreprises n’appliquant pas la déduction, ce qui confirme l’efficacité de la disposition. La mesure adoptée prévoyait des déductions plus importantes pour les régions défavorisées du sud de l’Italie, mais les résultats n’indiquent pas une augmentation plus élevée de l’emploi dans ces régions.

ABSTRACT

An employment tax deduction is frequently used as a public policy tool to stimulate economic growth and recovery. Analysis of the impact of such provisions adopted in the recent past may shed light on the effects of current tax policies. This article aims to estimate the effects of a tax deduction for Italy’s imposta regionale sulle attività produttive (regional tax on productive activities), or IRAP, granted to firms that increased their personnel between 2005 and 2007. The main objectives of the analysis are to assess the increase in, and the permanence of, new employment; to detect any changes in the

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employment structure of beneficiary firms; and to evaluate the effectiveness of different deduction amounts granted to firms in disadvantaged regions in order to reduce the employment gap.

The results of the analysis using a difference-in-difference model indicate that firms enjoying IRAP incentives registered more significant and more enduring changes in the selected indicators as compared with firms not taking the deduction, thus verifying the effectiveness of the provision. The adopted measure provided for larger deductions for disadvantaged regions of southern Italy, but the results do not register a larger increase in employment in those regions.

KEYWORDS: TAX DEDUCTIONS ■ ITALY ■ EMPLOYMENT POLICIES ■ EVALUATION ■ REGIONAL ■ TAX POLICY

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INTRODUCTION
An employment tax deduction is frequently used as a public policy tool to stimulate economic growth and recovery. In many countries, tax deductions are implemented to help firms to hire new employees. For instance, Canadian political parties have included different job creation tax measures in their election platforms. Examples are a tax cut of 9-11 percent for small businesses (which are primary job creators) proposed in the federal New Democratic Party (NDP) platform for the 2011 general election, and a proposal for a tax credit to help businesses to invest in new job creation included in the Alberta NDP platform for the province’s 2015 election.1

1 New Democratic Party, Giving Your Family a Break: Practical First Steps, federal NDP platform, 2011 (www.documentcloud.org/documents/83745-ndp-2011-platform.html); and Alberta New
On a regional basis, there are many other initiatives. For example, the Ontario co-operative education tax credit, which aims to create new fixed-term (four-month) employment contracts, mainly for students that are still enrolled in post-secondary programs, offers the employer a tax benefit of up to $3,000 for each new work placement/contract; and the Ontario apprenticeship training tax credit encourages the hiring of trainees by providing a refundable tax credit based on salaries and wages paid to apprentices (capped at $5,000 annually for each apprenticeship, for a maximum of three years).2

The ex-post evaluation of these kinds of incentive provisions may shed light on their advantages and disadvantages, and contribute to the debate on their use. In Italy, a measure was enacted in 2005 providing a deduction for the imposta regionale sulle attività produttive (regional tax on productive activities), or IRAP, that was available to Italian firms for new job creation. The deduction expired in 2008. In this article, the effects of this measure between 2005 and 2007 are analyzed.

A frequently recurring question related to employment tax deductions is whether they lead to the creation of jobs that would not have been created in the absence of the incentive. In addressing this question, it is necessary to determine whether employment tax deductions generate additional effects relating to job creation and to identify any differential effects between regions. We contribute to this discussion by conducting a systematic investigation of how the Italian IRAP deduction affected employment and the benefiting firms’ performances linked to employment. The novelty of this research is the use of a database that permits the inclusion of firms of any size and with varying characteristics, in addition to the estimated impact of the deduction on employment. Our analysis describes in detail the impact of the IRAP deduction at the regional level, and how a broad set of variables (productivity, sales, and average salaries) responded to the provision, in order to gain an understanding of the overall effect on firms’ employment policies. Finally, we compute the cost of obtaining such impact, broken down by industry and geographical zone, using information on the actual amount of the subsidy. In particular, we calculate the average cost of an additional job created as a result of the subsidy. These estimates permit a straightforward interpretation of the provision’s effects.

Prior Studies of the Impact of Tax Incentives on Employment

A number of studies have been conducted to determine the impact of tax incentives on employment in both the United States and Europe.3 Indeed, in recent years,
many European governments have implemented tax incentives to encourage firms to expand employment. For EU countries, the European Commission encourages policies that enhance the flexibility of labour markets and promote increased labour market participation, such as reforms in tax benefit systems that may contribute to improving the functioning of EU labour markets. A statistical and econometric analysis by Carone et al. showed that a greater tax wedge has a significant negative impact on labour force participation and employment rates for non-EU member countries.

More recent studies on this topic were carried out by Huttunen, Pirttilä, and Uusitalo and by Neumark and Grijalva. Both studies indicated positive effects of job subsidies and credits on employment using a difference-in-difference (DiD) methodology. Huttunen et al. analyzed the employment effects of a Finnish payroll-tax subsidy scheme targeted at older and low-wage workers. They found that there was an increase of approximately 1 percent in the employment rate of older workers as a result of the subsidy, but they did not find statistically significant effects for low-wage workers. They argued that the subsidy provision was inefficient owing to the high cost relative to the minimal effect on employment rates. Neumark and Grijalva analyzed state hiring credits in the United States. They did not find an effect on employment growth for the types of hiring credits that they examined. The results of their research indicated that a non-categorical and more broadly targeted hiring credit is substantially effective only during recessions. Moreover, evidence indicated

John H. Bishop and Mark Montgomery, Does the Targeted Jobs Tax Credit Create Jobs at Subsidized Firms? CAHRS Working Paper (Ithaca, NY: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human Resource Studies, September 1991); Peter Bohm and Hans Lind, “Policy Evaluation Quality: A Quasi-Experimental Study of Regional Employment Subsidies in Sweden” (1993) 23:1 Regional Science and Urban Economics 51-65; Hildegunn E. Stokke, Regional Payroll Tax Cuts and Individual Wages: Heterogeneous Effects Across Education Groups, Working Paper series no. 16815 (Trondheim: Norwegian University of Science and Technology, Department of Economics, 2015); and Robert S. Chirinko and Daniel J. Wilson, Job Creation Tax Credits and Job Growth: Whether, When and Where? Working Paper 2010-25 (San Francisco: Federal Reserve Bank of San Francisco, 2010).

4 See Giuseppe Carone and Aino Salomäki, Reforms in Tax-Benefits System in Order To Increase Employment Incentives in the EU, Ecofin Economic Papers no. 160 (Brussels: European Commission, Directorate-General for Economic and Financial Affairs, September 2001).
5 Giuseppe Carone, Klara Stovicek, Fabiana Pierini, and Etienne Sail, Recent Reforms of the Tax and Benefit Systems in the Framework of Flexicurity, European Economy Occasional Papers (Brussels: European Commission, Directorate-General for Economic and Financial Affairs, February 2009) (https://doi.org/10.2765/92751).
6 Kristiina Huttunen, Jukka Pirttilä, and Roope Uusitalo, “The Employment Effects of Low-Wage Subsidies” (2013) 97:1 Journal of Public Economics 49-60.
7 David Neumark and Diego Grijalva, “The Employment Effects of State Hiring Credits” (2017) 70:5 Industrial and Labour Relations Review 1111-45.
8 Huttunen et al., supra note 6.
9 Neumark and Grijalva, supra note 7.
that the effects of state hiring credits are stronger when such measures target the unemployed.

Another recent study\textsuperscript{10} analyzed a 2007 Swedish provision that substantially reduced the employer payroll tax for younger workers. The study’s findings showed a small impact on employment and wages; however, the effect on employment differed across ages and over the business cycle. The provision was more effective for younger employees than for older workers; furthermore, the impact of the provision appeared to be strongly procyclical.

In the context of Italy, prior studies have considered IRAP provisions and deductions aimed at employment growth. For example, Bordignon, Schmitz, and Turati\textsuperscript{11} focused on the relationship between reduction of the fiscal wedge (consisting of an IRAP deduction on the labour side) and the contemporaneous increase of value-added tax or fiscal devaluation. Their paper was based on a DiD model that analyzed the differential treatment of northern and southern Italian regions. The study revealed that the tax cut significantly increased the employment rate and that doubling the deduction increased the employment rate by about 2 percent.

