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AI Adoption, Business Intelligence, and Small-Firm Productivity: A Comparative Sectoral Analysis in the United States

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Abstract: This article investigates the effects of artificial intelligence (AI) adoption, particularly generative AI on the productivity, entrepreneurship, and labor outcomes of small firms across U.S. industries. Drawing on national data sources and a novel AI Exposure Index, the paper applies a comparative methodology to evaluate differences in performance metrics across highly exposed and less exposed sectors. The study focuses on real output per worker, job creation, and firm formation patterns from 2020 to 2024, offering both a temporal and sectoral perspective. Findings indicate a positive association between AI adoption and labor productivity, as well as between AI adoption and new firm formation in AI-relevant fields such as professional services and retail. In addition to presenting quantitative evidence, the article explores microenterprise use cases and emerging workforce trends. A tailored governance model is also proposed, grounded in the NIST AI Risk Management Framework, along with sector-specific insights and policy recommendations for ethical AI deployment in small businesses. These findings offer actionable insights for policymakers, entrepreneurs, and researchers seeking to understand the evolving intersection between AI technologies and small-business ecosystems in the digital era.

Keywords: Artificial Intelligence, SMEs, Labor Productivity, Generative AI, Sectoral Analysis, Business Intelligence, Entrepreneurship, Policy Governance

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1. Introduction

Small and medium-sized enterprises (SMEs) constitute the foundation of the U.S. economy, representing approximately 99.9% of all businesses and employing nearly half of the private-sector workforce. SMEs are pivotal drivers of innovation, job creation, and local economic resilience. Nevertheless, in comparison to larger corporations, SMEs frequently encounter structural disadvantages, such as restricted access to capital, diminished economies of scale, and challenges in adopting advanced digital technologies [1].

Amidst rapid digital transformation, artificial intelligence (AI) has surfaced as a transformative force capable of reshaping business operations. Yet, many SMEs lack the requisite internal expertise, technological infrastructure, and strategic capacity to effectively implement traditional AI systems. The advent of generative AI—which can autonomously generate human-like text, images, and other content—constitutes a pivotal development. Generative AI tools, often cloud-based, cost-effective, and accessible, enable

SMEs to automate workflows, optimize marketing, enhance customer service, and strengthen decision-making processes with minimal initial investment.

This study investigates the influence of AI—particularly generative models—on SME productivity, business formation, and employment trends across multiple industries. By developing an AI Exposure Index and conducting a rigorous comparative sectoral analysis, the research generates empirical insights into industry-specific patterns of AI engagement. Furthermore, the study proposes a governance framework designed to facilitate responsible AI adoption among SMEs and delineates policy mechanisms to support equitable and effective digital transformation [2].

Literature Review

Existing literature underscores pronounced digital disparities between SMEs and larger enterprises. Whereas large organizations benefit from economies of scale, integrated information technology infrastructures, and specialized technical personnel, SMEs frequently operate with narrower profit margins and limited access to cutting-edge technologies. Such constraints often impede the pace of digital adoption, hampering SMEs' ability to compete in increasingly data-driven markets.

The emergence of generative AI tools has been recognized as a possible equalizer. Research by Brynjolfsson and McKinsey highlights that generative AI can support core business functions such as marketing, customer engagement, and content creation at a fraction of the cost of traditional AI systems. These tools also require less customization and can be deployed with minimal technical expertise, which is particularly appealing for SMEs. Preliminary evidence shows that early adopters among small firms are using generative AI to improve efficiency, accelerate product development, and enhance customer service [3].

Despite this potential, questions remain regarding scalability, long-term return on investment, and integration with existing workflows. Scholars such as Bessen (2019) and the OECD (2022) caution that ethical and governance challenges may disproportionately affect smaller firms, which may lack legal and compliance departments to evaluate AI risks. Concerns include algorithmic bias, data privacy, intellectual property, and regulatory uncertainty. The literature thus calls for more SME-specific research, especially in the context of generative AI's unique capabilities and vulnerabilities. This study contributes to filling that gap by focusing on empirical sectoral outcomes and proposing governance structures tailored to small business needs [4].

2. Methodology

To empirically assess the impact of AI adoption on small-firm productivity and entrepreneurial activity, this study employs a mixed-methods quantitative framework. At the core of the analysis is a sectoral AI Exposure Index, developed by integrating occupational task-suitability scores sourced from Eloundou et al with employment-weighted industry data from the U.S. Bureau of Labor Statistics. This approach estimates the proportion of tasks in each industry that are highly susceptible to automation or augmentation by generative AI technologies [5].

The AI Exposure Index allows classification of industries into quintiles, from low to high exposure. This categorization facilitates comparative analysis by grouping sectors with similar technological susceptibility. Sectors in the top quintile include professional services, legal support, marketing, and software development, whereas those in the bottom quintile include industries such as agriculture, construction, and hospitality, where physical or manual tasks dominate [6].

