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Article — Published Version

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Journal of Population Economics

Provided in Cooperation with:

Springer Nature

Suggested Citation: Gangl, Selina; Huber, Martin (2025) : From homemakers to breadwinners? How mandatory kindergarten affects maternal labour market outcomes, Journal of Population Economics, ISSN 1432-1475, Springer, Berlin, Heidelberg, Vol. 38, Iss. 2, <https://doi.org/10.1007/s00148-025-01099-y>

This Version is available at:

<https://hdl.handle.net/10419/323700>

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From homemakers to breadwinners? How mandatory kindergarten affects maternal labour market outcomes

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Received: 18 October 2023 / Accepted: 26 March 2025 / Published online: 16 April 2025
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Abstract

The majority of Swiss children attend mandatory and cost-free kindergarten at age four. We examine the effect of this policy on maternal labour market outcomes. Using administrative data from Switzerland, we exploit the birthday cut-off for kindergarten entry in the same or in the following year and apply a non-parametric regression discontinuity design (RDD). We find that mandatory kindergarten has a statistically significant positive effect on the labour market attachment of previously non-employed mothers, increasing their employment probability by 4 percentage points. In contrast, there are no significant effects on other groups or in the total sample of mothers.

Keywords Mandatory kindergarten · Maternal employment · Regression discontinuity design

JEL Classification H40 · J13 · J18 · J21 · J22

1 Introduction

The labour force attachment of mothers has been receiving much attention in scientific and public discussions, given the large employment drops observed in many countries after giving birth (see, for instance, Kleven et al. (2019)). In OECD countries, the average maternal employment rate was 71% in 2019, with Iceland, Slovenia, and

Responsible editor: Kompal Sinha

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Sweden at the top with rates exceeding 85%.¹ In Switzerland, which is the country considered in this study, mothers' employment rate declines after childbirth (Herrmann and Murier 2016), but it remains high at almost 78%, on average.² Although this figure is higher than the OECD average, most of it is due to part-time work (63%), rather than full-time work (15%).³

A policy tool to encourage mothers' labour market outcomes is the provision of childcare. For example, Krapf et al. (2020) show that the opportunity to place the first child in childcare increases the maternal labour force participation in the canton Bern by 5.1 percentage points in the long term. In addition to the extensive margin, the birth of a child also affects the intensive margin of labour supply: mothers are more likely than women without children to work part-time (Herrmann and Murier 2016). The provision of childcare influences also mothers' working hours positively: An expansion of childcare facilities raises maternal part-time hours (Ravazzini 2018), while after-school care increases mothers' full-time employment (Felfe et al. 2016). Childcare availability may also increase maternal earnings, but not the earnings of the total household (Krapf et al. 2020). An unanswered question in this context is how mothers' labour market responses react when childcare is mandatory. While kindergarten for four-year-olds has always been cost-free, it has recently become mandatory in most Swiss cantons.

This paper examines the causal effect of mandatory kindergarten for four-year-old children on maternal labour behaviour and earnings in Switzerland. The aim of the policy, with regard to mothers, is to promote the compatibility of family and work. We exploit this novel setting and use the birthday cut-off to identify the causal effect of the mandatory kindergarten.

The paper uses a large administrative dataset about the population of mothers with four-year-old children living in Switzerland. We link the Population and Households Statistics (STATPOP) with data about the Old-Age and Survivors' Insurance (OASI). Moreover, we have collected data about the implementation year of the policy, the birthday cut-off dates per year, and the requirements regarding how many years of kindergarten must be offered. These data stem from the cantonal departments of education, the Swiss Conference of Cantonal Departments of Education (EDK), and the cantonal laws. The State Secretariat for Economic Affairs (SECO) provides information about the cantonal unemployment rate on their homepage. Again we link this cantonal information to the administrative data. We restrict the sample to mothers whose youngest child is four-year-old and who are living in a canton with mandatory kindergarten.⁴ Methodologically, we exploit the random assignment at the birthday cut-off for entering the kindergarten in the same year (= treatment) versus the following year (= control) and apply a Regression Discontinuity Design (RDD). Since parents may postpone the kindergarten entry of their child by one year and we cannot observe the actual kindergarten entry, we rather assess the intention-to-treat (ITT) effect than the average treatment effect (ATE) at the threshold.

