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STUDENT LOANS AS PUBLIC INVESTMENT: EVIDENCE FROM A SOCIAL RETURN ON INVESTMENT ANALYSIS OF THAILAND

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ABSTRACT

Government-funded student loan programs are subject to long-term fiscal exposure, but their evaluation is often confined to short-run budgetary measures or repayment outcomes. This paper will analyze the Student Loans Fund (SLF) in Thailand using the estimation method and a linkage between program costs and the earnings-related returns seen in the labor market. Earnings profiles by level of education are derived from Mincer-type regression models of Thailand's 2022 Labor Force Survey, and these profiles are applied to predict earnings premiums against an upper secondary education baseline level. Several benefit components are considered in the valuation, such as interest cost savings for the borrowers, opportunity cost value of mandatory volunteer service, and discounted gains in income across an intentionally reduced horizon. On the cost side, operating expenditures, expected loan losses, and implicit interest rate subsidies embedded in income-related repayment are considered. Under baseline assumptions, monetized benefits are greater than net public costs. This finding is robust to changes in important parameters, including discount rates, retention, default, and earnings horizons. The estimates are conservative by construction, since their benefits are limited to early-career outcomes and broader spillovers are underappreciated. The analysis doesn't touch on other program design or causal effects, but it helps establish a framework for viewing student loan schemes as public investments exposed to income risk, rather than as static fiscal liabilities.

KEYWORDS: Student Loan Programs; Social Return on Investment; Human Capital Investment; Education Finance; Public Investment Valuation; Cost-Benefit Analysis.

1. INTRODUCTION

Government-run student loan programs are a subject that is endlessly talked about in ways which disclose not much more than they conceal. At face value they are simple: students receive public money up front, pay it back gradually over time and exposure to taxpayer risk can be calculated. In reality, the picture is less neat. Costs are borne early and with certainty; the returns, by contrast, depend on labor market trajectories that unfold slowly and unequally – and often in ways that can't be predicted. Repayment is based on income rather than collateral so it's not that uncertainty is an extra factor applied to these schemes, but instead uncertainty is fundamental to them. In part, however, loans to students have continued to be viewed in budgetary terms that treat cost of funds over the short horizon as more important than longer run economic consequences (Friedman, 1955; Barr, 2001).

This division is also evident in the bulk of prior studies. These studies of student loans often concentrate on repayment outcomes - default, delinquency, or repayment burdens- and therefore how public policy shapes the division of risk between individual borrowers and the state (Avery & Turner, 2012). At the same time labor economists have focused much effort on estimating -returns to education, most commonly by regressing earnings on schooling and experience in various adaptations of the Mincer framework (Mincer, 1974; Card, 1999; Card, 2001). Program evaluations layer institutional detail and distributional concern on top, but they rarely try to weave these strands together. The result is a literature that is thick in individual domains but thin across their intersection, providing little sense of whether student loan programs pay social returns commensurate with their fiscal cost.

This literature is, of course, also limited; the politics of U.S. federal student loans both exemplifies and underscores the value and limits of that literature. As we show, when one looks more carefully at the distribution of actual Stafford loan repayment outcomes among borrowers, it becomes clear that average measures mask considerable risk faced by some. Default rates have been correlated with consumption hardship, and repayment burdens are a significant contributor of default risk, which highlights the role that this plays in designing loans (Baum & Schwartz, 2006; Chapman & Lounkaew, 2015). What these papers do more rarely, however, is connect the observed earnings dynamics with an inquiry into whether public resources are well deployed when regarded as a form of investment.

Our work in the current study was inspired by this lack. Instead of viewing the repayment behavior,

earnings returns and fiscal accounts as separate issues to deal with, it puts all these aspects in a common valuation exercise.

We think of student loans here as long-horizon public investments that yield streams of benefits and costs, all of which can be mapped onto present value bases (Lochner & Monge-Naranjo, 2015). This does not eliminate uncertainty – earnings paths still vary widely, repayment behavior is not perfectly predictable and program parameters can change – but it makes the trade-offs explicit.

An example is the Student Loans Fund (SLF) in Thailand, which would provide a context where such an approach can be pursued with minimal heroic assumptions. The program has been in existence for several decades, gone through a number of design changes and now reaches much of the population of post-secondary students. Its very institutional characteristics allow the risk aspects of repayment and implicit subsidy to be observable, instead of only conjectural. Meanwhile, representative labor force survey data can also be used to estimate earnings profiles by education using local evidence rather than imported parameters (National Statistical Office, 2022; Chapman & Lounkaew, 2010).

The empirical strategy is straightforward in sequence. We first estimate returns to education using a Mincerian framework, taking upper secondary education as the counterfactual benchmark (Mincer, 1974). These forecasts are then employed to estimate projected earnings premiums across the intentionally conservative horizon. A second stage relationship is estimated in which the earnings difference per act-hour are transformed to a present value and added to a gross monetary value of compulsory volunteer time, valued using an opportunity cost concept. Finally, program costs are built up around loan outlays net of anticipated repayment to create an implicit subsidy measure that is also responsive to risks of non-repayment and how the program is structured rather than purely accounting-based (Chapman & Lounkaew, 2010).

These factors are aggregated through a social return on investment (SROI) ratio, which is the present value of monetized benefits divided by the present value of their net public costs. Experience in applying SROI methodologies shows that reported ratios are very sensitive to assumptions regarding scopes and time horizons (Banke-Thomas et al., 2015; Vluggen et al., 2020). For that reason, the analysis in this space is deliberately circumscribed. Benefits streams are constrained to those that can be directly tied to observed data and program rules; larger benefits spillover factors are withheld. The estimates should be interpreted as conservative rather than comprehensive assessments of social returns.

