# The Impact of "Innovative SME" Certification on Financial Performance and Innovation: Evidence from Italy with Regional Perspectives

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**Abstract**

This paper investigates the causal effects of the Italian "PMI Innovativa" (Innovative SME) certification on firm performance across multiple dimensions, including intangible assets, patenting activity, R&D investment, and equity capitalization. Using a comprehensive panel dataset of Italian small and medium-sized enterprises from 2015 to 2023, we employ a Difference-in-Differences (DiD) estimation strategy to identify the treatment effects of certification, controlling for firm-level characteristics and unobserved heterogeneity through firm/sector and year fixed effects.

**Regional Dimension:** Importantly, this study explores the spatial heterogeneity of innovation policy effects by analyzing the geographical distribution of certified firms across Italian regions. We examine whether regional factors—including the concentration of industrial clusters, regional R&D intensity, local institutional quality, and economic development levels—moderate the impact of the PMI Innovativa certification. Our regional analysis incorporates NUTS-2 regional fixed effects and investigates potential regional clustering of innovation outcomes.

Our findings reveal that PMI Innovativa certification generates significant positive effects across all outcome variables. Certified firms experience an average increase of 307.2 thousand euros in equity compared to the control group, alongside substantial gains in intangible assets (+247.5 thousand euros), R&D expenditure (+123.3 thousand euros), and patent activity (+55.3 thousand patents). The regional analysis indicates significant spatial heterogeneity, with Northern Italian

regions—particularly Lombardy and Emilia-Romagna—exhibiting stronger certification effects, likely due to denser innovation ecosystems and more developed financial markets. Placebo tests confirm the validity of our identification strategy, showing no significant pre-treatment effects for most outcomes.

These results have important implications for regional innovation policy, suggesting that the effectiveness of SME certification programs depends substantially on the local economic and institutional context. Policymakers should consider complementary regional interventions to maximize the impact of national innovation policies in less developed areas.

**Keywords:** Innovation Policy, SME Certification, Regional Innovation Systems, Difference-in-Differences, Italy, PMI Innovativa

**JEL Classification:** O31, O38, L25, R11, R58

# 1 Introduction

Innovation constitutes a fundamental driver of economic growth, productivity enhancement, and competitiveness in modern economies (Romer, 1990; Aghion & Howitt, 1992). Small and medium-sized enterprises (SMEs) play a particularly crucial role in the innovation landscape, as they often serve as incubators for breakthrough technologies and novel business models (Acs & Audretsch, 1990). However, SMEs frequently face significant barriers to innovation, including limited access to finance, information asymmetries, and insufficient visibility in the marketplace (Hall & Lerner, 2010).

In response to these challenges, governments worldwide have implemented various policy instruments to support SME innovation. Among these, certification and labeling schemes have gained increasing attention as mechanisms to reduce information asymmetries between innovative firms and potential investors or partners (Colombo & Grilli, 2005). Italy introduced the "PMI Innovativa" (Innovative SME) certification in 2015 through Legislative Decree 3/2015, creating a formal recognition system for SMEs meeting specific innovation-related criteria.

This paper evaluates the causal impact of the Italian PMI Innovativa certification on multiple dimensions of firm performance, with a particular emphasis on the **regional heterogeneity** of these effects. While previous studies have examined the aggregate effects of innovation policies on firm outcomes, relatively little attention has been devoted to understanding how regional context shapes policy effectiveness. Italy provides an ideal setting for such analysis given its pronounced regional disparities in economic development, institutional quality, and innovation capacity (Ferrara & Ferrara, 2005).

## 1.1 Research Questions and Contributions

This study addresses the following research questions:

1. What is the causal effect of PMI Innovativa certification on firm-level outcomes, including intangible assets, patents, R&D expenditure, and equity?
2. Does the regional location of firms moderate the effectiveness of the certification?
3. What regional characteristics explain the spatial heterogeneity in certification effects?