Many subsidies and grants may be differentiated at the regional level or may be provided directly by local authorities. In such cases, the differential impact of a provision at the regional level can be studied. In the United States, the findings of studies administered locally in several states\textsuperscript{12} suggested evidence of job creation in response to tax incentives, specifically employment tax credits. Gabe and Kraybill\textsuperscript{13} analyzed the effects of economic development incentives on employment growth at the state level in the United States between 1993 and 1995, while Porro and Salis\textsuperscript{14} recently analyzed four types of incentives aimed at firm growth provided in the Lombardy region in northern Italy. Neither analysis revealed evidence that those provisions had a positive impact on employment growth at the regional level. On the other hand, Shuai and Chmura\textsuperscript{15} carried out a state-level study in the United

\textsuperscript{10} Niklas Kaunitz and Johan Egebark, \textit{Payroll Taxes and Firm Performance}, IFN Working Paper no. 1175 (Stockholm: Research Institute of Industrial Economics, 2017) (revised April 8, 2018).

\textsuperscript{11} Massimo Bordignon, Marie-Luise Schmitz, and Gilberto Turati, “Does Fiscal Devaluation Really Work? Evidence from an Italian Experiment,” paper presented at CESifo Area Conference on Public Sector Economics, April 16-18, 2015.

\textsuperscript{12} Dagney Faulk, “Do State Economic Development Incentives Create Jobs? An Analysis of State Employment Tax Credits” (2002) 55:2 \textit{National Tax Journal} 263–80 (https://doi.org/10.17310/ntj.2002.2.04); and Jungyul Sohn and Gerrit-Jan Knaap, “Does the Job Creation Tax Credit Program in Maryland Help Concentrate Employment Growth?” (2005) 19:4 \textit{Economic Development Quarterly} 313–26.

\textsuperscript{13} Todd M. Gabe and David S. Kraybill, “The Effect of State Economic Development Incentives on Employment Growth of Establishments” (2002) 42:4 \textit{Journal of Regional Science} 703–30.

\textsuperscript{14} Giuseppe Porro and Valentina Salis, “Do Local Subsidies to Firms Create Jobs? Counterfactual Evaluation of an Italian Regional Experience” (2018) 97:4 \textit{Papers in Regional Sciences} 1039–56.

\textsuperscript{15} Xiaobing Shuai and Christine Chmura, “The Effect of State Corporate Income Tax Rate Cuts on Job Creation” (2013) 48:3 \textit{Business Economics} 183–93.

Electronic copy available at: https://ssrn.com/abstract=3564312
States to analyze the impact of a tax cut on employment growth. They found a positive relationship between the tax cut and growth of employment for those states that cut their corporate taxes, and they verified a decrease in the gap between states with higher employment growth and states with lower employment growth. Another study based on US state-level data\textsuperscript{16} found that any increase in state tax on dividend income reduced tax revenue, while states benefited, in terms of revenue, from an increase in tax on income from wages or in sales or property tax.

Similar incentives have been implemented in Canada in the past. For instance, the Cape Breton investment tax credit aimed to spur investment, employment, and productivity in Cape Breton, although the effectiveness of this provision was questioned.\textsuperscript{17}

In the context of France, a study that aimed to determine the most efficient instrument to fill the gap in economic performance (productivity) at the regional level\textsuperscript{18} found that providing a financial incentive and granting an investment credit were less costly policies than the alternative option of lowering the corporate tax rate.

Finally, a UK study by Devereux, Griffith, and Simpson\textsuperscript{19} aimed to analyze how the impact of government grants influenced firms’ decisions on the location of their plants. The results showed that the location decisions of firms were influenced more by the local industry structure than by government grants, which were found to be of little importance.

**Aims of This Study**

In Italy, some incentives in the form of deductions from the IRAP tax base were introduced in the last decade to promote employment. These measures included incentives for small firms, facilitation of job placement for disadvantaged employees, incentives for transitioning from fixed-term employment contracts to permanent (open-ended) employment contracts, and help for disadvantaged regions. Owing to the peculiar characteristics of the IRAP, a large portion of employment tax deductions in Italy are implemented through IRAP deductions.\textsuperscript{20}

\textsuperscript{16} Hakan Yilmazkuday, “Individual Tax Rates and Regional Tax Revenues: A Cross-State Analysis” (2017) 51:5 Regional Studies 701-11.

\textsuperscript{17} Michael Daly, Ian Gorman, Gordon Lenjosek, Alex MacNevin, and Wannakan Phiriapreunt, “The Impact of Regional Investment Incentives on Employment and Productivity: Some Canadian Evidence” (1993) 23:4 Regional Science and Urban Economics 559-75.

\textsuperscript{18} Hélène Laurent, Michel Mignolet, and Olivier Meunier, “Regional Policy: What Is the Most Efficient Instrument?” (2009) 88:3 Papers in Regional Science 491-507.

\textsuperscript{19} Michel P. Devereux, Rachel Griffith, and Helen D. Simpson, “Firm Location Decisions, Regional Grants and Agglomeration Externalities” (2007) 91:3-4 Journal of Public Economics 413-35.

\textsuperscript{20} This provision did not overlap any other subsidy granted to firms before or after the period considered here. The actual sample data span the years 2004-2010, which include one year before the introduction of the provision and three years after the last deduction was obtained.
Our contribution is to estimate the impact of the IRAP tax deduction on employment using a large sample of Italian firms and applying a reduced-form approach to empirical modelling. We explore the effects of the IRAP deduction on employment growth from the following perspectives:

- the durability of the increasing effects of the tax deduction on employment owing to a change in the occupational structure of firms;
- the reduction of the employment gap between more developed regions and regions that are disadvantaged;
- increasing employment of a skilled workforce; and
- an increase in productivity in the form of an increase in market share, as indicated by increased sales.

Other studies have examined similar measures and similar incentives related to the IRAP. For instance, Monteduro et al. investigated an IRAP tax credit granted for job hiring after 2007; however, this study focused only on small and medium-sized enterprises (SMEs) located in southern regions, and it did not calculate the average cost of an additional job. Recently, Porro and Salis considered four programs granted at the local level by the Lombardy region that provided financial incentives for job-hiring firms, with a partial focus on territory regarding the targets of the provisions. However, the authors implemented only a short-run analysis, so some questions remain about the long-run effects.

Kangasharju analyzed the wage subsidy policy in Finland. This provision is quite different from a tax credit, since the subsidies aim to increase wages up to the minimum level granted in Finland. Hence, “wage subsidies are directed to firms who employ the kind of unemployed whose productivity and qualifications are lower than the levels needed in active labour markets.” In other words, the instrument is not targeted to a generalized public.

As stated above, the IRAP deduction generated some questions. For example, is there a real differential in employment growth as between beneficiaries and non-beneficiaries? Is there a greater employment change for southern regions given the greater deductions granted for firms located there? Are the effects of the deduction on employment permanent? Does the deduction affect the performance of non-beneficiary firms? How efficient is the provision in terms of cost per new job created?
in different regions? To address these questions, we carried out a two-step procedure (using propensity score matching and DiD), which identified a firm as “treated” if it benefited from the IRAP deduction after hiring an employee with a permanent contract (subject to the rules and limitations discussed in the next section). This implies greater deductions from the IRAP base with respect to non-beneficiary firms.

To sum up, the aim of this article is multifold. We try to verify not only the employment increase for beneficiaries, but also whether the change was enduring. In other words, we want to verify the existence of a differential effect on another dimension—the duration of the employment increase. The methodology used in estimating differential effects can help to determine whether the differential change in employment level is permanent (an important consideration), and whether the differential effects calculated for other variables, such as productivity, salary, and sales, are actual as well.

Many authors studying economic measures have utilized, as an outcome variable, the target of the provisions. Kangasharju25 analyzed the effects of a wage subsidy for new workers on employment and employees’ skill and wage level by means of a DiD methodology. Other studies analyzed the effects of employment tax deductions on total employment growth for all firms located in southern Italian regions, by means of “average treatment effect on the treated” (ATT) estimates.26 In the same way, analyses of the impact of tax policies on other economic variables, carried out by means of DiD methodologies, have considered the provision target as an outcome variable. For instance, Haegeland and Møen27 and Bozio, Irac, and Py28 examined the effects of a tax deduction for investment in research and development (R & D) on the increase in such investments, while Bronzini and de Blasio29 investigated the effect on investment growth of investment incentives granted by Law 488/12 in Italy.

Our study analyzes an extensive and generalized provision not targeted to specific firms or employees, but aimed at improving employment all over the country. It represents a comprehensive analysis of this particular measure—a tax deduction granted on the basis of a regional tax—implemented in 2005-2007, which also compares the effects at the regional level.