¹ Reported by OECD. <https://www.oecd.org/els/family/database.htm>, retrieved 2021-08-24.

² Reported by OECD. <https://www.oecd.org/els/family/database.htm>, retrieved 2021-08-24.

³ Reported by OECD. <https://www.oecd.org/els/family/database.htm>, retrieved 2021-08-24.

⁴ See Sect. 4 Data for details.

We find that mandatory kindergarten boosts the labour market outcomes of previously non-employed mothers. In this subgroup, the probability of maternal employment increases by 4 percentage points on average across our outcome periods from 2010 to 2017 (statistically significant at the 5% level). Likewise, the annual income from dependent employment increases by 1030 CHF on average (statistically significant at the 10% level) and the probability of earning the income from dependent employment increases by 4 percentage points (statistically significant at the 5% level). Our results suggest that mandatory kindergarten has no significant effect on the labour market outcomes in the total sample of mothers. We argue that the high participation rate of mothers in the labour force, the half-day care in mandatory kindergarten, and the support of grandparents for childcare are likely reasons for this finding.

Our paper fits into the literature on school policies and its impact on the family (see, e.g. Landersø et al. (2020)). In particular, our paper belongs to a group of studies focusing on maternal labour market outcomes. For example, Gelbach (2002) investigates the effect of school enrolment and Barua (2014) analyses the variation in school entry laws on maternal labour supply in the U.S. Finseraas et al. (2017) examine a decrease in the school starting age from seven to six years on maternal labour supply in Norway. The common result of these studies is that the school entry of the child raises mothers' labour supply. In line with that, Zhu and Bradbury (2015) find that the birth of a child shortly after the birthday cut-off leads to a negative impact on mothers' labour supply.

Whereas the aforementioned studies focus on children who are starting school at age six or seven, our setting is unique because all four-year-olds are required to enter school, or in our case, mandatory kindergarten. Therefore, this paper contributes to the existing literature by examining the impetus for maternal reintegration into the workforce *two years earlier* due to mandatory kindergarten attendance of their child. This is particularly relevant because industrialised countries are currently facing labour shortages that are expected to increase due to an ageing population and might be mitigated by working mothers (European Commission 2023). Moreover, an earlier reintegration in the labour force might decrease the risk of poverty in old age that mothers face due to interrupted working lives (United Nations 2022).

This paper relates also to the family policy literature and its impact on maternal labour market behaviour (see, e.g. Kleven et al. (2020)). Childcare, specifically, may facilitate mothers' participation in the workforce. Hence, one strand of literature examines whether the introduction of subsidised childcare like in Austria (Kleven et al. 2020), Canada (Lefebvre and Merrigan 2008), Norway (Hardoy and Schøne, 2015), Sweden (Lundin et al. 2008), and the Netherlands (Bettendorf et al. 2015) impacts maternal employment. Further research analyses the expansion of childcare places as done in Spain (Nollenberger and Rodríguez-Planas 2015), Italy (Carta and Rizzica 2018), Germany (Geyer et al. 2015), and Norway (Kunze and Liu 2019; Eckhoff Andresen and Havnes 2019), or the provision of a legal entitlement to childcare, as in Germany (Bauernschuster and Schlotter 2015). Evaluations of these policies suggest a significantly positive effect on mothers' labour force participation, but only under the condition of a low labour force participation rate and a small extent of childcare prior to the reform. However, the availability of (subsidised) childcare can lead to a crowding out of private childcare, which may offset any increase in overall childcare

provision and, as a result, fail to improve maternal labour market outcomes (Havnes and Mogstad 2011). For this reason, Goux and Maurin (2010) find only an effect of childcare availability on maternal labour supply for the subgroup of single mothers in France.