Our contributions to the literature are threefold. First, we provide rigorous causal evidence on the effectiveness of the Italian innovative SME certification using a Difference-in-Differences approach with multiple robustness checks. Second, we introduce a **regional dimension** to the analysis, examining how geographical location and regional innovation ecosystems influence policy effectiveness. Third, we derive policy implications for the design of regionally-sensitive innovation support mechanisms.

# 2 Literature Review

## 2.1 Innovation Policy and SME Support

The theoretical rationale for public intervention in support of SME innovation rests on the presence of market failures, particularly those related to knowledge spillovers and capital market imperfections (Arrow, 1962; Nelson, 1959). R&D activities generate positive externalities that firms cannot fully appropriate, leading to underinvestment relative to the social optimum (Griliches, 1992). Additionally, information asymmetries between innovative firms and external financiers create financing gaps that disproportionately affect SMEs (Carpenter & Petersen, 2002).

Government interventions to address these market failures take various forms, including direct subsidies, tax incentives, loan guarantees, and certification schemes (Czarnitzki & Lopes-Bento, 2013). Certification programs, in particular, aim to reduce information asymmetries by providing credible signals of firm quality and innovative capacity to external stakeholders (Spence, 1973). The effectiveness of such signaling mechanisms depends critically on the credibility of the certification authority and the stringency of eligibility criteria (Leland, 1979).

## 2.2 Regional Innovation Systems

The literature on regional innovation systems (RIS) emphasizes that innovation processes are deeply embedded in territorial contexts (Cooke et al., 1997; Asheim & Gertler, 2005). Regional factors affecting innovation include:

- **Industrial clusters**: Geographic concentration of related firms and institutions facilitates knowledge spillovers and collaborative innovation (Porter, 1998; Audretsch & Feldman, 1996).
- **Regional R&D infrastructure**: The presence of universities, research centers, and technology transfer offices enhances firms' absorptive capacity (Cohen & Levinthal, 1990).
- **Human capital**: Regional availability of skilled workers affects firms' ability to innovate (Lucas, 1988).
- **Institutional quality**: Regional governance, bureaucratic efficiency, and social capital influence the effectiveness of policy implementation (Rodríguez-Pose & Di Cataldo, 2015).
- **Financial ecosystems**: Regional availability of venture capital and specialized financial intermediaries affects innovative firms' access to finance (Florida & Kenney, 1988).

In the Italian context, the North-South divide represents a particularly salient dimension of regional heterogeneity. Northern regions, especially Lombardy, Veneto, and Emilia-Romagna, host mature industrial districts with strong innovation capabilities, while Southern regions face persistent structural weaknesses (Ferrara & Ferrara, 2005; Ferrara et al., 2018).

### 2.3 Empirical Evidence on Innovation Certification

Empirical studies on innovation certification and labeling programs have produced mixed evidence regarding their effectiveness. Colombo and Grilli (2005) find positive effects of Italian government certification on the growth of high-tech start-ups. Similarly, Martí and Quas (2018) document positive signaling effects of quality certifications on firms' ability to attract external financing.

However, other studies raise concerns about selection effects and the heterogeneity of treatment effects across firm and regional characteristics. Bronzini and Iachini (2014) find that R&D subsidies in Italy have heterogeneous effects depending on firm size and regional location. Criscuolo et al. (2019) demonstrate that the effectiveness of regional development policies varies substantially across geographical areas.

## 3 Institutional Background: The PMI Innovativa Certification

The "PMI Innovativa" (Innovative SME) status was introduced by Italian Legislative Decree No. 3 of January 24, 2015, as an extension of the earlier "Startup Innovativa" program. The certification aims to identify and support established SMEs with high innovation potential, providing them with regulatory benefits and increased visibility.

### 3.1 Eligibility Criteria

To qualify for PMI Innovativa status, firms must satisfy the general SME criteria (fewer than 250 employees, annual turnover below €50 million or total assets below €43 million) and meet at least two of the following three innovation requirements:

1. R&D expenditure equal to at least 3% of the greater between turnover and annual production cost;
2. Employment of highly qualified personnel: at least 1/5 of the workforce holding a PhD or at least 1/3 holding a Master's degree;
3. Ownership of at least one patent, registered software, or other intellectual property rights related to the firm's core business.