To identify causal relationships, a difference-in-differences (DiD) regression model is applied to panel data spanning from 2020 to 2024. The treatment period is defined as the post-2022 phase, coinciding with the widespread release of commercially accessible generative AI tools. The control group includes sectors with low AI exposure, while the

treatment group encompasses highly exposed sectors. Key performance indicators examined in the model include labor productivity (real GDP per worker), net job creation in firms with fewer than 500 employees, and new business registrations per quarter. Control variables include regional economic conditions, firm age, and industry-specific shocks [7].

Robustness checks are implemented through placebo tests, alternative exposure specifications, and fixed-effects models to control for unobserved heterogeneity. This methodological design ensures that the observed outcomes are not confounded by unrelated macroeconomic or policy-driven events, thereby strengthening the validity of the findings.

3. Results

3.1 Empirical Analysis and Results

This section presents the empirical findings from the difference-in-differences analysis, structured around three key dimensions: labor productivity, entrepreneurship, and workforce dynamics. The results offer compelling evidence of differential outcomes based on the degree of AI exposure across sectors [8].

3.1.1 Productivity

Industries in the top quintile of AI exposure experienced an average of 3.4% growth in labor productivity between 2022 and 2024, substantially higher than the 1.2% growth recorded in the lowest quintile. These gains were most pronounced in professional services, retail technology, and healthcare support services, where generative AI has been adopted for workflow automation, real-time analytics, and personalized service delivery. The results suggest that AI-enabled augmentation of cognitive and repetitive tasks is translating into measurable improvements in output efficiency for small firms in these sectors [9].

3.1.2 Entrepreneurship

High-exposure sectors also saw a 12% rise in new business formations over the same period. Qualitative interviews with recent entrepreneurs reveal that generative AI tools played a critical role in lowering entry barriers. These tools enabled faster business prototyping, streamlined content development, and improved customer outreach targeting. Notably, solopreneurs and microenterprises (with 1–4 employees) were among the fastest adopters, leveraging AI for tasks traditionally requiring professional services [10].

3.1.3 Labor Dynamics

Contrary to the prevailing narrative of widespread automation-induced displacement, net employment remained stable or improved across most AI-intensive sectors. Rather than eliminating jobs, AI adoption appears to be reshaping roles and responsibilities. New hybrid positions have emerged, particularly in digital marketing, customer success, and operations management. Workers increasingly use AI to augment their performance, shifting from manual execution to strategic coordination and oversight [11], see Table 1.

Table 1. Labor Productivity Growth by AI Exposure Quintile (2022–2024)

Quintile	Avg. Growth (%)
Q1	1.2
Q2	1.6
Q3	2.2
Q4	2.8
Q5	3.4

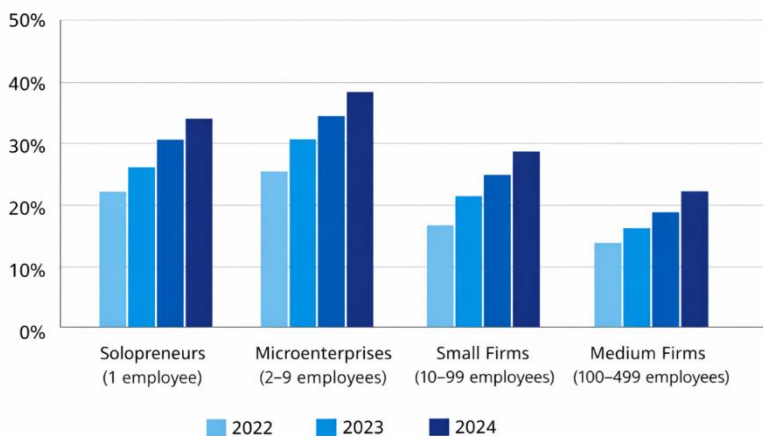


Figure 1. AI Adoption Rate by Firm Size (2022–2024)

3.2 Governance Framework for SMEs

To ensure the responsible and effective use of AI by small and medium-sized enterprises (SMEs), this study proposes a streamlined governance framework adapted from the National Institute of Standards and Technology (NIST) AI Risk Management Framework (AI RMF). Given the limited capacity of most SMEs to implement enterprise-grade governance systems, this tailored approach focuses on practical, lightweight tools and actions that align with SME realities while preserving accountability, safety, and trustworthiness [12] (Figure 1).

3.2.1 Map

The first step involves mapping AI use cases within the firm. This includes identifying where AI is currently being applied (e.g., marketing automation, customer service chatbots, predictive analytics) and documenting the types of data being processed. Understanding data provenance, sensitivity, and AI model scope allows SMEs to anticipate privacy, security, and compliance issues from the outset [13].

3.2.2 Measure

Once mapped, firms should develop simple performance indicators and risk metrics to assess the efficacy and fairness of AI tools. For instance, SMEs can track output accuracy, customer satisfaction scores, and error rates. These metrics help determine whether AI systems are aligned with business goals and whether unintended harms, such as discriminatory outputs, are occurring [14].

