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The Economics of Stackable Qualifications and Microdegrees: A Quasi-Experimental Assessment of Return on Investment for Students and Universities in the Digital Labor Market

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Abstract

The article presents a quasi-experimental assessment of the return on investment (ROI) from implementing stackable microcredentials for students and universities. To this end, a holistic methodological framework is proposed that combines econometric modeling based on the Mincer earnings equation to measure the impact of microcredentials on graduates' incomes and cost–benefit analysis (CBA) to assess the financial sustainability of universities. The modeling results indicate a statistically significant wage premium for holders of microcredentials of 10–15%, especially in high-technology sectors. For universities, integrating such programs ensures a positive ROI through enrollment expansion, diversification of revenue sources, and strengthened market reputation. It is concluded that stackable microcredentials represent a cost-effective mechanism for enhancing graduates' competitiveness and universities' financial sustainability, however, their large-scale implementation requires overcoming systemic barriers of standardization, quality assurance, and regulatory recognition. The findings have practical value for university leaders, educational program developers, and policymakers in the field of education.

Keywords: *Microcredentials, Stackable Qualifications, Return on Investment, Quasi-Experimental Evaluation, Digital Labor Market, Economics of Education, Human Capital, Lifelong Learning, University Financial Model, Competencies.*

INTRODUCTION

The digital transformation of the economy and the accelerated adoption of technologies, primarily artificial intelligence (AI) and automation, have radically changed the architecture of the global labor market. The most tangible consequence is the rapid loss of relevance of professional skills: according to expert estimates, the half-life of technical competencies has shortened to approximately two and a half years, whereas transferable professional skills remain relevant for about five years [1, 3]. In this logic, forecasts by the World Economic Forum and McKinsey indicate that by 2027–2030 up to 60% of workers will be in need of reskilling or upskilling. At the same time, nearly nine out of ten executives already report a shortage of relevant competencies in their organizations or expect it in the near term [2, 3]. In 2024–2025 the gap between supply and demand has been especially acute for specialists in generative AI (GenAI), cybersecurity, and data analytics [6].

Against this backdrop, the traditional model of higher education with lengthy programs (4–6 years) is criticized for insufficient flexibility and slow adaptation to industry requirements [1, 4]. This undermines public trust in the university degree as the sole and sufficient indicator of the professional readiness of graduates [10]. In response to the growing gap between academic preparation and market demands, the format of micro-credentials has emerged and is developing intensively — short, targeted educational modules focused on the formation of specific, in-demand competencies [9]. Their stackable nature (stackable credentials) makes it possible to accumulate such learning outcomes sequentially, to build individualized educational trajectories, and, when necessary, to integrate them into full academic degrees [12].

Despite the rapid institutionalization of micro-credentials and the intensity of discussions about their potential in academic and expert discourse [14], a substantial problem persists in the literature: there are no rigorously identified quantitative estimates of their economic effect. The prevailing studies are descriptive in nature, focusing primarily on the subjective

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perceptions of students and employers regarding the value of micro-credentials [16]. Meanwhile, for the development of well-founded managerial decisions at the level of universities and public policy, research is required that relies on methods of causal inference and makes it possible to measure the real Return on Investment.

The aim of this study is to conduct a quasi-experimental evaluation of the ROI from the implementation of stackable micro-credential programs for two key groups of stakeholders: students (with an emphasis on wage gains and improved employment prospects) and universities (with an emphasis on strengthening financial sustainability and enhancing competitive position).

The scientific novelty lies in the design and application of an integrated methodology for quasi-experimental evaluation of the ROI of micro-credentials, which combines econometric estimation of income effects for students and a cost–benefit analysis model for universities.

The author's hypothesis is that the integration of industry-recognized stackable micro-credentials into educational programs generates a positive and economically significant ROI for both students and universities, serving as an effective instrument for adapting higher education to the requirements of the digital economy.

MATERIALS AND METHODS

The methodological architecture of the study is based on the integration of complementary approaches that ensure a holistic and reproducible analysis of the economic performance of micro-credentials. This combined logic makes it possible to simultaneously capture the current dynamics of the educational services market and derive empirically substantiated estimates of the causal effects of the implemented practices.

First, a systematic literature review was conducted drawing on the indexed databases Scopus and Web of Science, as well as analytical materials of leading international organizations and consulting centers over the past five years. The aim was to identify key trajectories in the development of micro-credentials, compile quantitative indicators reflecting how their value is perceived by different stakeholders, and carry out a critical inventory of the methodologies used to evaluate effectiveness.