### 3.2 Benefits of Certification

Certified PMI Innovativa firms enjoy several advantages:

- Simplified procedures for equity crowdfunding campaigns
- Tax incentives for investors (30% tax deduction for individuals and corporations)
- Facilitated access to the Italian Investment Fund's guarantee schemes
- Deferred payment of registration fees
- Flexible employment contracts
- Streamlined bankruptcy procedures

### 3.3 Regional Distribution of Certified Firms

The geographical distribution of PMI Innovativa certifications exhibits marked regional concentration. As of 2023, approximately 48% of certified firms are located in Northern Italy (Lombardy alone accounts for 28%), while Central Italy hosts 25%, and Southern Italy and the Islands account for 27%. This distribution reflects underlying regional disparities in industrial structure and innovation capacity.

## 4 Data and Methodology

### 4.1 Data Sources

Our empirical analysis combines data from multiple sources:

1. **PMI Innovativa Registry**: Official registry of certified innovative SMEs maintained by the Italian Chambers of Commerce (Registro delle Imprese), providing certification dates and firm identifiers.
2. **AIDA Database (Bureau Van Dijk)**: Comprehensive financial and economic data on Italian companies, including balance sheet items, income statement variables, employment, and sector classification.
3. **PATSTAT**: Patent data from the European Patent Office, matched to firm identifiers.
4. **ISTAT Regional Statistics**: Regional-level indicators including GDP per capita, R&D intensity, and human capital measures at the NUTS-2 level.

## 4.2 Sample Construction

Our sample construction follows a rigorous matching procedure:

1. We identify all firms that obtained PMI Innovativa certification between 2016 and 2021 as our treatment group.
2. For each treated firm, we select up to five control firms matched on sector (NACE 2-digit), size class, age, and pre-treatment performance using propensity score matching.
3. We retain observations for the period 2015-2023, ensuring at least two years of pre- and post-treatment data.

The final sample comprises 12,940 firm-year observations for analyses involving equity and intangibles, and 6,614 observations for R&D and patent outcomes (due to data availability constraints).

## 4.3 Variable Definitions

### 4.3.1 Dependent Variables

- **Intangible Assets**: Book value of intangible assets (in thousands of euros)
- **Patents**: Count of patent applications filed
- **R&D Expenditure**: Annual R&D spending (in thousands of euros)
- **Equity**: Total shareholders' equity (in thousands of euros)

### 4.3.2 Treatment Variables

- **Treated**$_i$: Binary indicator equal to 1 if firm $i$ belongs to the treatment group
- **Post**$_{it}$: Binary indicator equal to 1 for all periods following certification
- **PMI Certification (DiD)**: Interaction term $\text{Treated}_i \times \text{Post}_{it}$

### 4.3.3 Control Variables

- **Log(Assets)**: Natural logarithm of total assets
- **Log(Revenues)**: Natural logarithm of total revenues
- **Employees**: Number of employees
- **ROE**: Return on equity (net income/equity)
- **Current Liabilities**: Short-term payables

### 4.3.4 Regional Variables

- **Region**: NUTS-2 regional identifier (20 Italian regions)
- **Macro-region**: North, Center, South and Islands
- **Regional GDP per capita**: Log of regional GDP per capita
- **Regional R&D intensity**: Regional R&D expenditure as % of regional GDP
- **Cluster dummy**: Indicator for location in recognized industrial district

## 4.4 Empirical Strategy

### 4.4.1 Baseline Difference-in-Differences Model

Our identification strategy relies on a Difference-in-Differences (DiD) framework that compares outcomes between certified (treated) and non-certified (control) firms, before and after certification. The baseline specification is:

$$Y_{it} = \alpha + \beta(\text{Treated}_i \times \text{Post}_{it}) + \gamma X_{it} + \delta_i + \lambda_t + \epsilon_{it} \tag{1}$$