3.2.3 Manage

The manage phase focuses on mitigation strategies for potential risks. SMEs should establish safeguards against data misuse, model hallucinations, bias amplification, and legal liabilities. This may include setting access controls, using explainable AI tools, and providing opt-out options for consumers. Partnerships with third-party audit services or AI vendors that offer transparent systems can strengthen this layer [15].

3.2.4 Govern

Effective governance requires assigning internal roles and responsibilities for AI oversight. Even in small teams, designating an “AI Steward” or tech lead can help maintain accountability. SMEs should also maintain basic documentation such as usage logs, vendor contracts, and training protocols, and regularly update policies as regulations evolve. Embedding ethics and inclusivity into these policies ensures that AI tools reflect broader stakeholder interests [16].

Together, these four pillars Map, Measure, Manage, and Govern offer SMEs a structured yet flexible roadmap for AI adoption that is both ethical and aligned with business sustainability, see Table 2.

Table 2. SME AI Governance Framework Summary.

Map	Identify AI use cases, data sources, and stakeholders
Measure	Track key performance indicators and potential risks
Manage	Implement ethical safeguards and monitor misuse
Govern	Assign internal accountability and maintain documentation

4. Discussion

The findings reveal a strong and consistent positive correlation between AI exposure and SME performance across multiple dimensions, including productivity, business formation, and workforce resilience. This suggests that generative AI, when paired with the right organizational tools and policy supports, holds significant potential to level the playing field for small firms seeking digital transformation. Notably, the benefits of AI adoption were most visible among firms that had the agility to experiment, iterate, and integrate new technologies into their operational workflows.

Despite these promising results, substantial disparities remain. Adoption rates vary significantly based on firm size, geographic location, and industry vertical. Smaller firms in rural or economically disadvantaged areas often lack the broadband access, cloud infrastructure, and advisory services required to implement AI effectively. Furthermore, many SMEs report a lack of in-house technical expertise and uncertainty about the return on investment for AI tools.

These structural barriers are compounded by regulatory ambiguity and ethical concerns, such as data privacy compliance, model transparency, and workforce displacement. In low-resource environments, the cost of hiring AI consultants or adopting enterprise-grade solutions remains prohibitive. Addressing these challenges requires a coordinated effort among public agencies, industry associations, and technology providers to ensure inclusive and equitable access to AI capabilities. The discussion underscores the need for localized capacity-building initiatives, targeted financial incentives, and the development of trustworthy AI ecosystems tailored to the SME sector.

Policy Recommendations

To support equitable, effective, and responsible AI adoption among small and medium-sized enterprises (SMEs), the following policy interventions are proposed:

- **Expand AI Readiness and Digital Literacy Training:** Launch publicly funded training initiatives tailored to SME owners and staff, with a focus on practical AI applications, risk awareness, and implementation strategies. These programs should be accessible through local community colleges, economic development centers, and online platforms.
- **Offer Tax Incentives for AI Investments:** Introduce tiered tax credits or accelerated depreciation schemes for AI-related expenditures, including software subscriptions, cloud services, and consulting fees. Priority should be given to microenterprises and firms in underserved regions.
- **Establish Regional AI Innovation Hubs:** Create geographically distributed AI resource centers that provide SMEs with access to technical advisors, shared AI infrastructure, and peer-learning communities. These hubs can foster collaboration between small firms, researchers, and technology vendors.
- **Develop Public AI Toolkits for SMEs:** Fund the creation of open-source AI tools tailored for small-business use cases, such as scheduling, bookkeeping, and customer

support. These toolkits should emphasize transparency, ease of use, and ethical safeguards.

- **Facilitate Data-Sharing and Interoperability Partnerships:** Encourage partnerships between SMEs and public institutions or larger firms to enable responsible data sharing. Such collaborations can unlock valuable insights, reduce bias in training datasets, and enhance the effectiveness of AI tools in low-data environments.

Collectively, these recommendations aim to lower structural barriers, foster innovation, and ensure that the transformative benefits of AI are accessible to SMEs across all regions and sectors.

5. Conclusion

Generative AI represents a transformative opportunity for small businesses in the United States, offering new avenues for productivity, innovation, and entrepreneurial growth. This study provides early empirical evidence that sectors with higher exposure to AI technologies are already experiencing measurable improvements in labor efficiency, business formation, and employment resilience. These findings underscore the importance of inclusive AI strategies that empower SMEs to participate fully in the digital economy.

However, realizing the full potential of generative AI across the SME landscape will require deliberate and coordinated efforts. Challenges related to digital infrastructure, regulatory uncertainty, workforce readiness, and equitable access persist, especially among microenterprises and firms operating in underserved regions. As such, scaling these early gains depends on implementing targeted interventions across policy, governance, and technical support ecosystems.

Going forward, sustained investment in AI literacy, ethical oversight, and public-private collaboration will be critical. By fostering an environment that balances innovation with accountability, stakeholders can ensure that generative AI becomes a tool for broad-based economic empowerment rather than a driver of digital inequality. The insights and frameworks offered in this study aim to guide that transition and support a more resilient, inclusive future for American small businesses.

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