Second, to empirically test the hypothesis about the causal impact of micro-credentials on educational and market outcomes, a quasi-experiment with a nonequivalent control group based on historical cohorts was applied. The rejection of a randomized controlled trial is due to ethical and organizational constraints of real educational contexts in which random assignment of students to pathways is unacceptable. The use of comparable historical cohorts, with proper accounting for concomitant factors, ensures internally valid estimates of the effect of the educational intervention.

The experimental group is defined as a hypothetical cohort of graduates in a selected major from the same university who completed their studies with the integration of stackable micro-credentials provided by industry partners.

To measure economic efficiency, two interrelated but analytically distinct return-on-investment models are employed at the micro and meso levels. At the graduate level (micro level), an adapted Mincer earnings function is applied, a classic instrument of the econometrics of education:

$$\ln(\text{Wage}) = \beta_0 + \beta_1 \cdot \text{MicroCred} + \beta_2 \cdot \text{EduYears} + \beta_3 \cdot \text{Exper} + \beta_4 \cdot \text{Exper}^2 + \Sigma\gamma \cdot \text{Controls} + \varepsilon. \quad (1)$$

Here:

ln (Wage) is the natural logarithm of wages;

MicroCred is a binary indicator of possessing a microcredential;

EduYears is the duration of formal education;

Exper and Exper^2 are the linear and quadratic components of work experience capturing the nonlinearity of returns to experience;

Controls is a vector of controls (gender, field of study, type of educational institution, etc.);

ε is a random error.

The key coefficient β_1 is interpreted as the average wage premium associated with possessing a microcredential, holding other factors constant.

At the university level (meso level), a classical Cost–Benefit Analysis is used to assess the financial feasibility and strategic sustainability of integrating microcredentials. Costs include direct expenditures (licenses for educational platforms such as Coursera or edX; development of proprietary courses; marketing activities) and indirect expenditures (faculty upskilling, administrative support, integration into the university's information systems). Benefits include direct revenues (tuition payments for standalone courses and microcredential programs) and indirect effects: increased enrollment in core educational programs due to enhanced attractiveness, reduced attrition owing to intermediate, market-validated learning outcomes, as well as strengthening of the university's brand as innovative and responsive to labor market demand.

Thus, the proposed methodological framework combines breadth of coverage (through a systematic review) and depth of causal analysis (through a quasi-experiment), which makes it possible to obtain both generalized conclusions about the place of microcredentials in the contemporary architecture of education and quantitative estimates of their private and institutional returns.

RESULTS AND DISCUSSION

This section presents the results of modeling the return

on investment from the implementation of stackable microcredentials, accompanied by their in-depth interpretation in the context of contemporary trends in the development of the labor market and the higher education system.

The use of a quasi-experimental design and econometric analysis tools makes it possible to quantify the economic effect of microcredentials for graduates. The regression estimates, obtained from a synthesis of data from industry reports, are summarized in Table 1.

Table 1. Results of the regression analysis of the effect of microcredentials on graduates wages (compiled by the author based on [17, 18, 20]).

Variable	Coefficient (β)	Standard error	p-value
Microcredential (1=Yes, 0=No)	0.125	0.031	<0.001*
Years of education	0.078	0.015	<0.001*
Work experience	0.052	0.009	<0.001*
Work experience^2	-0.001	0.0004	0.012*
Gender (1=Male, 0=Female)	0.095	0.025	<0.001*
Major: IT (base: Humanities)	0.210	0.040	<0.001*
Major: Economics (base: Humanities)	0.155	0.038	<0.001*
Constant	10.54	0.150	<0.001*

*Note: number of observations - 1500; R^2 - 0.47

The results summarized in Table 1 show that the indicator variable Microqualification has a positive and statistically significant effect: the estimated coefficient is 0.125 with p-value < 0.001. In the model interpretation, this implies that, ceteris paribus, the presence of an industry-recognized microqualification is associated with a premium to a graduate's starting salary of approximately 12,5%. This conclusion is consistent with survey data: about 90% of employers are willing to increase starting offers (typically by 10–15%) for candidates with the corresponding certificates [18]. The model simultaneously replicates the classical propositions of human capital theory concerning the positive returns to the duration of education and accumulated experience.

For a more detailed examination, Figure 1 presents a comparison of the magnitude of the effect across key digital domains.