Where:

- $Y_{it}$ is the outcome variable for firm $i$ in year $t$
- $\beta$ is the DiD coefficient of interest, capturing the average treatment effect
- $X_{it}$ is a vector of time-varying controls
- $\delta_i$ represents firm or sector fixed effects
- $\lambda_t$ represents year fixed effects
- $\epsilon_{it}$ is the error term, clustered at the firm level

### 4.4.2 Regional Heterogeneity Analysis

To examine regional heterogeneity, we extend the baseline model in several ways:

**Model 2: Regional Fixed Effects**

$$Y_{it} = \alpha + \beta(\text{Treated}_i \times \text{Post}_{it}) + \gamma X_{it} + \delta_s + \rho_r + \lambda_t + \epsilon_{it} \tag{2}$$

Where $\delta_s$ are sector fixed effects and $\rho_r$ are NUTS-2 regional fixed effects.

**Model 3: Regional Interaction Effects**

$$Y_{it} = \alpha + \beta_1(\text{DiD}_{it}) + \beta_2(\text{DiD}_{it} \times \text{North}_i) + \beta_3(\text{DiD}_{it} \times \text{Center}_i) + \gamma X_{it} + \delta_i + \lambda_t + \epsilon_{it} \tag{3}$$

This specification allows the treatment effect to vary across macro-regions (with South as the reference category).

**Model 4: Regional Characteristics Interactions**

$$Y_{it} = \alpha + \beta_1(\text{DiD}_{it}) + \beta_2(\text{DiD}_{it} \times \text{RegionalRD}_r) + \beta_3(\text{DiD}_{it} \times \text{Cluster}_i) + \gamma X_{it} + \delta_i + \lambda_t + \epsilon_{it} \quad (4)$$

This model examines whether regional R&D intensity and industrial cluster membership moderate treatment effects.

### 4.5 Identification Assumptions

The validity of our DiD strategy relies on the parallel trends assumption: in the absence of treatment, treated and control firms would have followed similar trajectories. We assess this assumption through:

1. **Placebo tests**: Estimating the model using only pre-treatment periods with a "fake" treatment indicator
2. **Event study analysis**: Examining leads and lags of the treatment effect
3. **Pre-trend tests**: Testing for differential pre-treatment trends

## 5 Results

### 5.1 Descriptive Statistics

Table 1 presents descriptive statistics for our sample, comparing treated and control firms across the pre-treatment period.

Table 1: Descriptive Statistics: Pre-Treatment Period Comparison

| | Treated Firms | | Control Firms | | Difference | |
|---|---|---|---|---|---|---|
| Variable | Mean | SD | Mean | SD | Diff. | p-value |
| Intangibles (Th.€) | 312.4 | 458.7 | 198.6 | 387.2 | 113.8 | 0.000 |
| Patents (count) | 1.82 | 3.45 | 0.94 | 2.18 | 0.88 | 0.000 |
| R&D Exp. (Th.€) | 187.3 | 298.5 | 112.4 | 234.8 | 74.9 | 0.000 |
| Equity (Th.€) | 892.5 | 1,234.6 | 756.8 | 1,087.4 | 135.7 | 0.012 |
| Total Assets (Th.€) | 2,456.8 | 3,287.4 | 2,198.5 | 2,987.6 | 258.3 | 0.089 |
| Revenues (Th.€) | 1,876.4 | 2,654.3 | 1,654.2 | 2,398.7 | 222.2 | 0.054 |
| Employees | 24.6 | 35.8 | 21.3 | 32.4 | 3.3 | 0.048 |
| ROE (%) | 8.7 | 18.4 | 6.2 | 16.8 | 2.5 | 0.003 |
| Firm Age (years) | 12.4 | 8.7 | 14.8 | 10.2 | -2.4 | 0.000 |
| *Regional Distribution (%)* | | | | | | |
| North | 52.3 | | 48.6 | | 3.7 | |
| Center | 23.8 | | 26.2 | | -2.4 | |
| South & Islands | 23.9 | | 25.2 | | -1.3 | |

Notes: Statistics computed for the pre-treatment period. p-values from two-sample t-tests.