There are two options that drive from the beginning the analysis. Conservative assumptions are also consistently used, such as truncated scopes and selective definitions of non-market benefits. Second, uncertainty is viewed as an integral part of investments in human capital rather than an irrelevance to be smoothed out and we are interested in the way it impacts on both individual and aggregate levels of investment. Here we conduct sensitivity analyses, to examine how the results shift under alternative (though realistic) parameter settings which would reflect the risks of education financing (Friedman, 1955, Schultz, 1961).

The paper proceeds as follows. Section 2 develops the valuation framework and formal investment model that motivates the analysis. Section 3 describes the data and empirical strategy used to construct education-specific earnings profiles. Section 4 assembles program costs, repayment flows, and the implicit subsidy embedded in the Student Loans Fund. Section 5 then sets out the valuation methodology, explaining how the estimated earnings profiles and program parameters are mapped into the Social Return on Investment calculation. Section 6 reports the valuation results, including benefit decomposition, sensitivity analysis, and international comparison. Section 7 discusses the implications for education finance and public investment under uncertainty. Section 8 concludes.

2. CONCEPTUAL FRAMEWORK

The purpose of this section is limited. It does not propose a new theory of education finance, nor does it attempt to formalize all aspects of student loan design. Its role is more basic: to make explicit how benefits, costs, and uncertainty are connected in the valuation exercise that follows. Student loans are treated here as a form of public investment whose returns arrive late, depend on labor market outcomes, and are therefore uncertain by construction (Schultz, 1961; Becker, 1964; Woodhall, 2004; McMahon, 2009; Psacharopoulos & Patrinos, 2018).

2.1. Underpinned Theories

Consider a cohort of borrowers indexed by $i = 1, \dots, N$. At the start of the program, the government provides loan funds C_0 to support post-secondary education. These expenditures occur immediately and are known with certainty. Benefits, by contrast, arise only after borrowers enter the labor market. Let $t = 1, \dots, T$ index years after graduation.

The problem is intertemporal. Costs come first. Benefits come later, if at all. Any evaluation therefore requires converting flows at different points in time into comparable terms. Let r denote the social discount rate. Values realized in year t are

discounted by $(1+r)^{-t}$. This is standard, but it matters here because long horizons magnify the role of assumptions.

2.2. Earnings and counterfactual income paths

The main economic benefit generated by student loans operates through education-related earnings differences. Let w_{it}^S denote expected earnings of individual i in year t after completing post-secondary education. Let w_{it}^0 denote the counterfactual earnings path had education ended at the upper-secondary level.

Earnings are estimated using a conventional Mincer-type specification applied to labor force microdata:

$$\ln w_{it} = \alpha + \beta S_i + \gamma X_{it} + \varepsilon_{it}$$

where S_i captures educational attainment and X_{it} includes age and experience. The coefficient β summarizes the average earnings difference associated with post-secondary education. The earnings gain attributable to education in year t is then

$$\Delta w_{it} = w_{it}^S - w_{it}^0.$$

These gains differ across individuals and over time. They are not assumed to be constant, nor are they assumed to last indefinitely. Both magnitude and duration are treated as empirical objects.

2.3. Present value of earnings benefits

For each borrower, the present value of earnings benefits over the evaluation horizon T is defined as

$$PV_i^E = \sum_{t=1}^T \frac{\Delta w_{it}}{(1+r)^t}$$

Total earnings-related benefits are obtained by summing across borrowers:

$$PV^E = \sum_{i=1}^N PV_i^E.$$

Two choices are embedded here. First, the horizon T may be shorter than a full working life. This is intentional and conservative. Second, benefits are measured relative to an explicit counterfactual, not as absolute income levels.

2.4. Non-market obligations in the SLF

Thailand's Student Loans Fund (SLF) includes a requirement that borrowers complete a fixed amount of volunteer service. This obligation is part of the program design and cannot be ignored in valuation, even though its benefits are not traded in markets.

Let h_i denote the required volunteer hours for

individual i . Let v denote a conservative shadow wage representing the opportunity cost of time. The present value of volunteer service is defined as

$$PV_i^v = \frac{h_i \cdot v}{(1+r)^{t_v}}$$

where t_v denotes the timing of service. Aggregation across borrowers yields PV^v .

This valuation is intentionally narrow. It does not attempt to capture broader social spillovers associated with volunteering. The aim is to establish a defensible lower bound rather than an exhaustive estimate.

2.5. Costs, repayments, and implicit subsidy

Public cost depends not only on loan disbursement but also on repayment. Let R_{it} denote repayments made by borrower i in year t . The present value of repayments is

$$PV^R = \sum_{i=1}^N \sum_{t=1}^T \frac{R_{it}}{(1+r)^t}$$

Net public cost is then

$$PV^C = C_0 - PV^R.$$

This formulation makes clear that fiscal cost is endogenous to labor market outcomes. An implicit subsidy rate can be written as

$$\sigma = 1 - \frac{PV^R}{C_0}.$$

Different values of σ reflect assumptions about income growth, compliance, and policy rules rather than accounting differences (Debande, 2004; Woodhall, 1992).

2.6. Social return on investment

Total monetized benefits are defined as

$$PV^B = PV^E + PV^v.$$

The social return on investment is then

$$SROI = \frac{PV^B}{PV^C}.$$

Interpreted this way, the SROI is simply a benefit-cost ratio applied to a public investment undertaken under uncertainty. Because benefits are conservatively defined and horizons truncated, the resulting values should be read as lower bounds.

2.7. Uncertainty

Uncertainty enters at several points: earnings estimation, repayment behavior, discounting, and horizon choice. The framework does not attempt to

collapse these into a single estimate. These concerns are especially salient in middle-income and developing economies, where education finance operates alongside extensive public subsidies (Tilak, 1992). Instead, key parameters are varied in sensitivity analysis. This does not resolve uncertainty, but it makes clear how dependent the valuation is on assumptions.

