1. Empirical Analysis

To evaluate the effects of the *Neulbom* school public childcare expansion in Korea on maternal employment, child development, the substitution of private care services, the number of workers hired by schools, and the desired number of children, we exploit the quasi-experimental variations in the introduction of *Neulbom* schools across grades and schools in the first semester of 2024.

We employ a difference-in-difference framework by estimating equation (1) for students in grade1-4:

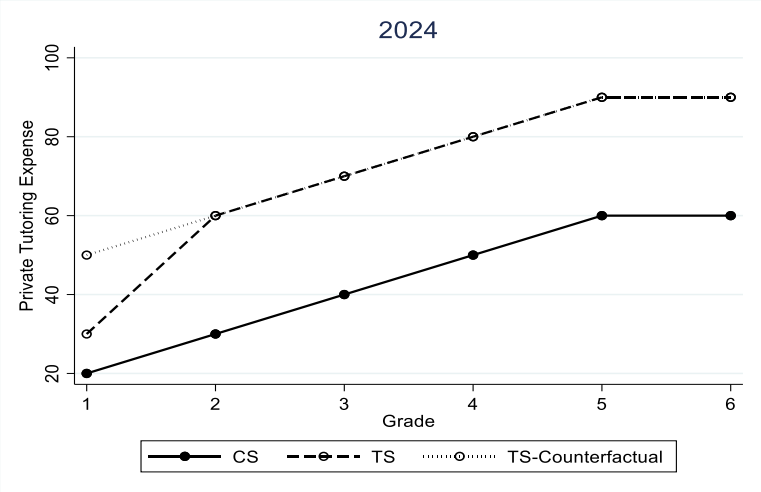
$$Y_{ijg} = \alpha_0 + \tau_g + \lambda_j + \delta_{y1} TS \times TG + X'_{ijg}\beta_0 + \varepsilon_{ijg,} \quad (1)$$

where *TS* is a dummy variable indicating whether schools are *Nuelbom* schools (treated school) and *TG* is also a dummy variable indicating whether the grade is first grade in *Nuelbom* schools (treated grade). The subscript i, j, g refer to students, schools and grades, respectively. *Y* includes several outcomes as explained in prior subsection. *X* includes individual and household characteristics such as household income, sex of students and whether the household is a multicultural family.

The parameter of interest of is δ_{y1} which captures the differences in the aforementioned outcome variables of interest between the first- and other-grade students in *Neulbom* schools compared to those of non-*Neulbom* schools. Even in *Neulbom* schools, students in first grade and their parents can choose to utilize the programs offered by *Neulbom* schools. According to the MOE data, 74.3% of first-grade students are attending *Neulbom* schools. Therefore, δ_{y1} captures the ITT (intention-to-treat) effect.

As described in Figure 1, we expect our estimation results on private tutoring expenses. The key identifying assumption of the difference-in-difference estimation strategy is that the treatment and control group have similar outcome trends in absence of the treatment. We verify this assumption, using the post-period trend given that the behaviors are consistent across students within the same school. Using the pre-period trend would give mixed results due to combined effects of school entry and the introduction of *Neulbom* school, especially for first grade students.

<Figure 1> Expected results for private tutoring expenses



*Note: Y-axis refers to private tutoring expenses and X-axis refers to grade. CS indicates controlled school (i.e. non-*Neulbom* school) and TS indicates treated school (i.e. *Neulbom* school).

Figure 1 illustrates the private tutoring expenses for first through sixth grade students at *Neulbom* School (TS) and non-*Neulbom* schools (CS) in 2024. In the absence of *Neulbom* school, the small-dashed line (TS-counterfactual) would show a declining trend in the expenses, parallel to that of CS. However, due to the introduction of the *Neulbom* school, the large-dashed line (TS) shows a significantly larger decline in expenses for first grade students at *Neulbom* school.

We examine the effect of *Neulbom* schools on several outcomes for compliers-those who utilize the programs and childcare services provided by *Neulbom* schools-by estimating equation (2) and (3) using an instrumental variable and a difference-in-difference model. We predict the proportion of students utilizing the services offered by *Neulbom* schools with equation (2) and use it in equation (3) to estimate the parameter of interest, δ_{IV}, which captures the effect of *Neulbom* schools on compliers.

$$P_{ijg} = \alpha_1 + \tau_{g1} + \lambda_{j1} + \delta_P TS \times TG + X'_{ijg}\beta_1 + \eta_{ijg}, \quad (2)$$

$$Y_{ijg} = \alpha_2 + \tau_{g2} + \lambda_{j2} + \delta_{IV}\widehat{P_{ijg}} + X'_{ijg}\beta_2 + \psi_{ijg}, \quad (3)$$

where we follow the same notations as in equation (1). P is a dummy variable indicating whether students attend *Neulbom* schools or not. We predict the proportion of students utilizing the services offered by *Neulbom* schools with equation (2). Then, to estimate the parameter of interest, δ_{IV}, which captures the effect of Neulbom schools on compliers, we estimate equation (3) with the predicted value of P, $\hat{P}$.

We acknowledge that δ_{y1} or δ_{IV} may capture the effects of other events occurring in 2024 other than the introduction of Neulbom school on private tutoring expenses and maternal employment. To enhance the robustness of our analysis, we estimate the false effects of the *Neulbom* schools by using data from 2023 and compare those with the effects during 2024, using a difference-in-difference-in-difference (DDD) framework. In particular, we estimate the below equation (4):

$$Y_{ijg} = \alpha_3 + \beta_{31}TT + \beta_{32}TS + \beta_{33}TG + \gamma_{31}TT \times TS + \gamma_{32}TT \times TG + \gamma_{33}TS \times TG + \delta_{y2}TT \times TS \times TG + \varphi_{ijg}, \quad (4)$$

where we follow the same notations as in equation (1). *TT* is a dummy variable indicating the timing of the introduction of *Neulbom* schools. δ_{y2} captures the differences between the effect of *Neulbom* schools in 2024 and 2023.

2. Data Collection and Key Outcomes

We are collecting data through surveys for sampled students and parents to use detailed individual level information on education and employment in the first half of 2024 and 2023. Our research team, in collaboration with MOE, developed a survey instrument, and we summarize our main outcome variables above. These are categorized into five main areas: 1) employment, 2) education, 3) household finance, 4) life satisfaction, and 5) family. Note that we are collecting data for both 2023 and 2024 based on participants' recollections, enabling us to conduct robustness analysis and verify that the behaviors are consistent across students within the same school.