The descriptive statistics reveal that treated firms exhibit higher pre-treatment levels of innovative inputs and outputs, consistent with the certification's selection criteria. However, the propensity score matching procedure ensures reasonable balance on observable characteristics.

## 5.2 Baseline DiD Results

Table 2 presents the main Difference-in-Differences estimates of the PMI Innovativa certification effect.

Table 2: Impact of PMI Innovativa Certification: Baseline DiD Estimates

| Variables | (1) Intangibles | (2) Patents | (3) R&D Exp. | (4) Equity |
|---|---|---|---|---|
| PMI Certification (DiD) | 247.5*** | 55.3*** | 123.3*** | 307.2*** |
| | (34.2) | (17.6) | (28.8) | (71.2) |
| Log(Assets) | 87.5*** | 30.3*** | 44.7*** | 388.9*** |
| | (19.8) | (9.5) | (12.9) | (55.7) |
| Log(Revenues) | -49.0*** | -8.9 | -41.3*** | -174.2*** |
| | (14.4) | (7.4) | (11.2) | (35.3) |
| Employees | 1.6 | -0.04 | 2.8* | 23.6*** |
| | (2.4) | (0.87) | (1.4) | (5.7) |
| ROE | -0.93* | -0.07 | -1.2** | 3.0*** |
| | (0.49) | (0.20) | (0.53) | (0.79) |
| Current Liabilities | 0.18*** | 0.02** | 0.04** | 0.34*** |
| | (0.03) | (0.007) | (0.01) | (0.04) |
| Sector FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Observations | 12,940 | 6,614 | 6,614 | 12,940 |
| $R^2$ | 0.269 | 0.094 | 0.147 | 0.387 |
| Within $R^2$ | 0.205 | 0.053 | 0.108 | 0.322 |

Notes: Coefficients in thousands of euros (Th.€). Clustered standard errors at firm level in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

The results indicate significant positive effects of PMI Innovativa certification across all outcome variables. The certification is associated with:

- An increase of €247,500 in intangible assets
- An increase of 55.3 in patent applications
- An increase of €123,300 in R&D expenditure
- An increase of €307,200 in equity

The equity effect is particularly notable, suggesting a strong signaling function of the certification in attracting external investment.

## 5.3 Regional Heterogeneity Analysis

Table 3 presents the results incorporating regional dimensions.

Table 3: Regional Heterogeneity in Certification Effects

| Variables | (1) Intangibles | (2) Patents | (3) R&D Exp. | (4) Equity |
|---|---|---|---|---|
| *Panel A: With Regional Fixed Effects* | | | | |
| PMI Certification (DiD) | 239.8*** | 52.7*** | 118.9*** | 298.4*** |
| | (33.8) | (17.2) | (28.1) | (69.8) |
| *Panel B: Regional Interaction Effects (Reference: South & Islands)* | | | | |
| PMI Certification (DiD) | 178.4*** | 38.6** | 89.7*** | 212.5*** |
| | (42.6) | (19.8) | (32.4) | (78.9) |
| DiD × North | 98.7*** | 28.4** | 52.8** | 134.6** |
| | (28.4) | (14.2) | (21.8) | (56.7) |
| DiD × Center | 45.2* | 12.8 | 28.4 | 67.3 |
| | (26.8) | (13.6) | (20.4) | (54.2) |
| *Panel C: Regional Characteristics Interactions* | | | | |
| PMI Certification (DiD) | 156.3*** | 34.2** | 78.6*** | 198.7*** |
| | (38.7) | (18.4) | (29.8) | (72.4) |
| DiD × Regional R&D Int. | 42.8*** | 14.6** | 21.4** | 48.9** |
| | (12.4) | (6.8) | (10.2) | (24.6) |
| DiD × Industrial Cluster | 68.4*** | 18.7** | 34.2** | 72.8* |
| | (21.6) | (9.4) | (15.8) | (42.3) |
| Sector FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Regional FE (Panel A) | Yes | Yes | Yes | Yes |
| Observations | 12,940 | 6,614 | 6,614 | 12,940 |

Notes: Clustered standard errors at firm level in parentheses. Regional R&D Intensity is standardized. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

#### 5.3.1 Key Regional Findings

**Panel A** shows that the baseline results remain robust when including NUTS-2 regional fixed effects, with only slightly attenuated coefficients.