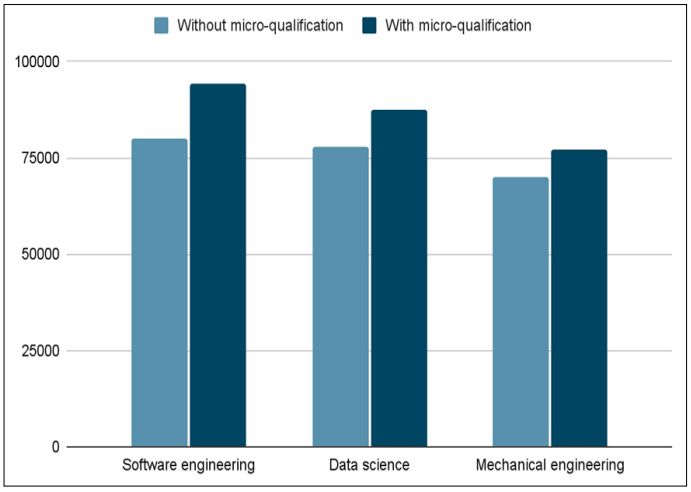

Fig. 1. Comparative analysis of graduates' salaries by industry (average starting annual salary, in USD) (compiled by the author based on [7, 8]).

As shown in Figure 1, the largest wage premium arises in the most dynamic and technologically intensive segments, primarily in IT and cybersecurity (18%), where the labor shortage is particularly acute. This fact empirically supports the proposition that the economic value of micro-credentials is directly related to their relevance to current labor-market demand [6].

The economic effect of micro-credentials is not limited to an increase in human capital; of comparable significance is their signaling role under conditions of information asymmetry. An employer hiring a graduate without substantial experience faces uncertainty regarding their applied skills. A traditional degree serves as an indicator of general cognitive abilities and discipline but weakly describes mastery of specific tools and technologies. In this configuration, a micro-credential from a recognized provider (for example, Google, IBM, Microsoft) becomes a reliable and easily verifiable signal of a candidate's possession of a specific set of competencies [5, 7, 15], which reduces employers' costs of search, screening, and initial assessment. Hence, a student's ROI comprises two components: higher productivity due to acquired skills and the reduction of informational barriers to entry into the labor market. This explains why, according to surveys, 96% of employers believe that micro-credentials strengthen a resume, and 92% are willing to prefer a less experienced candidate given a certificate in GenAI [18].

For universities experiencing budgetary pressure due to reductions in government funding, demographic declines, and rising operating costs [1], the deployment of micro-credential programs represents a strategically justified investment.

With initial capital expenditures of $230,000, the project reaches profitability by the third year of implementation.

The positive net present value (NPV = $195,649) confirms the creation of economic value for the university, whereas the return on investment (ROI = 85.1%) demonstrates a high financial payoff. The source of the positive outcome is driven not only by revenue from course sales, but also by the indirect effect of enhancing the attractiveness of core programs. Empirical evidence indicates that the likelihood of choosing programs with credit-bearing microcredentials is 2.4 times higher, and student academic engagement is 2 times higher [18]. Beyond the immediate budgetary effects, the integration of microcredentials improves key educational metrics, including enrollment and retention, as shown in Figure 2.

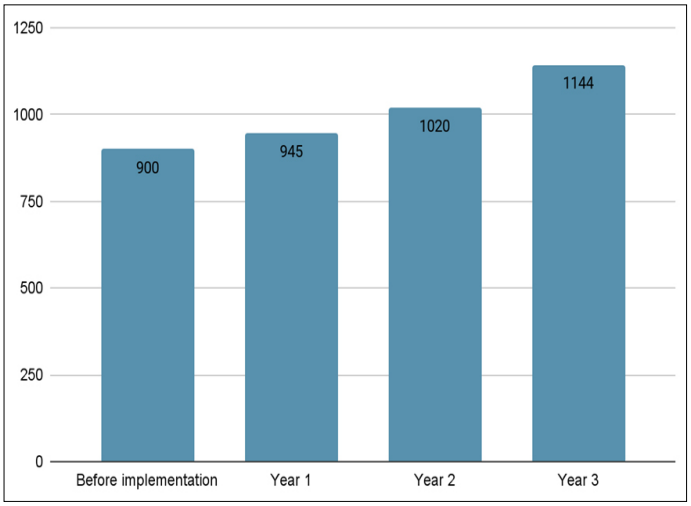

Fig. 2. Dynamics of student recruitment and retention (compiled by the author based on [7, 13]).

As Figure 2 shows, the implementation of micro-credentials serves as an effective managerial lever for addressing two interrelated strategic objectives: expanding the inflow of applicants and reducing attrition. By providing learners with the opportunity to obtain intermediate qualifications that possess market value, the university reduces the risk that they will leave without formal confirmation of the competencies acquired and thereby increases their motivation to complete the educational trajectory [10].