The rest of the article is organized as follows. The next (second) section describes the IRAP tax deduction. The third section describes the data sources and summary

25 Kangasharju, supra note 23.
26 See, for example, Monteduro et al., supra note 21.
27 Torbjørn Haegeland and Jarle Møen, Input Additionality in the Norwegian R & D Tax Credit Scheme, Report no. 2007/47 (Oslo: Statistics Norway, December 2007).
28 Antoine Bozio, Delphine Irac, and Loriane Py, Impact of Research Tax Credit on R & D and Innovation: Evidence from the 2008 French Reform, Banque de France Working Paper no. 532 (Paris: Banque de France, December 2014).
29 Raffaello Bronzini and Guido de Blasio, “Evaluating the Impact of Investment Incentives: The Case of Italy’s Law 488/1992” (2006) 60:2 Journal of Urban Economics 327-49.
statistics for this study, and the fourth section outlines the study methodology. The fifth section explains the evaluation of the results of the matching procedure, and the sixth section presents the results of the DiD estimation for employment and other indicators. The conclusions are reported in the last section. An appendix to the article provides an estimate of the efficiency of the IRAP tax deduction.

THE IRAP TAX DEDUCTION

The IRAP

The IRAP is a regional production tax adopted in 1998 as part of a reform package designed to remedy certain weaknesses in the Italian tax system. The IRAP represents perhaps the most important modern move toward a local business value-added tax. It is similar, in some respects, to the French territorial economic contribution (contribution économique territoriale); for instance, both programs use a method of allocating revenues among localities that is essentially based on local employment, as described in Gilbert. Implementation of the IRAP was intended to address multiple issues, including avoiding the imposition of high statutory tax rates on income or additional taxation on business net worth, and to provide regions with an autonomous source of revenue to increase their fiscal accountability, specifically in the health-care sector. The tax burden was no longer focused on gross profits, but instead was based on a broader definition of corporate revenues to allow for a reduction in rates.

The IRAP’s tax base is the net value added generated by all types of businesses in each region. Thus, the tax is based not on net income before tax, but on the value added produced by a company at the local level. Value added is defined as the difference between operating revenues and costs before interest income and expenses, and, in particular, labour costs are deducted, so that part of the tax affects values other than the company’s pure income. As well as differentiating tax base from gross profit, the IRAP is also payable in the event of a reported loss. This provision makes the tax procyclical and thus may worsen the already difficult situation of companies during economic and financial crises.

Given the broad tax base, the ordinary statutory rate applied at the time the IRAP was enacted was relatively low—though, notwithstanding the low rate, the tax revenue was considerable—and the initial tax rate has been reduced in the last decade. As for the definition of the tax base, specific rates apply to different sectors of economic activity and different organizational forms. If the activity is conducted in several regions, the value is divided according to the remuneration payable to staff in each region. Once the tax has been collected, the revenues are allocated among regions in proportion to labour costs incurred in each region, net of a share to be paid to the Italian state, as compensation for costs associated with control and certification activities. The regions then distribute a share of the income to each

30 Guy Gilbert, “Finances Publiques Locales Enjeux et Perspectives,” paper presented at the Institut National des Études Territoriales, Strasbourg, France, May 31-June 1, 2010.
province and municipality. The introduction of the IRAP, moving taxation toward the regional level, implies a better balance between national and subnational tax systems. Almost all IRAP revenue is allocated to health-care expenditures, the main field of competence of the regions. Since 2005, regions can modify the tax rate by up to 1 percent when running into deficits with health-care expenditures. This option became compulsory in 2006 and since then has resulted in increased IRAP rates in the Abruzzo, Campania, Lazio, Molise, and Sicilia regions.

Since the implementation of the IRAP, various incentives (in the form of deductions from the tax base) have been introduced to promote small businesses and permanent employment, and to reduce regional gaps. The IRAP remains distinct from the corporate tax (IRES), even if it is possible to deduct some IRAP items from general corporate tax liabilities. (For an in-depth analysis of the IRAP, see Bordignon et al.)

The IRAP Deduction Introduced To Promote Employment

Law n. 80 (2005) and Law n. 311 (2004) (Budget Law for 2005) introduced an important IRAP deduction aimed at increasing the employment base. The deduction, operative from 2005 until 2008, when it expired, was intended to promote employment through permanent contracts and to improve employment rates to a greater extent in disadvantaged regions relative to the rest of the country. The provision covered both full-time and part-time permanent contracts, but was conditional on an actual increase in a firm’s employment base. The structure of the IRAP deduction influenced the effectiveness of the provision in creating jobs. The most relevant features of the deduction include the following:

- The IRAP’s new employment deduction was available for the creation of new, permanent contract jobs, so the deduction was not available for fixed-term contract jobs.
- The deduction applied against the IRAP tax base; firms with no IRAP tax liabilities could not use the deduction.
- The provision allowed for the deduction of labour costs up to €20,000 for each new employee if the average number of permanent employees, calculated on an annual basis, increased relative to the previous year.
- An increase in the level of employment was realized if the difference between the number of employees at the end of a year and the annual average of the number of employees in the previous year was positive.
- The deduction was maintained if the total employment did not increase in the fiscal years following the fiscal year for which the deduction was granted.

31 Bordignon et al., supra note 11.

32 In this study, we considered the deduction effect only for the three-year period before the financial crisis (that is, 2005-2007).
The deduction aimed to provide additional permanent employment and was not available for replacement workers (employees replacing laid-off workers).

The amount of the deduction granted varied, depending on the location of the firm. This provision was intended to foster employment in less-developed regions; thus, a greater deduction was allowed if a firm was located in one of the less-developed regions in southern Italy (Campania, Puglia, Basilicata, Calabria, Sicilia, Sardinia, Abruzzo, or Molise).33

A firm had to maintain the additional jobs created until the end of the 2008 financial year in order to maintain the employment base increase.

The deduction was extended to all types of industries.

A firm could obtain the IRAP deduction for one or more years. For example, a firm could obtain the deduction for 2005 and 2006, or a beneficiary firm in 2006 could obtain a further deduction (for other new employees) in 2007.

Finally, the deduction granted for each new job in a disadvantaged area (a southern region) increased during the period 2005-2007.

These provisions can be summarized as follows. Beneficiary firms had to increase their employment base from the average of the preceding financial year before receiving the deduction. It was possible for the same firm to decrease its employment base in subsequent financial years, but only if the employment change remained positive compared to the initial year until financial year 2008. The benefit for the firm was achieved by means of deductions from the IRAP tax base, which includes the cost of labour. An example of the calculation of the number of deductions granted to a hypothetical firm is presented in table 1.

In order to benefit from the provision, eligible enterprises must be informed about the existence of the incentive and apply if the expected benefits exceed the expected cost of application. The costs incurred by firms in becoming beneficiaries of the IRAP deduction fall into several categories: search costs, compliance costs, reporting costs (linked to providing additional information to fiscal authorities), and hiring costs. Depending on those costs, firms in different industries and of different sizes may find it more or less advantageous to exploit tax deductions linked to new employment; moreover, they must maintain a positive employment differential relative to the initial year.

Access to the deductions differed according to firms’ characteristics. In 2005, more “younger” firms, in business for fewer years, accessed the deduction than “older” firms. Newer firms are more dynamic and better able to accommodate the administrative costs referred to above. For the same reasons, the larger (and best-organized) firms accessed the deduction more often than smaller firms. The geographical and economic-sector classifications also mattered: in the northern

33 The additional deduction differs from one region to another. The calculation of the deduction is more complicated in these cases, but it can be estimated at around three to five times the base deduction granted for the rest of the country.
regions, in 2005, the share of beneficiaries was higher than in the southern regions; and industries (manufacturing and energy supply) received a larger share of the benefits than the service sector. These facts may explain why some eligible firms were not beneficiaries. They also contribute to the construction of the profile of the beneficiary firm used in the matching procedure described below.

**DATA AND VARIABLES**

We exploited two main sources of data: corporate tax return data from the Italian Ministry of Economy, including all tax forms related to Italian limited enterprises (approximately 1,050,000 firms per year); and the balance sheet data of limited enterprises, a database acquired by the Italian Institute of Statistics (Istat) from the Chamber of Commerce.