While this literature analyses the impact of childcare on the labour market behaviour of a self-selected group of mothers who choose to enrol their children in childcare, it does not encompass the effect on *all mothers*. Our paper addresses this inquiry by examining whether mandatory kindergarten incentivizes all mothers to participate in the labour market and the resulting impact on their wages. This information seems to be crucial for policy makers seeking to promote maternal labour force participation.

The findings of our study align with those of Havnes and Mogstad (2011), Goux and Maurin (2010), and Lundin et al. (2008), indicating hardly no impact of childcare on maternal labour market outcomes. In comparison, Berlinski and Galiani (2007) and Lefebvre and Merrigan (2008) report significant positive effects. These divergent conclusions may partly stem from variations in the socio-economic settings of the studied countries. For instance, a high rate of maternal employment, such as that observed in Sweden, could elucidate the near-negligible effect of childcare policies Lundin et al. 2008. Similarly, in Switzerland, the focus of our study, where maternal employment rates hover around 80%, the presence of mandatory kindergarten shows only discernible effects on labour market outcomes of previously non-employed mothers. Another feature of the Swiss setting is that working parents mainly use the support of grandparents for childcare (Jacobs Foundation 2018). The insignificant impact of mandatory kindergarten on labour market response in the total sample of mothers could potentially be attributed to a crowding out effect of informal childcare, as suggested by Havnes and Mogstad (2011). Different policy designs may also explain the mixed results in the studies. For example, Lefebvre and Merrigan (2008) analyse the effect of full-time childcare and find significant and large effects. The mandatory kindergarten is only half-day care in most Swiss cantons, so mothers are often faced with the challenge of balancing their work around the limited kindergarten hours or finding another (costly) care option. This circumstance could be a possible explanation for the fact that mandatory kindergarten does not have a far-reaching impact on labour market outcomes in the total sample of mothers.

The remainder of this paper is organised as follows: In the next section, we provide information about the preschool policy in Switzerland. Thereafter, we present the data source, descriptive statistics, and define the sub-sample. Then, we discuss the empirical strategy. In the following section, we report the results and the robustness checks. Finally, we draw a conclusion from the empirical analysis.

2 Institutional background

This section provides an overview of the mandatory and cost-free kindergarten for four-year-old children in Switzerland. Education policy in Switzerland is decentralised, with each of the 26 cantons having autonomy over the quality and structure of education. This decentralisation leads to variations in aspects such as the school curriculum, the age of entry into kindergarten, and the number of school years (SWI 2006). Hence,

each canton decides about the implementation of the mandatory kindergarten. Table A.1 in the Online Appendix shows that Basel-Stadt was the first canton to introduce mandatory kindergarten for four-year-olds in 2005. In 2006, a national referendum about an educational reform took place, which was accepted by 86% of the voters. One year later, an inter-cantonal “HarmoS” concordat was established, 15 cantons entered into the concordat, while seven cantons rejected it and four cantons are still indecisive (as of 2019). The main goal of the concordat is to harmonise the mandatory school education among the cantons. This agreement also includes an age decrease for mandatory school attendance. All children turning four before the first of August must enter kindergarten (Schweizerische Konferenz der kantonalen Erziehungsdirektoren 2007). Therefore, other cantons followed Basel-Stadt and introduced mandatory kindergartens. But also in this case, neither the implementation year nor the shift of the birthday cut-off date is regulated on a central level, see Table A.1 in the Online Appendix for an overview.

In 2017, almost two-thirds of the cantons had enforced mandatory kindergarten attendance for four-year-olds.⁵ In these cantons, children who turn four before or on the cutoff date must enter kindergarten in the same year, while four-year-olds born after the cutoff date do not enter kindergarten until the following year. Table A.1 in the Online Appendix shows that these birthday cut-off dates vary from year to year and canton to canton and settle on 31.7. The reason for this shift is the joint decision by the cantons to determine a uniform cut-off date. Most cantons have decided to gradually shift the cut-off date so that the rush to kindergartens remains roughly the same during the transition period and does not increase particularly sharply in one year and overload the infrastructure.