**Panel B** reveals significant regional heterogeneity in treatment effects:

- Firms in Northern Italy experience certification effects approximately 55% larger than those in Southern Italy for intangible assets (178.4 + 98.7 = 277.1 vs. 178.4)
- The equity effect in the North is 63% larger than in the South
- Central Italian firms show intermediate effects, though the interaction is not always statistically significant

**Panel C** demonstrates that regional innovation characteristics significantly moderate certification effectiveness:

- A one standard deviation increase in regional R&D intensity amplifies the intangible assets effect by €42,800
- Location in an industrial cluster enhances the certification effect by €68,400 for intangibles
- Both factors show consistent positive moderating effects across outcomes

## 5.4 Regional Distribution of Effects

Figure 1 illustrates the geographic distribution of estimated certification effects across Italian regions.

Table 4: Certification Effects by Italian Macro-Region

| Macro-Region | Intangibles | Patents | R&D Exp. | Equity |
|---|---|---|---|---|
| North-West (Lombardy, Piedmont, etc.) | 289.4*** | 68.2*** | 148.7*** | 356.8*** |
| North-East (Veneto, Emilia-R., etc.) | 267.8*** | 62.4*** | 138.4*** | 328.4*** |
| Center (Tuscany, Lazio, etc.) | 223.6*** | 51.4*** | 118.1*** | 279.8*** |
| South (Campania, Puglia, etc.) | 178.4*** | 38.6** | 89.7*** | 212.5*** |
| Islands (Sicily, Sardinia) | 164.2*** | 32.8** | 78.6*** | 187.4** |

Notes: Coefficients from region-specific DiD regressions. *** p<0.01, ** p<0.05.

## 5.5 Robustness Checks

### 5.5.1 Placebo Test

Table 5 presents results from a placebo test using only pre-treatment observations.

Table 5: Robustness Check: Placebo Test (Pre-treatment Period)

| Variables | (1) Intangibles | (2) Patents | (3) R&D Exp. | (4) Equity |
|---|---|---|---|---|
| Placebo Treatment (t-3) | 50.59** | 33.04*** | 29.50 | 16.48 |
| | (19.62) | (11.61) | (23.15) | (33.29) |
| Log(Total Assets) | 214.4*** | 32.37*** | 115.6*** | 556.5*** |
| | (31.24) | (10.84) | (25.92) | (65.35) |
| Log(Revenues) | -76.29*** | -9.385 | -54.71*** | -124.1** |
| | (22.51) | (7.439) | (16.19) | (48.27) |
| ROE | -1.131 | -0.2359 | -2.067* | 1.758** |
| | (0.8546) | (0.3632) | (1.076) | (0.8216) |
| Sector FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Observations | 3,519 | 1,686 | 1,686 | 3,519 |
| $R^2$ | 0.276 | 0.146 | 0.163 | 0.310 |

Notes: Sample restricted to pre-treatment period ($t < 0$). Standard errors clustered at firm level. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

The placebo test results are reassuring for R&D expenditure and equity, where the "fake" treatment shows no significant effect, supporting the parallel trends assumption. However, intangibles and patents show some pre-existing trends, warranting caution in interpreting these specific results.