We identified eligible firms as those described in a study by Caiumi, or firms for which the IRAP economic base was greater than zero. We assembled a panel of approximately 1.2 million observations relating to about 168,000 firms per year over the seven years from 2004 through 2010. We considered only those firms

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**TABLE 1 Calculation of Deductions Granted to a Hypothetical Firm**

|                | 2005             | 2006             |
|----------------|------------------|------------------|
| Number of employees at 31/12/2004 | 22               | Number of employees at 31/12/2005 | 27               |
| Hirings in 2005 | 5                | Deductions granted for 2005 | 5                |
| Number of employees at 31/12/2005 | 27               | Number of employees at 31/12/2006 | 25               |
| Average number of employees in 2004 | 26.3             | Dismissed in 2006 | 5                |
| Employment growth, 2005 | 0.7             | Hirings in 2006 | 3                |
| Deductions granted for 2005 | 5                | Average number of employees in 2005 | 26.5             |
| Employment growth, 2005 | −1.5            | Deductions granted for 2006 | 5                |
| Granted for 2005 | 5                | Granted for 2006 | 0                |

Note: Employment growth is calculated as the difference between the prior-year average and the current-year number of employees at year-end. Assumed financial year-end is December 31.

Source: Agenzia delle Entrate (Italian Revenue Agency), Administrative Circular, February 13, 2006, n. 7/E.

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34 Antonella Caiumi, *The Evaluation of the Effectiveness of Tax Expenditures—A Novel Approach: An Application to the Regional Tax Incentives for Business Investment in Italy*, OECD Taxation Working Paper no. 5 (Paris: Organisation for Economic Co-operation and Development, 2011).

35 We considered a span of time longer than 2005-2007 in order to have data for a one-year period before the introduction of the provision and a three-year period after the last deduction was received.
that remained in the panel for at least five consecutive years and that received a certain deduction amount; hence, having at maximum only seven presences, we obtained a quasi-balanced panel with very little attrition, concentrated in the first year (2004) and in the last two years (2009 and 2010). This panel is representative of incorporated enterprises.

In this study, the following variables were considered:

- **ROA** (return on assets): calculated as operating income (OI) over total assets;
- **Tangibles**: defined as the ratio of tangible fixed assets to total assets;
- **Age**: information about a firm’s age, in years;
- **Tax status**: if the firm had corporate tax (IRES) liabilities, tax status = 1; otherwise, tax status = 0;
- **Persons employed**: the number of persons employed at the firm;
- **Sales**: annual turnover;
- **Average salary**: salary amount per head;
- **Productivity**: the ratio of value added to persons employed; and
- **Export tendency** (Exp_tend): export amount on turnover.

Firms were classified according to some categorical variables. Firm size was divided into three large revenue (turnover) classes: small (under €2 million), medium (from €2 million to €10 million), and large (over €10 million). Two other classifications were considered: economic sector classification and geographical area classification. The use of a geographical area classification allowed for the disentanglement of the differential area deduction effects in the probit model described below. A summary of the sample firms’ statistics for the variables considered in this study is presented in table 2.

From 2005 to 2007, the specific deduction amount for permanent contracts tripled for the firms included in the panel, while the number of beneficiaries increased by 20 percent. Consequently, the average firm deduction doubled in the period for the sample firms (table 3).

In general, the deduction amount increased with firm size, and the distribution of size categories remained substantially unaltered during the period. Southern regions received increasing average deductions owing to the additional deduction granted to them at the local level.

**METHODOLOGICAL FRAMEWORK**

**DiD model**

This empirical study aims to determine whether exploiting the IRAP tax deduction had a causal effect on firms’ economic indicators, by reference to a targeted eligible firm. Following the approach and notation used by Blundell and Costa Dias36 and

36 Richard Blundell and Monica Costa Dias, “Evaluation Methods for Non-Experimental Data” (2000) 21:4 Fiscal Studies 427-68.
by Bandick and Karpaty,\textsuperscript{37} we adopted a two-stage strategy.\textsuperscript{38} We first constructed a sample of matched beneficiary and non-beneficiary firms, and then we estimated a DiD coefficient for the matched sample.

For this purpose, we developed the following formula and series of equations. Let $TC \in \{0,1\}$ be an indicator of whether firm $i$ is a beneficiary of the IRAP deduction in time period $t$, and let $y_{i,t+s}$ be employment at time $t+s; s > 0$, after the first

\begin{table}
\centering
\begin{tabular}{lccc}
\hline
Variable & Mean & Standard & Median \\
\hline
Persons employed & 26.8 & 240.9 & 9.0 \\
Average salary\textsuperscript{a} & 23.2 & 19.2 & 21.1 \\
ROA & 5.8 & 10.5 & 4.8 \\
Tax status & 0.8 & 0.4 & 1.0 \\
Age & 17.2 & 12.3 & 14.0 \\
Productivity\textsuperscript{a} & 47.3 & 91.4 & 36.2 \\
Sales\textsuperscript{a} & 6,608 & 6,610 & 1,268 \\
Export tendency & 0.04 & 0.15 & 0.02 \\
Tangibles & 0.21 & 0.22 & 0.1 \\
\hline
\end{tabular}
\caption{Summary Statistics, 2004-2010}
\end{table}

\textsuperscript{a} Thousands of euros.

\begin{table}
\centering
\begin{tabular}{lrrr}
\hline
 & 2005 & 2006 & 2007 \\
\hline
Total IRAP deduction\textsuperscript{a} & 1,549,865 & 3,203,217 & 4,544,177 \\
Number of beneficiaries & 71,697 & 80,893 & 86,200 \\
Average firm deduction\textsuperscript{a} & 22 & 40 & 53 \\
By geographic area & & & \\
North-west & 21 & 38 & 46 \\
North-east & 21 & 32 & 45 \\
Centre & 21 & 35 & 48 \\
South & 24 & 57 & 79 \\
By firm size (turnover classes) & & & \\
Less than €2 million & 12 & 19 & 29 \\
€2 million to €10 million & 24 & 43 & 60 \\
Over €10 million & 85 & 163 & 181 \\
\hline
\end{tabular}
\caption{Annual IRAP Deductions, Sample Firms, 2005-2007}
\end{table}

IRAP = regional tax on productive activities.

\textsuperscript{a} Thousands of euros.

\textsuperscript{37} Roger Bandick and Patrik Karpaty, “Employment Effects of Foreign Acquisition” (2011) 20:2 International Review of Economics and Finance 211-24.

\textsuperscript{38} Also described in Alessandro Zeli, “The Impact of ACE on Investment: The Italian Case” (2018) 35:3 Economia Politica 741-62.
The evaluation of job tax incentives: an analysis of a regional tax deduction year. If firm $i$ is a non-beneficiary firm, its outcome is denoted as $y_{i,t+s}^0$. The causal effect on employment by being an IRAP tax deduction beneficiary for firm $i$ at time $t$ can be defined as

$$y_{i,t+s}^1 - y_{i,t+s}^0.$$  

(1)

Now it is possible to observe $y_{i,t+s}^1$, while $y_{i,t+s}^0$ is not observable; this is the primary problem in the estimation of causal effects. So it is possible to define the average effect of exploiting the tax deduction as

$$E\{y_{i,t+s}^1 - y_{i,t+s}^0 | TC_{it} = 1\} = E\{y_{i,t+s}^1 | TC_{it} = 1\} - E\{y_{i,t+s}^0 | TC_{it} = 1\}.  

(2)

The last term of equation 2 is the counterfactual, which is difficult to construct. In other words, we must estimate what the outcome for firms exploiting the tax deduction would have been, on average, had those firms not used the tax deduction. One method to determine this estimation is to use the average employment of firms that were not deduction beneficiaries, expressed as $E\{y_{i,t+s}^0 | TC_{it} = 0\}$. Variable $TC_{it}$ is influenced by many other variables and simultaneous effects being endogenously so determined. If these influences are not considered, the estimation of causal effects will be biased.

Since this is a missing-data problem, we need to use the available information to impute the relevant information that is not possible to observe. However, if the selection into treatment is completely determined by a set of exogenous covariates ($X$), and if those covariates can be observed by the researcher and the assignment into treatment is random, then the outcomes for the non-treated firms are independent of the participation status.

Our approach employed a matching technique. Matching involves pairing beneficiary with non-beneficiary firms on the basis of similar pre-provision characteristics ($X$), including size, location, age, and profitability. Using this technique, we built a sample of non-recipient firms twinned with recipient firms to better approximate the non-observed counterfactual event in equation 2. We used the Rubin$^{[39]}$ and Rosenbaum and Rubin$^{[40]}$ propensity score matching methodology. Under the conditional independence assumption, the selection occurs only on observables.