3. DATA AND EMPIRICAL STRATEGY

This section describes the data and empirical procedures used to construct education-specific earnings profiles and valuation inputs. The focus is deliberately narrow. The objective is to obtain internally consistent earnings trajectories for different educational pathways, rather than to estimate a single pooled wage equation.

3.1. Data source and sample definition

The analysis uses microdata from the 2022 Thai Labor Force Survey (LFS), conducted by the National Statistical Office. The LFS provides information on monthly wages, educational attainment, and age for a nationally representative sample of the working-age population.

The estimation sample is restricted to individuals reporting positive wage income. Unpaid family workers and individuals with zero reported earnings are excluded.

All earnings are converted to real terms using a common price base year to ensure consistency with subsequent present value calculations.

Education is classified into three mutually exclusive groups: upper secondary education, vocational diploma, and bachelor's degree. These groups correspond to the dominant post-secondary pathways in Thailand and form the basis of the empirical analysis.

3.2. Education-specific earnings regressions

Earnings profiles are estimated separately for each education group using a simple Mincer-type specification. For each group $g \in \{0, 1, 2\}$, the regression takes the form

$$\ln w_{it}^{(g)} = \alpha_g + \beta_g \text{Age}_{it} + \delta_g \text{Age}_{it}^2 + \varepsilon_{it}^{(g)},$$

where $w_{it}^{(g)}$ denotes real monthly wages of individual i in education group g .

No additional covariates are included. The specification is intentionally simple. Estimating separate equations by education group allows allow age-earnings profiles to differ flexibly across educational pathways, rather than imposing a common slope structure through education dummy variables. The regressions are estimated on

education-specific subsamples.

3.3. Entry ages and age normalization

To construct comparable earnings trajectories, age is interpreted relative to typical labor market entry points for each education group. Entry ages are set at 18 for upper secondary graduates, 20 for vocational diploma holders, and 22 for bachelor's degree graduates.

These entry ages are not estimated parameters; they are imposed as institutional assumptions reflecting the structure of Thailand's education system. Earnings profiles are therefore interpreted as beginning at different ages depending on educational attainment, with post-secondary education delaying labor market entry but potentially generating higher subsequent earnings.

3.4. Construction of earnings differentials

Earnings differentials are constructed by comparing predicted earnings across education-specific profiles. For a given age t , expected earnings for vocational and bachelor's degree holders are compared to the counterfactual earnings of upper secondary graduates at the same chronological age.

Let $\hat{w}_t^{(g)}$ denote predicted earnings from the education-specific regression for group g . The earnings differential relative to upper secondary education is then defined as

$$\Delta w_t^{(g)} = \hat{w}_t^{(g)} - \hat{w}_t^{(0)}, g \in \{1, 2\}.$$

These differentials form the basis for the valuation of education-related benefits.

3.5. Projection horizon and smoothing

Predicted earnings differentials are evaluated over a truncated horizon that does not extend to the end of the working life. This reflects both the timing of loan repayment obligations and the diminishing weight of distant income flows under discounting. Because earnings profiles are generated from quadratic age functions, the resulting trajectories are smooth by construction. Short-term volatility is not modeled. For valuation purposes, expected flows are sufficient.

3.6. Mapping earnings profiles to valuation inputs

Earnings differentials are converted into annual real amounts and discounted using the social discount rate defined in Section 2. Aggregation across individuals uses survey weights. No general equilibrium effects or displacement are modeled. Earnings gains are interpreted as productivity-related benefits accruing to borrowers. Conservative bounding is imposed elsewhere in the analysis

through horizon truncation and the exclusion of spillover effects.

4. PROGRAM COSTS, REPAYMENTS, AND IMPLICIT SUBSIDY

This section describes how program costs and repayment flows under Thailand's Student Loans Fund (SLF) are constructed and how the implicit subsidy embedded in the program is defined for valuation. The aim is not to reproduce administrative accounting, but to translate program rules and observed repayment behavior into cost streams that are consistent with the valuation framework developed earlier.

4.1. Loan outlays and unit discipline

Program costs begin with loan disbursements made by the SLF to eligible students. Administrative data provide information on loan amounts by education level and cohort. These disbursements are recorded in nominal terms at the time of lending and reflect the upfront fiscal commitment of the program.

For valuation purposes, all loan outlays are converted into real terms using the same price base year applied to earnings estimates. Maintaining a single price year is essential, as benefits and costs are combined in present value calculations. Throughout the analysis, monetary values are expressed in Thai baht (THB), and units are stated explicitly whenever aggregates are reported to avoid ambiguity between THB and million THB.

Loan disbursements are treated as occurring at the beginning of the investment horizon. Although loans are typically disbursed over the period of study, spreading them across years has a negligible effect on present values once discounting is applied. Treating outlays as upfront therefore simplifies the analysis without materially affecting results.

4.2. Repayment structure and timing

Repayment obligations under the SLF are income-related and extend over multiple years following graduation. Actual repayments depend on borrowers' post-graduation earnings and compliance with program rules, making repayment flows inherently uncertain.

Expected repayment streams are constructed by combining program-level information on repayment schedules with the education-specific earnings profiles estimated in Section 3. Repayments are modeled as annual flows and expressed in real terms. To ensure comparability with benefits, repayment streams are truncated at the same evaluation horizon used for earnings-based benefits.

This truncation is a conservative modeling choice.

Excluding repayments beyond the evaluation horizon increases estimated net public cost rather than reducing it. As a result, the valuation does not rely on optimistic assumptions about long-term repayment behavior.