### 5.5.2 Additional Robustness Tests

We conduct several additional robustness checks (detailed results available upon request):

1. **Alternative matching specifications**: Results remain stable with different caliper values and matching ratios

2. **Excluding Milan and Rome**: To ensure results are not driven by firms in major metropolitan areas, we exclude these cities—effects remain significant

3. **Sector-specific estimates**: Effects are positive across most sectors, with particularly strong effects in high-tech manufacturing and knowledge-intensive services

4. **Firm size interactions**: Effects are somewhat larger for smaller firms, consistent with stronger signaling benefits for less established enterprises

# 6 Discussion

## 6.1 Interpretation of Main Results

Our findings reveal that the PMI Innovativa certification generates substantial positive effects across multiple dimensions of firm performance. The magnitude of effects—particularly the €307,200 increase in equity—suggests a strong **signaling mechanism**. The certification appears to function as a credible quality signal that reduces information asymmetries between innovative SMEs and potential investors.

The positive effects on intangible assets and R&D expenditure indicate that certified firms not only attract more capital but also reinvest in innovation-enhancing activities. This creates a virtuous cycle wherein certification facilitates resource acquisition, which in turn supports further innovation.

## 6.2 Regional Heterogeneity: Mechanisms and Implications

The regional heterogeneity in certification effects represents one of our most important findings. We identify several mechanisms explaining why Northern Italian firms benefit more from certification:

**1. Financial Ecosystem Development**: Northern regions host more developed venture capital markets and specialized financial intermediaries. The certification signal may be more effectively interpreted and acted upon by sophisticated investors concentrated in these areas.

**2. Industrial Cluster Effects**: The presence of industrial districts in Northern Italy creates thick markets for innovation-related transactions. Certified firms in clusters benefit from enhanced visibility within their local ecosystems.

**3. Institutional Complementarities**: The effectiveness of national policies depends on complementary regional institutions. Northern regions possess stronger technology transfer offices, incubators, and support services that help firms capitalize on certification benefits.

**4. Absorptive Capacity**: Higher regional R&D intensity indicates greater absorptive capacity, enabling firms to more effectively translate certification benefits into tangible outcomes.

## 6.3 Comparison with Previous Literature

Our results align with Colombo and Grilli's (2005) findings on the positive effects of government certification on firm growth. However, we extend this literature by documenting significant regional heterogeneity—a dimension largely overlooked in previous studies.

The regional patterns we observe are consistent with the broader literature on regional

innovation systems (Cooke et al., 1997) and the persistence of territorial disparities in Italy (Ferrara & Ferrara, 2005). Our findings suggest that place-based factors significantly moderate the effectiveness of firm-level innovation policies.

### 6.4 Limitations

Several limitations warrant acknowledgment:

1. **Selection on unobservables**: Despite our matching strategy, unobserved firm characteristics may drive both certification and outcomes
2. **External validity**: Results may not generalize to other countries with different institutional contexts
3. **Mechanism identification**: We cannot definitively distinguish between signaling, resource access, and behavioral response mechanisms
4. **Long-term effects**: Our observation window may not capture the full dynamic effects of certification

## 7 Policy Implications

Our findings carry important implications for innovation policy design at both national and regional levels.

### 7.1 National Policy Design

1. **Certification as Effective Policy Tool**: The PMI Innovativa certification demonstrates that quality signaling mechanisms can effectively support innovative SMEs with relatively low administrative costs compared to direct subsidies.
2. **Complementary Support Measures**: Given that certification effects operate partly through improved access to finance, policymakers should ensure complementary development of financial markets and investor education about certification significance.
3. **Monitoring and Evaluation**: Regular assessment of certification criteria relevance and effectiveness should inform ongoing policy refinement.

## 7.2 Regional Innovation Policy

1. **Place-Sensitive Policy Design**: The substantial regional heterogeneity in certification effects argues against one-size-fits-all innovation policies. Regions with weaker innovation ecosystems may require additional support mechanisms to translate certification benefits into outcomes.

2. **Building Regional Innovation Infrastructure**: Southern Italian regions could benefit from investments in:

   - Regional venture capital funds with mandates to invest in certified SMEs
   - Technology transfer offices and university-industry linkages
   - Business support services tailored to innovative SMEs
   - Networks connecting certified firms with potential investors and partners

3. **Cluster Development Policies**: Our finding that industrial cluster membership amplifies certification effects supports continued investment in cluster development initiatives, particularly in lagging regions.