A probit model was used to estimate the probability (or propensity score) of being a beneficiary firm. This is the first step in implementing propensity score matching. We begin with the following formula:

$$p(TC_{it} = 1) = F(X_{it-1,D_j,D_i}),$$  

(3)

$^{[39]}$ Donald B. Rubin, “Assignment to Treatment Group on the Basis of a Covariate” (1977) 2:1 Journal of Educational Statistics 1-26.

$^{[40]}$ Paul R. Rosenbaum and Donald B. Rubin, “The Central Role of the Propensity Score in Observational Studies for Causal Effects” (1983) 70:1 Biometrika 41-55.
where $TC_{it} = 1$ denotes a non-beneficiary firm in year $t − 1$ that benefits from tax deduction in year $t$; $X_{it−1}$ is a vector of relevant firm-specific variables in year $t − 1$ that may influence the firm’s probability of being a beneficiary in year $t$; $D_j$ controls for industry or area effects; and $D_t$ controls for time-fixed effects.

The following equation explicitly indicates the variables included in the probit model.

$$p(TC_{it} = 1) = \beta_0 + \beta_1 Age_{t−1} + \beta_2 Age^2_{t−1} + \beta_3 TS_{t−1} + \beta_4 ROA_{t−1} + \beta_5 Exp_{t−1} + \beta_6 Tangibles_{t−1} + \delta_1 Size + \delta_2 Area + \delta_3 Industry + \epsilon.$$  (4)

Using the propensity scores after the probit model estimation, it is possible to select the control firms for which the propensity score determines the closest match with a treated firm. We utilized the Stata procedure PSMATCH2 developed by Leuven and Sianesi to match treated and control firms. To identify the counterfactual, the main estimation method adopted was nearest-neighbour matching without replacement.

When the control group of firms is identified, the DiD estimator can be used to estimate the impact of use of the tax deduction on the firms’ economic indicators. According to Wooldridge, this estimate can be obtained by employing the following regression:

$$y_{it} = \beta_0 + \beta_1 TCA_i + \beta_2 After_{it+s} + \beta_3 TCA_i \times After_{it+s} + \beta_4 X_{it} + \epsilon_{it},$$  (5)

where $y_{it}$ is the target outcome variable (change in employment). $TC$ is a dummy variable equal to 1 for beneficiary (treated) firms and equal to 0 for non-beneficiary firms. We multiply this dummy by the total deduction amount for the single $i$th firm over the period $(A_i)$ to exploit this micro-level information, and thus obtain the variable $TCA_i$ as shown in Angrist and Pischke. The dummy variable $After_{it+s}$ takes a value of 1 in the post-tax deduction year $t + s$ and a value of 0 in the year before the tax deduction. This dummy variable captures aggregate period effects that are common between the two groups $T$ and $C$. The last term $TCA_i \times After_{it+s}$ represents the interaction between $TCA_i$ and $After_{it+s}$. The coefficient of this last term ($\beta_3$).

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41 Edwin Leuven and Barbara Sianesi, “PSMATCH2: Stata Module To Perform Full Mahalanobis and Propensity Score Matching, Common Support Graphing, and Covariate Imbalance Testing,” Statistical Software Components, Boston College Department of Economics, 2003 (http://ideas.repec.org/c/boc/bocode/s432001.html).

42 Jeffrey M. Wooldridge, *Econometric Analysis of Cross-Section and Panel Data* (Cambridge, MA: MIT Press, 2002).

43 In thousands of euros.

44 Joshua A. Angrist and Jörn-Steffen Pischke, * Mostly Harmless Econometrics: An Empiricist’s Companion* (Princeton, NJ: Princeton University Press, 2009).
represents the DiD estimator of the effect of being a beneficiary on treated firm $T$, or $\beta_3 = \gamma_{t+s}$. The DiD estimator eliminates unobserved time-invariant differences in employment between beneficiary and non-beneficiary firms. Finally, $X_{t+s}$ is a set of control dummy variables: geographical area, size, industry, and year. Moreover, as in Bandick and Karpaty, we included a vector of firm characteristics to control for differences in observable attributes among firms. In particular, following the literature on similar topics, sales and a measure of profit ($ROA$) were included in the control variables matrix $X$. Regression 4 was replicated for each of the variables of interest (turnover, average salary, and productivity).

An important hypothesis underlying the DiD procedure is the parallelism assumption—that, without the deduction, the supported firms would have followed a trajectory parallel to that of the non-supported firms. However, there is nothing to support the truth of that assumption, as discussed in a 2012 report by the Associazione per lo Sviluppo della Valutazione e l’Analisi delle Politiche Pubbliche (ASVAPP).

To address this issue, the employment trends for beneficiaries and non-beneficiaries in the matched sample and the probably natural dynamic for beneficiaries (that is, employment without the IRAP deduction) were further analyzed. The results are presented in figure 1. The beneficiaries and non-beneficiaries have parallel trajectories before 2005 (the starting year for IRAP deductions). After 2005, there is an increase in employment for beneficiaries that surpasses the increase for non-beneficiaries. The beneficiaries’ trajectories remain divergent from those of the non-beneficiaries throughout the three-year period 2005-2007.

After 2008, the trajectories resume a parallel path, showing an impact of the tax deduction provision and a constant differential between beneficiaries and non-beneficiaries owing to the provision itself. The graph does not show effects in the years before the provision was adopted. The beneficiaries’ employment impact trend displays a strong increase in the first years after the provision was enacted (2005-2007); subsequently, the trend flattens out, indicating a permanent higher employment level for the beneficiaries. Hence, figure 1 supplies evidence of a common underlying trend (the natural dynamic) for treated and control firms, and a treatment effect producing a deviation from that trend.

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45 Bandick and Karpaty, supra note 37.
46 Bronzini and de Blasio, supra note 29; and Kangasharju, supra note 23.
47 Associazione per lo Sviluppo della Valutazione e l’Analisi delle Politiche Pubbliche (ASVAPP), Counterfactual Impact Evaluation of Cohesion Policy: Impact and Cost-Effectiveness of Investment Subsidies in Italy, final report to the European Commission (DG Regional Policy) (Torino: ASVAPP, June 2012).
48 David H. Autor, “Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing” (2003) 21:1 Journal of Labor Economics 1-42, at 25-26; and Angrist and Pischke, supra note 44, at 178-80.
To assess the robustness of our results, we used an alternative format in which propensity score matching and DiD are computed simultaneously, as shown by Blundell and Costa Dias.49 In this case, the DiD matching estimator is given by the equation

$$ATT = \frac{1}{N_T} \sum_{i \in T} \left( y_{i,t+s}^T - y_{i,t-1}^T - \sum_{j \in C} w_j (y_{j,t+s}^C - y_{j,t-1}^C) \right),$$

where $ATT$ is the average effect of treatment on treated; $N_T$ is the number of beneficiary firms; $y_{i,t+s}^T$ is the outcome variable (employment) for beneficiary firm $i$ at year $t + s$; $y_{j,t+s}^C$ and $y_{j,t-1}^C$ are the outcome variables for non-beneficiary firm $j$ at years $t + s$ and $t - 1$, respectively; $S$ denotes the region of common support; and the weights $w_j$ are defined by $w_j = \sum_i w_{ij}$. We use a nearest-neighbour matching algorithm, for which standard errors are obtained by bootstrapping, as described in Becker and Ichino.50

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49 Richard Blundell and Monica Costa Dias, “Alternative Approaches to Evaluation in Empirical Microeconomics” (2009) 44:3 Journal of Human Resources 565-640.

50 Sascha O. Becker and Andrea Ichino, “Estimation of Average Treatment Effects Based on Propensity Scores” (2002) 2:4 Stata Journal 358-77.
Displacement Effects

In our analysis, we assumed that the potential outcome for firms located in one region did not depend on whether firms located in another region (or in the same region) received treatment or not. The identification of the treatment effect was based on the premise that subsidized firms did not influence the actions of non-subsidized or less-subsidized firms.

Among the factors that could influence non-treated firms, given the presence of treated ones, were the competitive edge of treated firms owing to the decrease in the marginal cost of labour and the reallocation of spared funds for labour costs to marketing intensification. A negative effect may be the gain in market share for beneficiaries relative to non-beneficiaries. A positive effect of treatment on non-treated firms is the tendency for those firms to have increasing employment because of favourable market prospects and an improved business climate. Moreover, if there was different treatment at the regional (or geographical zone) level, firms located in less-subsidized zones may be inclined to move to more-subsidized zones. This effect may occur among different geographical areas. Such movement would imply an effect on a positive net inflow of firms because of the incentive to relocate to areas with more generous deduction schemes, as analyzed by Bennmarker, Mellander, and Öckert\(^{51}\) and by Bordignon et al.\(^{52}\) If these factors were not negligible, the estimate included both the effect of treatment on the treated firms and the effect of subsidies on other firms. Hence, the counterfactual employment estimate decreased/increased (since the employment of non-subsidized firms decreased/increased), and estimates were biased upward/downward.