4.3. Repayment Burden, Default Risk, and Aggregate Recovery under a Mortgage-Type Schedule

Taking up the institutional characteristics of the Student Loans Fund (SLF) explained here, a section describes the mechanical implications of the repayment plan of the SLF for borrower behavior and total loan recovery. Instead of simply repeating the structure of the scheme, this paper explores how a fixed, mortgage-type repayment plan interacts with heterogeneous income paths to create default risk and fiscal trade-offs.

Under the SLF, repayment obligations are ex ante fixed proportions of outstanding debt that increase over time. As a result, repayment burdens develop independently of the actual income realized by a borrower. This distinction makes the SLF distinct from income-contingent loan systems and suggests that repayment stress is a function not only of loan size but also of the overlap between the repayment structure and the trajectory of post-graduation earnings.

For borrowers with solid earnings growth, expanding repayment shares might be bearable. However, for individuals with weak or unpredictable earnings, applying the same schedule can result in repayment obligations that do not meet realistic budget constraints. The pivotal mechanism, then, is not simply the nominal interest rate itself but the interplay of repayment conservatism and income dispersion.

Because distributions of earnings among graduates are highly skewed, consistency in repayment schedules translates into uneven burdens on borrowers. As repayment payments and debt repayments pile up over decades, the ratio between required payments and available income for low earners grows, increasing even if their real earnings growth is subdued or nonexistent. Defaults become by far the predominant adjustment mechanism when the minimum amounts owed rise above what the borrower is able to pay.

This results in a non-linear relationship between repayment stringency and aggregate recovery from the lending authority's side. Increasing effective repayment obligations raises recovery from compliant borrowers but increases default risk for borrowers at the margin of repayment feasibility. Thus, aggregate loan recovery measures the trade-off

between these two opposing forces.

It is worth noting that this balance is determined by the full distribution of earnings, not just average outcomes. This framework shows why evaluations of interest rate levels or average repayment rates are insufficient. Even slight increases in effective repayment burdens may lead to outsized increases in defaults if a large number of borrowers experience strain and fail to meet manageable rates of repayment.

On the other hand, overly lenient repayment schedules can maintain compliance but limit returns on investments by higher-income borrowers. Hence, the policy problem is essentially one of optimization under income risk, rather than a simple transaction of generosity and fiscal conservatism.

This mechanism is quantified in the following sections by correlating the SLF repayment schedule with empirical estimations of earnings distributions. This enables the joint evaluation of the expected default response and cumulative recovery, providing a means to evaluate how alternative parameters for repayment would impact the fiscal performance of the SLF.

4.4. Net public cost and implicit subsidy

Net public cost is defined as loan outlays net of the present value of repayments:

$$PV^C = C_0 - PV^R.$$

This measure differs from simple accounting balances because it reflects the time value of money and the income-related nature of repayment. It provides a consistent basis for comparing program costs with the present value of benefits.

An implicit subsidy rate can be defined as

$$\sigma = 1 - \frac{PV^R}{C_0}.$$

This definition clarifies the source of differences in reported subsidy rates. Higher estimates, such as those reported in earlier analyses, typically reflect longer repayment horizons or alternative discounting assumptions. Lower estimates arise when repayments are truncated or discounted more heavily. In this study, the implicit subsidy rate is defined strictly within the valuation horizon used for benefits, ensuring that cost and benefit measures are aligned.

4.5. Consistency checks and bounding

Several consistency checks are applied before valuation results are computed. All flows entering present value calculations are expressed in the same price year and monetary units. Repayment and

benefit horizons are aligned by construction. Implied subsidy rates are examined to ensure they fall within plausible bounds given program rules and observed repayment behavior.

No adjustments are made to force particular subsidy values. Where modeling choices affect the magnitude of the implicit subsidy, these choices are made explicit and examined through sensitivity analysis in later sections. This approach reinforces the interpretation of results as conservative lower-bound estimates rather than precise fiscal forecasts.

5. VALUATION METHODOLOGY

The empirical estimates generated in the preceding sections lay the foundation for valuation, but they do not on their own represent an evaluation of the Student Loans Fund as a public investment. Figures for earnings regressions, repayment parameters, and administrative cost figures define different dimensions of the program, each measured in different units and realized at different points in time. These should be put together in a coherent intertemporal accounting framework to determine whether the program generates social value commensurate with its public cost. This section thus crystallizes the valuation logic informing the Social Return on Investment (SROI) calculation by characterizing it as a net present value identity. This makes clear how every empirical estimate feeds into the valuation, clarifies the treatment of transfers versus real resource costs, and sets forth the conditions under which the reported SROI can be treated as a normalized measure of public investment performance rather than a standalone social indicator.

5.1. Data Sources

Main data for the earnings analysis is obtained from the 2022 Labor Force Survey in Thailand by the National Statistical Office (NSO). It is the most representative national survey, administered quarterly, with about 200,000 people participating each year. It includes a wealth of information regarding employment, occupation, industry, hours worked, earnings, educational attainment, and basic demographic features. The survey scale allows for estimating earnings profiles separately by education level without compromising statistical accuracy.

Three groups are constructed by analytical categories: those participants who have upper secondary education level maximum, vocational diploma holders, and bachelor's degree graduates. Upper secondary is the counterfactual baseline group. The sample was limited to working people who are employed and have income data that is not

missing. After the limitations, analytical samples are comprised of 5,015 upper secondary completers, 2,330 vocational diploma holders, and 3,929 bachelor's degree graduates.

Details on borrowers and loan amounts are sourced from the administrative figures obtained from the release of the Student Loans Fund (Student Loans Fund, 2022). The program enrolled 487,217 active borrowers in 2022, with 47,673 vocational diploma students and 439,544 bachelor's degree students. In order to avoid counting multiple borrowers in the main analysis, the number of borrowers at lower educational levels is excluded from the study, as many individuals borrowed again at higher levels of education.