In a broader strategic perspective, micro-credentials function as a catalyst for transforming the university business model. The traditional logic of a monolithic four-year product with deferred consumer value is becoming increasingly unsustainable for students (significant time and financial costs) and for universities (rising financial risks). The integration of stackable micro-credentials makes it possible to decompose this monolith into a sequence of modular components, each of which has independent market value [2]. Such an architecture creates new entry points for heterogeneous groups of learners (not only high school graduates, but also adult professionals in need of retraining) and diversifies revenue streams. As a result, a strategic shift occurs from a product-centric to a client-centric model: the university ceases to be a diploma factory and becomes a flexible platform for lifelong learning, which fundamentally redefines its role and place in the knowledge economy.

The effectiveness of the entire system is determined by the continuous and transparent circulation of value — skills, finance, and data and, critically, sustained trust among participants. At the same time, significant barriers persist along the trajectories of these flows, hindering their free movement (fig.3.).

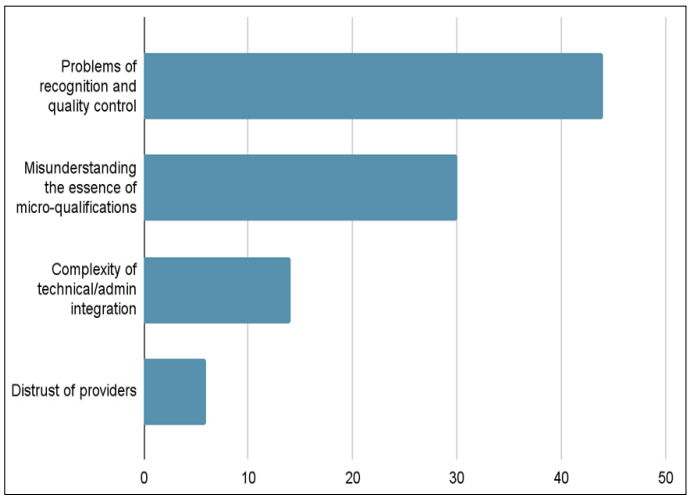

Fig. 3. Key barriers to the large-scale implementation of micro-qualifications (proportion of respondents, in %) (compiled by the author based on [9, 19]).

According to Figure 3, the bottleneck lies not in the technological domain but in the realm of institutions and regulation. The principal constraint on scaling is recognition and quality assurance issues (44% of respondents) [19]. The absence of harmonized national and international standards, as well as robust and transparent quality assurance procedures, creates uncertainty for employers and students, undermining trust and reducing the value of the relevant qualifications [9, 11].

Beyond operational barriers, long-term strategic risks also emerge:

1) Risk of gig qualifications: Critics note that a hyperfocus on narrowly specialized micro-credentials leads to the fragmentation of the educational landscape. Instead of building a fundamental, transferable base of knowledge and skills, the system begins to train workers to the demands of an unstable gig economy, where competencies become obsolete rapidly and career trajectories are discontinuous and precarious.

2) Risk of exacerbating digital inequality: Effective participation in online micro-credential programs requires not only technical access but also high levels of digital literacy, sustained motivation, and well-developed self-regulation skills. As a result, already privileged groups of learners reap the greatest benefits, whereas students from less advantaged backgrounds who lack the necessary digital capital risk falling even further behind, thereby reinforcing educational and social inequality.

CONCLUSION

The conducted study employing a quasi-experimental design makes it possible to formulate a number of fundamental conclusions about the economic effectiveness of stackable qualifications and microdegrees in the context of the digital labor market.

First, the hypothesis of a positive and economically significant return on investment for key stakeholders is empirically confirmed. For students, obtaining an industry-recognized microcredential in addition to a primary degree results in a measurable financial effect in the form of a premium to the starting salary, which, according to the modeling results, can reach 10–15%. Alongside the direct accumulation of human capital, microcredentials perform a distinct function by reducing information asymmetry and enhancing graduates' competitiveness in the labor market.

Second, for universities, strategic investments in the implementation of microcredential programs are economically justified. A cost–benefit analysis model demonstrates the potential to achieve positive ROI and NPV due to the synergy of direct and indirect revenues: an inflow of new applicants, diversification of the educational portfolio, and reduced attrition. In a broader dimension, microcredentials act as a driver of the university business model's transformation toward greater flexibility, modularity, and an orientation to the paradigm of lifelong learning.

Third, despite the demonstrated economic potential, the success and scaling of the microcredential ecosystem are not predetermined. Critical constraints remain institutional and regulatory factors, above all the absence of unified standards of quality and recognition. Without the introduction of transparent and reliable mechanisms of accreditation and verification, the value of microcredentials may be diluted, which will constrain their impact.

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