We followed the approach of Kangasharju\(^{53}\) to address the first displacement effect. The displacement effects most likely occur within the same industry and/or geographical area. There are three potential displacement effects, generated by firms within the same industrial sector, within the same region, or within the same sector and region as the beneficiary firms. In building the industry-specific displacement variable, it was necessary to sum the industry-specific deduction amounts for each \(i^{th}\) firm and then subtract from this aggregate the deduction that the same \(i^{th}\) firm received that year. In the case of non-beneficiary firms, the deducted amount was 0. Thus, this variable showed for each firm the total deductions given to other firms in a specific industry. The same approach was followed to create the displacement for region-specific variables and for industry- and region-specific variables. The following formulas give the formal notation for the displacement variables as described:

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\(^{51}\) Helge Bennmarker, Erik Mellander, and Björn Öckert, “Do Regional Payroll Tax Reductions Boost Employment?” (2009) 16 Labour Economics 480-89.

\(^{52}\) Bordignon et al., supra note 11.

\(^{53}\) Kangasharju, supra note 23.
where $i$ represents firms, $k$ indicates industry, $r$ reflects region, $y$ stands for year, and $D$ is the amount of deductions. The estimation was implemented utilizing the DiD model described previously (equation 4) and including the displacement variables $DI$ (for industry-level effect), $DR$ (for regional-level effect), and $DIR$ (for industry and regional effect).

Finally, to detect firm relocation toward more-subsidized geographical zones, we analyzed the effect of the provision on net firm inflow at the “nomenclature of territorial units for statistics” (NUTS) 3 level (Italian provinces) by estimating the following equation over the provision’s duration period, 2005-2007:

$$\text{Net_{inflow}_p} = \alpha + \beta_1 D_{ed_p} + \beta_2 A_{Ded_p} + \beta_3 \text{Zone} \times A_{Ded_p} + \varepsilon,$$

where $D_{ed_p}$ is the total amount of deduction for the province $p$; $A_{Ded_p}$ is the average deduction calculated for beneficiary firms; and $\text{Zone} \times A_{Ded_p}$ is an interaction term between the more-subsidized zone and the average deduction.

**MATCHED SAMPLE**

Differences in characteristics between beneficiary and non-beneficiary firms before deductions could result in biased estimates of the causal effects of access to the deduction. This is because it is difficult to distinguish whether the performance of firms in those post-deduction years was attributable to the deduction itself or to the fact that firms with high performance tended to be beneficiaries.

To determine the firm-specific characteristics that may affect the probability of being a tax-deduction-receiving firm, we referred to some prior studies of local job-creation incentive programs. The main variables used in these studies included tax status, age, age$^2$, ROA, firm location (headquarters), size (in terms of persons employed), a sales class dummy, and an economic activity dummy. We also added the ratio of tangible assets to total assets ($\text{Tangibles}$) and tendency to export ($\text{Exp_tend}$).

Having or not having corporate tax (IRES) liabilities determined, in part, the benefits to firms from participating in the employment tax deduction. Firms that had low or no corporate tax liabilities had little incentive to take the IRAP deduction, while firms with high corporate tax liabilities in the current year were more likely to try to decrease liabilities by taking the deduction. Since the IRAP deduction facilitates the participation of firms in less-developed regions, those firms may be

54 Dagney Faulk, “The Participation of Firms in Tax Incentive Programs” (2001) 31:1 Review of Regional Studies 39-50; and Faulk, supra note 12.
more likely to take the deduction for job creation, and thus to participate in the tax incentive provision. The sales class is a measure of firm size. A tax incentive for larger firms may yield better outcomes than provision of the same incentive to smaller firms. Moreover, firms in certain industries may be more likely to take the tax deduction, either because certain industries use labour-intensive technologies and therefore can more easily increase employment, or because they are more likely to have corporate tax liabilities.

To evaluate different specifications, we used the balancing condition in order to ensure that each independent variable did not differ significantly as between treated and non-treated firms. Thus, only treated and non-treated firms with the same propensity score and the same distribution of their observable characteristics were matched. Table 4 shows the results from estimating the probit model evaluated for the years before the deduction was introduced (that is, in the year \( t - 1 \)). It appears that more capital-intensive firms were less likely to be beneficiaries, while more profitable firms and firms with corporate tax liabilities were more likely to be beneficiaries.

A range of specifications with different saturated models and interactions of different explicative variables were estimated. The outcomes were not significantly different from those of the base model, and there was no substantial improvement of the goodness-of-fit statistics. The base model was chosen because of its simplicity.

The result of the matching procedure with regard to the common support is illustrated in figure 2. It can be observed that the common support extended over all propensity score values.

To verify the quality of matching, \( t \)-tests for equality of means in the treated and non-treated groups, both before and after matching, were performed. For good balancing, \( t \)-statistics should be non-significant after matching. Moreover, the standardized bias, as stated in Rosenbaum and Rubin, should be less than 5 percent after matching. As reported in table 5, all covariates were well balanced (with a percentage bias after matching of less than 5 percent). Thus, the matching procedures were effective in building a good control group.

A subsample consisting of only matching units was also considered, reducing the sample size to around 347,000 firms. This set of firms was utilized to estimate the DiD model described in equation 5.

The distribution of the control group firms by propensity score values, calculated in the \( t - 1 \) year, is presented in figure 3.

55 The models’ estimations are available on request.

56 Paul R. Rosenbaum and Donald B. Rubin, “Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score” (1985) 39:1 American Statistician 33-38 (https://doi.org/10.2307/2683903).
**TABLE 4  Probit Model To Estimate Propensity Score**

| Variable                        | Probability of being a beneficiary \( (t = 1) \) |
|--------------------------------|-----------------------------------------------|
| Persons employed               | 0.005                                         |
| Age                            | 0.010                                         |
| Age\(^2\)                      | −0.017 ***                                    |
| Tax status                     | 0.000                                         |
| ROA                            | 0.068 ***                                     |
| Tangibles                      | 0.008                                         |
| Exp\(_{\text{tend}}\)          | 0.004 ***                                     |
| Productivity                   | −0.080 ***                                    |

| Size dummies                   | yes                                           |
| Area dummies                   | yes                                           |
| Industry dummies               | yes                                           |
| LR\(_{\text{chi}}^2\)(22)      | 8,292.4                                        |

Notes: Persons employed in thousands; productivity in thousands of euros. Standard error in italics. *** Statistically significant at the 0.01 level. ** Significant at the 0.5 level. * Significant at the 0.1 level.

**TABLE 5  Balance Checking Statistics**

| Variable            | Unmatched/ matched | Mean treated | Control | Bias (%) | Reduction (%) bias | t    | t-test | p > t |
|---------------------|--------------------|--------------|---------|----------|--------------------|------|--------|-------|
| Persons employed    |                    |              |         |          |                    |      |        |       |
|                     | U                  | 31.912       | 22.728  | 3.4      | 7.64               | 0    |        |       |
|                     | M                  | 31.912       | 29.565  | 0.9      | 74.4               | 1.37 | 0.171  |       |
| Age                 |                    |              |         |          |                    |      |        |       |
|                     | U                  | 13.99        | 15.55   | −13      | −24.56             | 0    |        |       |
|                     | M                  | 13.99        | 14.04   | −0.4     | 96.9               | −0.6 | 0.547  |       |
| Age\(^2\)           |                    |              |         |          |                    |      |        |       |
|                     | U                  | 332.97       | 393.52  | −8.9     | −16.39             | 0    |        |       |
|                     | M                  | 332.97       | 333.81  | −0.1     | 98.6               | −0.18| 0.854  |       |
| Tax status          |                    |              |         |          |                    |      |        |       |
|                     | U                  | 0.83         | 0.8     | 8.5      | 16.07              | 0    |        |       |
|                     | M                  | 0.83         | 0.83    | −0.1     | 98.5               | −0.19| 0.846  |       |
| ROA                 |                    |              |         |          |                    |      |        |       |
|                     | U                  | 7.55         | 6.66    | 9.2      | 17.29              | 0    |        |       |
|                     | M                  | 7.55         | 7.53    | 0.2      | 97.6               | 0.31 | 0.756  |       |
| Tangibles           |                    |              |         |          |                    |      |        |       |
|                     | U                  | 0.19         | 0.2     | −5.3     | −9.69              | 0    |        |       |
|                     | M                  | 0.19         | 0.19    | −0.1     | 98.0               | −0.16| 0.876  |       |
| Exp\(_{\text{tend}}\)  |                    |              |         |          |                    |      |        |       |
|                     | U                  | 0.04         | 0.04    | 0.6      | 1.08               | 0.281|        |       |
|                     | M                  | 0.04         | 0.04    | −0.6     | −0.6               | −0.8 | 0.423  |       |
| Productivity        |                    |              |         |          |                    |      |        |       |
|                     | U                  | 47.6         | 46.4    | 1.4      | 2.4                | 0.016|        |       |
|                     | M                  | 47.6         | 48.3    | −0.9     | 35.2               | −1.43| 0.151  |       |

Electronic copy available at: https://ssrn.com/abstract=3564312
FIGURE 2  After-Matching Estimated Probability of Being an IRAP Deduction Beneficiary (Propensity Score)—Distribution by Treated and Control Groups

IRAP = regional tax on productive activities.