The Labor Force Survey uses a stratified multi-stage sampling design covering regions and sectors, both formal and informal employment.

Earnings measures combine wages with salaries, as well as reported self-employment income. The analysis is focused on wage earners in order to estimate earnings functions, which allows for better comparisons against standard Mincerian details and diminishes measurement error. One weakness of cross-sectional data is that the timing is inconsistent with loan disbursement and the outcomes in the labor market. During fiscal year 2022, all students receiving loans will be in the labor market several years later when income will begin, while earnings observed reflect earlier borrower cohorts. Consequently, the analysis assumes that education-specific earnings premiums are relatively unchanged for the concerned horizon.

The implication of the above assumption is based on the robustness of returns estimates between recent rounds of the Labor Force Survey, although there might be an exception, as structural changes in the economy may cause future returns to differ from those observed here.

Program costs are calculated using SLF annual reports and the official budget documents. Fiscal 2022: Operating expenditures are 42,073 million baht, as they represent the contemporary public resources costs incurred in this year. The implicit interest subsidy rate (48%) is consistent with Chapman et al. This parameter is the present-value subsidy per baht lent at concessional interest rates, grace periods, and extended repayment horizons and is thus invariant to price-year variations; it is applicable to loan volumes reported at constant prices.

Loan losses predicted will be at 25.39 percent, which is the average expected value reported by the National Economic and Social Development Council (23.44 percent) and Lounkaew (2016) (28.44 percent). This model is based on historical portfolio-level losses

for mortgage-type repayment and may be expected to exaggerate the losses for recent cohorts due to more stringent enforcement mechanisms that have been introduced, in particular employer-based withholding and clearer income verification, with the 2018 amendments to the Student Loans Fund Act. Its use thereafter adds to its conservative valuation.

Job employment rates are for education, based on NSO 2022 unemployment, when employment rates were 97.60 percent for graduates of bachelor's degrees and 98.90 percent for those with vocational diplomas, respectively. Earnings regressions are estimated based on employment, so rates are separately applied as probability weights in the valuation stage.

Values are reported in all currencies with the base date of 2022 Thai baht. Using the Consumer Price Index, cumulative inflation adjustments are applied to represent values with constant values in 2025, with 1.2 percent in 2023, 0.4 percent in 2024, and around zero in 2025 (Ministry of Commerce, Trade Policy and Strategy Office). The associated adjustment factor of 1.016 that is applied is provided throughout.

With respect to international comparability, US dollar equivalents are reported at the 2022 average exchange rate of 35.03 baht per USD (Bank of Thailand). Values of dollars are disclosed only as a reference and are not included in the valuation.

5.2. Earnings Function Estimation

Earnings profiles are calculated separately for each academic strata to account for educational age and earnings profiles for each education category and to represent education-specific patterns of age-earnings. The empirical specification is expressed by standard Mincerian approach:

$$\ln(\text{Wage}_i) = \beta_0 + \beta_1 \text{Age}_i + \beta_2 \text{Age}_i^2 + \varepsilon_i$$

where $\ln(\text{Wage}_i)$ denotes monthly income of individual i ; age is used as a proxy for experience in the labour market. The quadratic term enables us to approximate the age-earning relationship in the form of the concave relationship that is generally found in labor market data.

The equation is estimated independently for upper secondary, vocational diploma, and bachelor's degree samples using ordinary least squares with heteroskedasticity-robust standard errors. Age is used instead of potential experience to avoid mechanically connecting education level to the experience measure and to capture the data available. The estimated coefficients, under this specification, capture a joint effect of experiential accumulation and differences between cohorts.

To enable this, the regression coefficients are estimated separately by educational level to allow independent estimates of intercepts and slopes to be made across groups. Initial combined estimates counter the argument that age-earnings gradients are uniform between levels of education, and that the differences in slopes are economic inferences.

For positive fit and easy interpretation, monthly wages are described in logarithm. The estimated coefficients are employed to project expected earnings for each age and to assess earnings differentials with respect to upper secondary baseline.

Like the majority of cross-sectional earnings regressions, the estimates fail to eliminate source endogeneity issues caused by education selection. Nevertheless, the aim of the analysis is not to quantify individual-specific causal returns to education, but to describe observed distributions of earnings by levels of education for valuation purposes. This is the source why the estimates are treated as realized conditional earnings profiles which can be aggregated to present value.

5.3. Valuation Framework: SROI as a Net Present Value Identity

The SLF is discussed as a public investment, with its costs incurred early and long-term benefits realized through labour market outcomes and the outputs of the system. Let $t = 1, \dots, T$ index years after graduation, and r denote the real social discount rate. We define the net present value (NPV) of the program as:

$$\text{NPV} = \sum_{t=1}^T (\mathbb{E}[\Delta Y_t] + V_t^{NM} - C_t) (1+r)^{-t}$$

where $\mathbb{E}[\Delta Y_t]$ denotes the expected earnings differential relative to the upper secondary counterfactual, V_t^{NM} captures the value of non-market outputs produced by the program, and C_t represents net public resource costs.

Every flow is assessed through expectation, i.e., in uncertainty regarding earnings and employment and repayment outcomes. Repayment under the Student Loans Fund behaves similarly to a mortgage and has graduated repayment schedules. While repayment is not an income-contingent process, there is no formalized income-contingency. Realized earnings trajectories have been shown to affect repayment power and return on loan recoveries. The expected returns are determined, most notably through enforcement mechanisms that tie repayment through verified income in a proven income payment relationship. Labor-market risk thus continues to be

at the heart of the public fiscal exposure to that given program.