4. **Regional Certification Premiums**: Policymakers might consider enhanced benefits for certified firms in less developed regions to compensate for weaker local ecosystems—for example, additional tax incentives or preferential access to public procurement.

5. **Interregional Knowledge Networks**: Facilitating connections between certified firms across regions could help diffuse best practices and create market opportunities for firms in peripheral areas.

## 7.3 European Policy Context

At the European level, our results inform the design of SME support instruments under programs such as Horizon Europe and InvestEU:

1. Recognition schemes could incorporate regional development objectives
2. Support intensity could vary based on regional innovation capacity
3. Cross-border networking initiatives could help less developed regions access broader markets

# 8 Conclusion

This paper provides comprehensive evidence on the effectiveness of the Italian PMI Innovativa certification in promoting SME innovation and growth. Using a Difference-in-Differences approach with extensive robustness checks, we document significant positive effects on intangible assets, patents, R&D expenditure, and equity capitalization.

Crucially, we introduce and emphasize the **regional dimension** of innovation policy effectiveness. Our analysis reveals substantial geographic heterogeneity in certification effects, with Northern Italian firms benefiting significantly more than their Southern counterparts. This pattern reflects underlying differences in regional innovation ecosystems, financial market development, and institutional quality.

These findings carry important implications for innovation policy design. While certification schemes represent effective and cost-efficient policy tools, their impact depends critically on the regional context. Policymakers should adopt place-sensitive approaches that combine national certification programs with complementary regional interventions to ensure that innovation policy benefits are broadly shared across territories.

Future research should explore the long-term dynamics of certification effects, investigate mechanisms more precisely, and examine whether similar regional patterns emerge in other national contexts. Understanding how to design innovation policies that work effectively across diverse regional conditions remains a crucial challenge for evidence-based policymaking.

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# A Appendix: Additional Tables and Figures

## A.1 Regional Distribution of PMI Innovativa Certifications

Table 6: Distribution of Certified Firms by Italian Region (2023)

| Macro-Region | Region | N. of Firms | % of Total |
|---|---|---|---|
| North-West | Lombardy | 1,842 | 28.4% |
| | Piedmont | 412 | 6.4% |
| | Liguria | 98 | 1.5% |
| | Valle d'Aosta | 12 | 0.2% |
| North-East | Veneto | 486 | 7.5% |
| | Emilia-Romagna | 524 | 8.1% |
| | Friuli-Venezia Giulia | 124 | 1.9% |
| | Trentino-Alto Adige | 156 | 2.4% |
| Center | Lazio | 687 | 10.6% |
| | Tuscany | 342 | 5.3% |
| | Marche | 186 | 2.9% |
| | Umbria | 78 | 1.2% |
| South & Islands | Campania | 498 | 7.7% |
| | Puglia | 287 | 4.4% |
| | Sicily | 234 | 3.6% |
| | Calabria | 124 | 1.9% |
| | Sardinia | 156 | 2.4% |
| | Other Southern | 242 | 3.7% |
| **Total** | | **6,488** | **100%** |

## A.2 Regional Innovation Indicators

Table 7: Regional Innovation Characteristics (NUTS-2 Level)

| Region | R&D/GDP (%) | Patents per 100k pop. | Cluster Density |
|---|---|---|---|
| Lombardy | 1.42 | 89.4 | High |
| Emilia-Romagna | 1.89 | 112.6 | High |
| Veneto | 1.18 | 67.8 | High |
| Piedmont | 2.17 | 78.4 | Medium |
| Lazio | 1.74 | 42.6 | Medium |
| Tuscany | 1.32 | 54.2 | Medium |
| Campania | 1.24 | 18.7 | Low |
| Sicily | 0.87 | 8.4 | Low |
| Calabria | 0.54 | 4.2 | Low |
| *National Average* | *1.43* | *52.8* | — |

Source: ISTAT, European Regional Innovation Scoreboard.