FIGURE 3  Distribution of the Control Group Firms by Propensity Score Values
DIFFERENCE-IN-DIFFERENCE RESULTS

Results

To study whether the IRAP deduction has had any effects on employment in post-deduction years, we estimate the regression model in equation 5. The dependent variables are employment, sales, average salary, and productivity changes at the firm level, and the key estimate is the DiD estimator.

Table 6 presents the effects of the IRAP deduction on post-deduction employment estimated by means of an ordinary least square (OLS) robust estimator.

The results for OLS estimation of the base model are shown in column 1. The DiD estimator \( \text{inter} (\text{TCA}_i \times \text{After}_{t+}) \) is positive and indicates that, on average, the IRAP deductions had a positive effect on employment in the years for which the deduction was granted. The coefficients are also highly significant when firm-level controls—firm sales and the profitability ratio—are added (column 2).

If we want to check the parallelism assumption (as described above) in the framework of the DiD identification strategy, we have to add an individual-specific time trend to the regressors in \( X_{it} \), as shown in Angrist and Pischke.\(^57\) If the estimated effects of interest remain substantially unchanged and significant by the inclusion of this trend, we can accept the results obtained by the DiD procedure described previously. Column 3 in table 6 presents the estimated \( \text{inter} \) coefficients for the OLS base model when trend is included, and we can note that the \( \text{inter} \) coefficient (our DiD effects) registers a decrease but remains strongly significant; this confirms the effects found using our model.

The DiD estimator for the model in column 3 suggests that the deduction has had a positive and significant impact on employment in beneficiary firms. These results are in line with the outcomes of, for instance, Huttunen et al.,\(^58\) although they present higher values and so a larger economic impact of the deduction on employment growth.

To investigate the dynamic pattern of the post-deduction employment effects, in column 4 the interaction variable for the whole post-deduction period \( \text{inter} = (\text{TCA}_i \times \text{After}_{t+}) \) with year-by-year interaction variables is replaced—that is, \( \text{inter}_0 = (\text{TCA}_i \times \text{After}_{t+0}) \), starting from the first deduction year and continuing for the next three years. All coefficients on these interactions are significant and present an increasing effect over time until the second year after the year of initial deduction. The third year presents a decrease relative to the second year.

The differential outcome in terms of employment growth between treated and non-treated firms remains significant in all three periods after the last deduction year. Also, after 2008, when the financial crisis caused employment to begin to decrease, the outcomes of the non-beneficiaries do not fill the gap, but a decrease in the differential can be registered. This raises some doubt about the persistency of the deduction’s effects.

\(^57\) Angrist and Pischke, supra note 44.

\(^58\) Huttunen et al., supra note 6.
TABLE 6  Effects of the IRAP Deduction on Post-Deduction Changes in Employment, Sales, Average Salary, and Productivity, 2004-2010

| Variables (changes) | (1) OLS (t-ratio) | (2) OLS (t-ratio) | (3) OLS (t-ratio) | (4) OLS (t-ratio) | (5) OLS (t-ratio) | (6) OLS (t-ratio) | (7) OLS (t-ratio) |
|---------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Treated.            | 0.002 ***         | -0.0001           | -0.0002           | 0.007 ***         | -0.253            | -0.0001           | -0.377            |
|                     | 3.17              | -0.06             | 0.001             | 0.001             | 0.681             | 0.0002            | 0.406             |
| After_s.            | 0.198             | 0.217             | 0.210             | 0.113             | -30.373           | 0.099             | -173.742          |
|                     | 0.64              | 0.7               | 0.308             | 0.145             | 110.340           | 0.112             | 296.70            |
| Inter               | 0.04 ***          | 0.038 ***         | 0.037 ***         | 2.540 ***         | -0.001 *          | -1.993 **         |                   |
|                     | 0.007             | 0.006             | 0.006             | 1.080             | 0.000             | 0.742             |                   |
| Intera 0            |                   |                   |                   |                   |                   |                   |                   |
|                     | 0.026 ***         |                   |                   |                   |                   |                   |                   |
| Intera 1            |                   |                   |                   |                   |                   |                   |                   |
|                     | 0.047 ***         |                   |                   |                   |                   |                   |                   |
| Intera 2            |                   |                   |                   |                   |                   |                   |                   |
|                     | 0.062 ***         |                   |                   |                   |                   |                   |                   |
| Intera 3            |                   |                   |                   |                   |                   |                   |                   |
|                     | 0.051 ***         |                   |                   |                   |                   |                   |                   |
| Constant            | 2.758 ***         | 2.733 ***         | 1.459 **          | 1.989 ***         | -607.25 ***       | 2.146 ***         | -6,420.11 ***     |
|                     | 0.472             | 0.455             | 0.566             | 0.247             | 181.4             | 0.188             | 508.6             |
| Firm controls       | no                | yes               | yes               | yes               | yes               | yes               | yes               |
| Regional dummies    | yes               | yes               | yes               | yes               | yes               | yes               | yes               |
| Year dummies        | yes               | yes               | yes               | yes               | yes               | yes               | yes               |
| Industry dummies    | yes               | yes               | yes               | yes               | yes               | yes               | yes               |
| Individual-specific trend | no             | no               | yes               | yes               | yes               | yes               | yes               |
| Adjusted $R^2$      | 0.111             | 0.097             | 0.112             | 0.132             | 0.147             | 0.112             | 0.121             |
| No. of observations | 346,807           | 346,807           | 346,807           | 346,807           | 346,807           | 346,807           | 346,807           |

IRAP = regional tax on productive activities; OLS = ordinary least square.

Notes: T-statistics in italics. *** Statistically significant at the 0.01 level. ** Significant at the 0.5 level. * Significant at the 0.1 level. Robust estimations.
Our data permit an indirect evaluation of the quality of the jobs created. The evaluation is carried out by estimating the impact of the deduction on average salary and labour productivity measured at the firm level, as previously done by Monteduro et al.\textsuperscript{59} Average salary could also be interpreted as a proxy of the firm’s human capital, and competitiveness increases if the ratio of highly qualified workers rises. A higher number of qualified workers also augments the efficiency of the firm, thus stimulating its growth. Arrighetti and Lasagni\textsuperscript{60} found a positive relationship between the high level of human capital and the augmented probability of new hiring among Italian firms.

We analyzed the impact of the deduction on average labour costs and labour productivity by treating those factors as dependent variables in equation 5. Columns 5 to 7 in table 6 show the results for these estimations.

The analysis shows that the average effect of the deduction on the firms’ average salaries (column 6) was negative and non-significant—that is, there were no significant effects of treatment on average salaries. This result may be cautiously interpreted as an insufficient stimulus to hire more skilled employees. It may also suggest that the jobs created were of low quality (or at least the deduction did not help to enhance job quality). This result is consistent with the estimated effect of the deduction on productivity; in the latter case, the deduction had a strong negative impact (column 7). If there were no other elements (such as investments in terms of both tangible/intangible assets and human capital) to offset the increasing employment, in general the provision of the deduction entailed a decrease in productivity. Despite this result, it seems that the deduction has had a positive and significant impact on sales (column 5), meaning that the provision may enhance firm growth.

We similarly investigated the differential effects of treatment among the 11 Italian macro-regions.\textsuperscript{61} For each macro-region, we included the interaction effect between regional dummy and the treatment. The estimates are presented in table 7.