Earnings-Related Benefits. Benefits earned by the estimated earnings functions identified in Section 5.2. For each of the education levels, age-specific earnings are estimated and contrasted with the upper secondary baseline to yield expected earning differences. These differentials are indexed as a function of education-specific employment rates and retention rates and aggregated over the first decade of post-graduation work. The horizon is intentionally scaled back to conservative estimates and to reduce sensitivity to long-run structural changes. This framework is also used in our study to calculate future earnings differences.

All earnings are declared in real terms and discounted using the real social discount rate. At the same time, the counterfactual earnings path is that of a group whose education stops at the upper secondary level and is assessed at similar ages and labor market conditions. This is the next best observable alternative given the comparison points for SLF beneficiaries in Thailand's education system.

Non-Market Outputs. During years of study, borrowers have to engage in mandatory volunteer service. This is a real non-market output, not a fiscal transfer. The time spent volunteering is assessed in terms of opportunity cost, with the hourly wage of upper secondary graduates as the shadow cost. We value present values as a function of the duration of study, in this case, 2 years for a vocational diploma and 4 years for a bachelor's degree. Broader social spillovers of volunteer efforts are not monetized.

Net Public Resource Costs. Net public resource costs are formulated as:

$$C_t = \text{Disbursement}_t - \mathbb{E}[\text{Repayment}_t] \\ + \text{Administration}_t + \mathbb{E}[\text{Loan Loss}_t]$$

Loan disbursements form the first component of public expenditure. Expected repayments are written off to show recovery to normal over time under mortgage-type repayment schedules; repayment performance is influenced at the same time by borrowers' realized earnings and enforcement methods. Administrative costs and anticipated loan losses are added in as resource costs.

Interest subsidies built into concessional loan conditions are considered as implicit transfers and included in C_t only to the level that they cause net costs of public resources and that no benefits are duplicated with costs at lower levels. More stringent enforcement in the wake of the 2018 reform – with special emphasis on employer withholding and enhanced income verification – has further reduced

the risk of non-payment, but at the same time not turning its program into a formal income-contingent scheme. Such improvements are indirectly reflected by conservative assumptions about expected loan losses as opposed to explicit behavioral modeling. Note that, all value and benefit streams are assessed in real terms and discounted with a common real social discount rate.

The Net Present Value and Social Return on Investment. The Social Return on Investment is obtained as an expression of valuation identity that is normalized:

$$\text{SROI} = 1 + \frac{\text{NPV}}{\sum_{t=1}^T C_t (1+r)^{-t}}$$

An SROI greater than 1 directly gives us a positive net present value. At the same time, this ratio cannot be treated as a distinct evaluative concept but rather becomes convenient for normalization in comparison across assumptions and horizons.

6. VALUATION RESULTS

This section reports the empirical results underlying the valuation exercise. We begin with the earnings function estimates that form the basis for long-term benefit calculations. We then present each benefit component – direct borrowing cost savings, the value of required volunteer service, and earnings premiums – before assembling these components into an aggregate social return on investment (SROI). Sensitivity analysis and an international comparison conclude the section.

All monetary values are expressed in 2025 constant prices unless otherwise stated. All results are interpreted in the context of mortgage-type repayment with graduated obligations and income-linked enforcement, rather than formal income-contingent repayment.

6.1. Earnings function estimates

Table 1 reports the estimated Mincerian earnings functions by educational level. Separate regressions are estimated for upper secondary, vocational diploma, and bachelor's degree graduates. In all cases, the coefficients on age and age squared are statistically significant and imply the expected concave age-earnings profile.

Two features are particularly relevant for valuation. First, vocational diploma graduates exhibit the steepest age gradient, indicating relatively rapid earnings growth with experience. Second, bachelor's degree graduates display the highest intercept, reflecting higher earnings at labor market entry. These differences imply that earnings gaps across education groups evolve over time rather than

remaining constant. Such heterogeneity in earnings trajectories is also central to repayment risk in other national student loan programs, where repayment difficulties are concentrated among borrowers with weaker earnings growth (Schwartz & Finnie, 2002).

The estimated coefficients generate education-

specific earnings trajectories that diverge over the lifecycle. While bachelor's degree graduates command higher initial wages, the steeper age-earnings profile for vocational graduates implies partial convergence over time. These dynamic patterns underpin the construction of long-term earnings benefits reported below.

Table 1: Mincerian Earnings Function Estimates by Educational Level

Variable	Upper Secondary	Vocational Diploma	Bachelor's Degree
Age	0.0311** (0.0059)	0.0430** (0.0112)	0.0364** (0.0078)
Age ²	-0.0003** (0.0001)	-0.0003* (0.0002)	-0.0002* (0.0001)
Constant	8.6267** (0.1012)	8.4727** (0.1867)	8.9092** (0.1396)
Observations	5,015	2,330	3,929
R-squared	0.6913	0.5282	0.5625

Notes: Robust standard errors in parentheses. * and ** denote significance at the 10% and 5% levels, respectively. Data source: 2022 Thailand Labor Force Survey, National Statistical Office (2022).

6.2. Borrower-level interest subsidies (transfer component)

Direct benefits arise from interest rate subsidies embedded in the SLF, which reduce borrowers' effective borrowing costs relative to market alternatives. Table 2 reports per-person savings and

aggregate totals by education level. Total direct benefits amount to 17,946.55 million baht in 2025 prices. Bachelor's degree borrowers account for the majority of this amount, reflecting both larger average loan sizes and substantially greater borrower numbers.

Table 2: Direct Benefits from Reduced Borrowing Costs (2025 Prices)

Education Level	Per-person Savings (THB)	Borrowers	Total (Million THB)	Total (Million USD)
Vocational Diploma	13,295.00	47,673.00	634.01	18.10
Bachelor's Degree	39,387.00	439,544.00	17,312.54	494.29
Total (V₁)		487,217.00	17,946.55	512.39

Notes: Values expressed in 2025 prices using Thailand CPI. USD conversion at 35.03 THB/USD.

These interest savings represent borrower-level transfers arising from concessional loan terms rather than net additions to social resources. They are reported separately to maintain transparency regarding program design but enter the valuation only through their role in determining net public resource cost, consistent with the framework in Section 5.

6.3. Short-term indirect benefits from volunteer service

Borrowers under the SLF are required to complete mandatory volunteer service. The value of this

service is estimated using an opportunity cost of time approach, with a uniform shadow wage applied across activities.

Table 3 reports the present value of volunteer service in 2025 prices. The total value amounts to 4,048.14 million baht, making this the smallest benefit component in monetary terms. The valuation is intentionally conservative. It does not attempt to capture indirect effects such as civic engagement, skill development, or social capital formation, and should therefore be interpreted as a lower bound.

Table 3: Short-term Indirect Benefits from Volunteer Service (2025 Prices)

Education Level	Borrowers	Total Hours	PV (Million THB)	PV (Million USD)
Vocational Diploma	47,673.00	72.00 (2 years)	217.84	6.22
Bachelor's Degree	439,544.00	144.00 (4 years)	3,830.30	109.35
Total (V₂)			4,048.14	115.57

Notes: Hourly wage = 65.01 THB (2025 prices). 36 hours/year × program duration.

6.4. Long-term indirect benefits from enhanced earnings

Long-term earnings premiums constitute the dominant benefit component. Table 4 reports the present value of earnings gains over a conservative 10-year horizon, computed by projecting wages using the estimated earnings functions and comparing each education group to the upper secondary baseline.

Total long-term earnings benefits amount to 240,906.79 million baht in 2025 prices. Bachelor’s

degree graduates account for the majority of this value, reflecting both higher per-person earnings premiums and larger cohort size. The reported per-person present values are CPI-adjusted to 2025 prices to ensure consistency with other benefit components.

The 10-year horizon captures only the early portion of working life. Extending the horizon toward a full career would substantially increase estimated benefits. The conservative horizon is retained to provide a lower-bound estimate.

Table 4: Long-term Indirect Benefits from Enhanced Earnings (2025 Prices)

Education Level	Borrowers	Retention	Employment	PV/person (THB)	Total (Million THB)	Total (Million USD)
Vocational Diploma	47,673.00	75.31%	98.90%	139,811	4,964.43	141.72
Bachelor’s Degree	439,544.00	75.31%	97.60%	730,300	235,942.36	6,735.87
Total (V₃)					240,906.79	6,877.59

Notes: 10-year earnings horizon. Values expressed in 2025 prices.

6.5. Aggregate SROI calculation

Table 5 reports the components of the net present value calculation and presents the Social Return on Investment (SROI) as a normalized expression of that valuation identity. Total benefits amount to 262,901.48 million baht, while total costs amount to 105,864.30 million baht, yielding an SROI of 2.48.

Long-term earnings benefits account for

approximately 91.6 percent of total benefits, confirming that wage returns are the primary channel through which educational investment generates social value. Direct interest savings and volunteer service contribute smaller shares. Consistent with Section 5, the SROI should be interpreted as a rescaling of the underlying net present value rather than as an independent evaluative metric.

Table 5: SROI Summary Calculation (2025 Prices)

Component	Million THB	Million USD
Benefits		
V ₁ : Direct benefits (interest savings)	17,946.55	512.39
V ₂ : Volunteer service	4,048.14	115.57
V ₃ : Enhanced earnings	240,906.79	6,877.59
Total Benefits (A)	262,901.48	7,505.55
Costs		
C ₁ : Operating budget	42,746.17	1,220.36
C ₂ : Implicit subsidy (48%)	35,936.65	1,025.97
C ₃ : Expected losses	27,181.48	776.02
Total Costs (B)	105,864.30	3,022.35
SROI (A/B)	2.48	

Notes: Implicit subsidy rate based on project-specific SLF parameters. Chapman et al. (2010) cited for conceptual definition.

6.6. Sensitivity analysis

Table 6 reports SROI values under alternative assumptions. Across all scenarios, the SROI remains

above unity. Results are most sensitive to the earnings horizon, reinforcing the conservative nature of the baseline estimate.

Table 6: Sensitivity Analysis Results

Scenario	Parameter Change	SROI
Baseline	As specified	2.48
Higher discount rate	r = 5%	2.21
Lower retention	65%	2.14
Higher default	35%	2.31
Shorter horizon	T = 5 years	1.42
Extended horizon	T = 15 years	3.51
Combined pessimistic	Multiple	1.78

6.7. International comparison

Table 7 places the estimated SROI for Thailand’s Student Loans Fund within the range reported in selected international studies. The purpose of this comparison is contextual rather than evaluative. Given substantial differences in institutional design, valuation scope, and modeling assumptions, the figures should not be interpreted as direct performance benchmarks.

The estimated SROI of 2.48 lies near the middle of the reported range. Studies focusing narrowly on vocational or skills-based programs tend to report lower ratios, while evaluations that incorporate broader outcome sets—such as health, social inclusion, or intergenerational effects—often report higher values. These differences largely reflect methodological scope, particularly the treatment of earnings horizons and non-market benefits.

The proximity of the present estimate to earlier

Thailand-based work provides reassurance regarding plausibility but not precision. Differences in benefit definitions, cost treatment, and discounting imply that numerical similarity should not be overstated. More broadly, international evidence shows that SROI estimates in education are highly sensitive to horizon length and discounting choices, with truncated horizons yielding systematically lower ratios.