The parameters are all statistically significant and positive except for the north-west macro region (comprising Piedmont, Liguria, and Valle d’Aosta). On average, the coefficients were higher for north-central regions, indicating a stronger impact for these regions. Despite the greater effort made toward rebalancing the employment levels in southern regions (through larger deductions), it seems that the outcomes were limited.

\begin{itemize}
\item \textsuperscript{59} Monteduro et al., supra note 21.
\item \textsuperscript{60} Alessandro Arrighetti and Andrea Lasagni, \textit{Assessing the Determinants of High-Growth Firms in Italy}, Working Paper 2010-07 (Parma: University of Parma, Department of Economics, September 2012).
\item \textsuperscript{61} In this case, we utilized level 1 of the 1999 version of the Eurostat-NUTS classification (http://ec.europa.eu/eurostat/web/nuts/history).
\end{itemize}
Robustness Check

We implemented a robustness check by calculating a DiD matching estimator in equation 6. In all estimates, we controlled for changes in the firm-specific characteristics of sales and ROA. The estimates were calculated for the three financial years after the last year for which the firm benefited from the deduction. The results, shown in table 8, indicate that the obtained DiD estimates were robust for almost all of the firms’ characteristics considered in our analysis.

The ATT coefficients were not significant only for average salary. This suggests that there may have been weak (or null) effects of the deduction in terms of average salary (that is, in terms of the quality of the jobs created). Finally, the ATT estimates confirm a persistent effect of the deduction for some periods after the provision expired.

Displacement Effects

The displacement effect for employment change was tested by adding each displacement variable in equation 7. If there was a displacement effect, the previously

| Variable | OLS (t-ratio) | Variable | OLS (t-ratio) |
|----------|--------------|----------|--------------|
| After_5  | 0.237        |          |              |
|          | 1.1          |          |              |

North-Central

North-west ................. −0.017
−1.9
Lombardy ................. 0.036 ***
91.4
North-east ................. 0.042 ***
30.4
Emilia-Romagna ............ 0.041 ***
92.9
Centre ................. 0.027 ***
43
Lazio ................. 0.052 ***
95.5

Firm controls ............... yes
Year dummies ............... yes
Individual-specific trend ...... yes
Adjusted $R^2$ ............... 0.141
No. of observations .......... 346,807

IRAP = regional tax on productive activities; OLS = ordinary least square.
Notes: T-statistics in italics. *** Statistically significant at the 0.01 level. ** Significant at the 0.5 level. * Significant at the 0.1 level. Robust estimations.

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found coefficient should be influenced by the impact on other firms, as studied by Kangasharju. The analysis was carried out considering the deduction amounts for region-level and industry-level data. Results give no indication of a displacement effect that may bias the estimate of deduction effects, even if the interaction effect between industries and regions was considered. The estimated results of deductions were in all cases positive, but none indicated a statistically significant effect.

The results for firms’ net inflow estimated by equation 8 did not present significant effects of the IRAP deduction’s differential treatment between the north-central and southern zones. This indicates that the deduction amount had no effect on the creation of new firms and did not provide an incentive to relocate firms to zones with more generous deduction schemes. The results of our analysis of displacement effects encourage us to consider that there was little interference owing to such effects and the stable unit treatment value assumption is satisfied.

**CONCLUSIONS**

This article has provided estimates of the employment impact of the Italian IRAP deduction granted for new additional jobs created in the period 2005-2007, by comparing employment (and other variables) of firms that exploited the deduction and firms that did not exploit the deduction. Other studies analyzing the effects of

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62 Kangasharju, supra note 23.
economic policy measures have utilized, as an outcome variable, the target of the policy provisions itself; however, we have further broadened the study’s objectives to include the verification of other aspects, such as duration of the employment increase and effects on employment structure of the firm.

Results from the models indicate that firms taking advantage of the IRAP tax incentive created relatively more employment opportunities; but, more relevant, they also maintained this new employment at least up to 2008. Moreover, the efficiency analysis revealed that these provisions performed well in terms of cost per job created.

These results are noteworthy also because the analysis was conducted on a large sample of firms. Moreover, the analysis yielded results that are quantitatively similar to those of other studies relevant to this topic, as described above.

Other important aspects that we tried to verify are related to the effects of the provision both on other important economic variables and at the regional level. The effects of the provision in terms of job quality seem to be negative, since average salaries did not show significant changes and productivity presented a negative effect for beneficiaries. Perhaps firms did not accurately calculate the optimal amount of new employment required to obtain the deductions, and thus restricted growth in efficiency and productivity, as suggested by Bernini and Pellegrini. Only the growth in volume of sales presented a positive and significant differential. Efforts to redirect new employment toward the southern regions do not seem to have been successful.

The evidence derived from this kind of analysis may help in building forecasting models to foresee the effect of a fiscal provision and its interaction with the economic cycle. These models can illuminate the economic effects of tax policies on firms and the influence of such policies on firms’ competitiveness. This information should be provided to policy makers so that they may know the expected impact before designing incentive programs.

**APPENDIX  EFFICIENCY ESTIMATION**

Having produced estimates regarding the effectiveness of the IRAP deduction, we can determine the efficiency of the provision. For this purpose, we transformed the impact estimates obtained from the econometric analysis into more easily interpreted quantities. Following the approach utilized for other Italian subsidies (as discussed, for example, in the ASVAPP report), we added cost information to the firm variables, thus obtaining a simple cost-effectiveness measure—the average cost per job created—calculated as follows:

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63 Cristina Bernini and Guido Pellegrini, “How Are Growth and Productivity in Private Firms Affected by Public Subsidy? Evidence from a Regional Policy” (2011) 41:3 Regional Science and Urban Economics 253-65.

64 ASVAPP, supra note 47.
Cost per job created = \frac{\text{Total funds disbursed to beneficiary firms}}{\text{Average employment impact} \times \text{no. of beneficiaries}}.

Analogously to employment, we present the impact on sales in the following form:

Cost per extra euro of sales = \frac{\text{Total funds disbursed to beneficiary firms}}{\text{Average impact on sales} \times \text{no. of beneficiaries}}.

Some firms may exhibit a small number of jobs created, but they may also receive relatively fewer resources. For example, larger firms receiving larger grants tend to generate larger gains in employment per firm, but they also receive huge amounts of money, so the cost of job creation is also much higher.

As shown in table A.1, the cost-effectiveness indicators (cost of a job) are not high. This may be interpreted as a sign of efficiency if these results are compared with those reported in other studies of similar provisions.65

The average costs are higher in the services sector and for larger enterprises. This is a reasonable result given the higher amount of deductions granted to larger enterprises. The cost per extra euro of sales is quite high. Thus, in this case, it is difficult to take this result as a sign of efficiency; the cost is also high relative to the effects of other provisions. Moreover, the cost dramatically increases for services.

One possible objection is that a large fraction of the deduction amount is increasingly concentrated in southern Italy, which enjoys a higher deduction for each job created.

The efficiency performance of firms associated with the IRAP deduction is marked by highs and lows. The cost per job created is not high with respect to other similar provisions that aim to encourage employment, at both national and regional levels.66 The cost per extra euro of sales otherwise indicates a poor efficiency performance.

Finally, we must highlight that this analysis most likely overestimated the costs. We could not consider the positive feedback effects, including higher consumption and increased fiscal revenues driven by salary increases resulting from additional employment.

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65 Ibid.
66 See, for example, ibid.
### TABLE A.1  Average Impacts and Cost-Effectiveness of the IRAP Deduction on Employment and Sales, by Economic Activity and Firm Size

| Variable | No. of supported firms used in the analysis | Cost<sup>a</sup> |
|----------|--------------------------------------------|------------------|
| Employment |                                           |                  |
| Total     | 26,088                                     | 3,891            |
| Industry  | 11,637                                     | 3,730            |
| Services  | 14,451                                     | 6,304            |
| Turnover class |                                        |                  |
| Less than €2 million | 14,118                                     | 3,103            |
| €2 million to €10 million | 8,954                                     | 10,842           |
| Over €10 million | 3,016                                     | 18,264           |
| Sales     |                                           |                  |
| Total     | 26,088                                     | 41               |
| Industry  | 11,637                                     | 14               |
| Services  | 14,451                                     | 166              |

IRAP = regional tax on productive activities.

Note: Figures not reported in the case of negative coefficient estimates or results with no statistical significance at the level of 0.1.

<sup>a</sup> Employment: cost per job created. Sales: cost per extra euro of sales.