Against this background, the Thai SLF estimate should be read as a conservative lower bound. Earnings benefits are limited to a ten-year horizon, volunteer service is valued using opportunity cost, and broader spillovers are excluded. Under these constraints, the resulting SROI aligns with international experience for large-scale public education finance programs operating under income-related repayment risk.

Table 7: International Comparison of Educational SROI Studies

Study	Context	Year	SROI
Uno Minda Group	India (vocational)	2022	1.24
Social Ventures Australia	Australia (youth programs)	2011	3.10
UNFPA Youth Programs	Global	2019	4.00
This study (Thailand SLF)	Thailand	2022	2.48

Notes: Differences reflect variation in valuation scope, benefit horizons, and discounting assumptions.

7. DISCUSSION

The valuation exercise suggests that, under the assumptions imposed, the benefits associated with the Student Loans Fund exceed the program’s costs. This result is not especially surprising, but it is not automatic either. It depends on how benefits are defined, how far into the future they are traced, and how repayments are treated. Small changes in these choices can move the ratio, sometimes materially.

One way to read the results is to focus on timing. Public spending occurs early, while returns arrive slowly and unevenly. In that sense, student loan programs resemble other forms of public investment where risk is not a side issue but part of the design. Defaults, incomplete repayment, and periods of non-payment are not deviations from a benchmark; they are the mechanism through which income risk is absorbed. Evaluating the program without reference to the earnings that follow misses that point.

Differences across education groups also need to be read carefully. Bachelor’s degree borrowers generate the largest share of measured benefits, largely because their earnings start higher and because they represent a large share of borrowers. That does not mean vocational pathways are unproductive. In fact, the earnings profiles indicate relatively strong growth with experience for vocational graduates. Because the valuation horizon

is short, much of that growth sits outside what is counted here.

The horizon matters more than almost any other assumption. Evidence from other contexts suggests that longer-run effects may extend to family formation and life-cycle decisions, particularly for women (Gicheva, 2016). Limiting earnings benefits to ten years produces a number that is defensible, but incomplete. It captures early career effects and very little else. Extending the horizon would raise estimated benefits substantially, but would also move the analysis further away from directly observed data. The choice made here is conservative by construction, not because longer horizons are implausible.

The same applies to the treatment of non-market elements. Volunteer service is valued using a uniform opportunity cost of time. That choice is convenient and transparent, but it almost certainly understates value in some cases and overstates it in others. No attempt is made to resolve that imbalance. More importantly, other effects that are often discussed in relation to education—health, crime, family outcomes—are excluded altogether (Booij et al., 2012).

On the cost side, the presence of an implicit subsidy is sometimes treated as evidence of inefficiency. That interpretation is too narrow. Subsidies arise because repayments are linked to income and because interest rates are concessional. Both features are policy

choices. Whether they are justified depends on what they buy in terms of future earnings and repayment capacity. The valuation suggests that, even after accounting for these transfers, the balance remains positive.

There are limits to what can be inferred from this exercise. Earnings functions are estimated from cross-sectional data. Repayment behavior is modeled in expected terms. None of this captures individual trajectories particularly well (Christie & Munro, 2003). The analysis also does not speak to alternative designs or to whether the same resources could generate higher returns elsewhere. Those questions are left aside.

What the results do show is narrower. When the program is evaluated on its own terms, using conservative assumptions and limited benefit categories, it does not appear to destroy value. That conclusion is modest, but it matters.

Much of the public debate around student loans focuses on fiscal exposure without asking what is produced in return. The numbers here at least provide a way of thinking about that trade-off.

8. CONCLUSION

This paper has examined Thailand's Student Loans Fund by combining earnings evidence with program-level cost information in a single valuation exercise. The approach treats the program as a long-horizon public investment rather than as a budgetary item to be assessed at a point in time. Under the assumptions imposed, the resulting valuation indicates that monetized benefits exceed net public costs. That finding is not especially dramatic, but it is not trivial either.

The analysis is built on a narrow base by design. Earnings benefits are derived from education-specific age-earnings profiles and traced over a limited horizon. Non-market elements are restricted to those embedded directly in program rules, such as required volunteer service, and are valued conservatively. Other outcomes commonly associated with education are left aside. These choices constrain the scope of the results, but they also limit the extent to which the valuation depends on assumptions that cannot be verified.

A feature of the results that deserves emphasis is the role of time. Costs are incurred early and with certainty, while returns arrive slowly and unevenly. In this setting, incomplete repayment and default are not anomalies; they are part of how risk is distributed between borrowers and the state. Judging the program primarily through repayment performance therefore misses the broader question of what the initial outlay produces. The valuation suggests that what is produced is not negligible.

Differences across educational pathways appear in the results, but they should not be overinterpreted. Bachelor's degree borrowers account for most of the measured benefits, reflecting both cohort size and higher early-career earnings. Vocational graduates, however, exhibit steeper earnings growth with experience, much of which lies beyond the horizon considered here. Extending the horizon would change the relative magnitudes, but doing so would also move the analysis further away from directly observed data.

The treatment of subsidies and losses also warrants a careful reading. Implicit subsidies arise from concessional interest rates and income-related repayment rules, not from administrative failure. These features shift risk toward the public sector. Whether that shift is justified depends on whether the earnings gains realized by borrowers are large enough, in aggregate, to offset the fiscal exposure. On that question, the evidence presented here is sufficient, even if incomplete.

The paper does not claim to settle debates about student loan design or education finance more generally. It does not compare the SLF to alternative instruments, nor does it attempt to identify causal effects of borrowing on educational outcomes. Its contribution is narrower. It shows that, when evaluated consistently and conservatively, a large public student loan program need not be judged solely by its repayment record. Looking at what follows repayment—however imperfectly—changes the assessment.

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