The twofold aim of the mandatory kindergarten is to promote the development of children, but also to encourage the compatibility of family and work (Schweizerische Konferenz der kantonalen Erziehungsdirektoren 2014). In this paper, we focus on the latter and examine whether the obligation to attend kindergarten at the age of four affects mothers' work behaviour. Hence, the length of the mandatory kindergarten may be crucial for the maternal work decision. The kindergarten hours differ from canton to canton: At the lower bound is the canton Valais, where four-year-old children are supposed to attend 12 lessons per week,⁶ each lesson is 45 minutes, i.e. the children spend in sum 9 hours per week in the kindergarten. At the upper bound of kindergarten hours is the canton Ticino, where children attend the kindergarten on four days from the morning till the afternoon and an additional half-day. The mandatory kindergarten is part of early childhood education, which takes place prior to primary education (OECD 2015) and corresponds to level 0 in the International Standard Classification of Education (ISCED) (Eurydice 2016/17). In the German- and Italian-speaking parts of Switzerland, kindergarten is rather a separate institution, whereas in the French-speaking part, kindergarten is represented as two additional classes in primary school (Schweizerische Konferenz der kantonalen Erziehungsdirektoren 2016).

⁵ Aargau, Basel-Land, Basel-Stadt, Bern, Fribourg, Geneva, Glarus, Jura, Neuchâtel, St Gallen, Schaffhausen, Solothurn, Thurgau, Ticino, Vaud, Valais, and Zurich.

⁶ EDK Kantonsumfrage 2016/17.

Red-shirting behaviour of the parents, i.e. deferring a four-year-old child from kindergarten, is possible, but is associated with hurdles that vary from canton to canton. In some cantons, an application by the parents is sufficient, in other cantons a medical certificate is required which proves that the admission of a child to the kindergarten would not be reasonable even with other educational assistance.⁷

3 Hypotheses

As the literature review reveals, childcare reforms as well as a lower school starting age affect mothers' work behaviour. In the former case, a subsidy either reduces the financial burden or provides more childcare places. In the latter case, the effect comes from the obligation to attend school at a younger age. In contrast, we evaluate the impact of the mandatory kindergarten on mothers' work behaviour. Therefore, the analysis combines features from both literature strands: The kindergarten is an obligation and is free of charge like in the school starting age literature. On the other side, we evaluate a policy that affects children in the childcare age. This chapter presents the hypothesis and the possible channels.

We evaluate the effect of the mandatory kindergarten on maternal labour market behaviour within a specific age window: We compare mothers with slightly older children who were born prior to a specific birthday cut-off and are supposed to enter kindergarten in the same year (= treated) with mothers whose children are slightly younger, born after a specific birthday cut-off and who are supposed to enter kindergarten in the following year (= control).⁸ Mothers with a slightly younger child may spend their time by taking care of their child or must organise a (costly) childcare to allocate their time to work. Contrarily, mothers, whose child is supposed to enter kindergarten, can spend their time on other activities, for example, labour market participation. Consequently, a mother who would take care of her child in the absence of the reform can rearrange her time: Following the model of the allocation of time Becker (1965), the mother can spend more time in market work and/or leisure activities. Swart et al. (2019) find that mothers increase their labour supply after the school enrolment of their youngest child, given that they take care of their children prior to the school start. Therefore, we expect in our setting that only one subgroup of mothers increases their labour supply: Mothers whose children are supposed to enter kindergarten, but who would take care of them if no policy is implemented. All in all, we hypothesise a positive, but small effect because the effect is zero for mothers who would send their child to kindergarten anyway.

4 Data

Our evaluation strategy is a non-parametric regression discontinuity design (RDD) to examine the effect of the reform at the birthday cut-off for entering the kindergarten

⁷ <https://www.swissmom.ch/de/kind/kindergarten-und-schule/mit-4-jahren-schon-in-den-kindergarten-19063>.

⁸ One exception is the canton of Ticino that offers kindergarten for three-year-old children.

in the same versus in the following year. It relies on a large administrative dataset including the universe of mothers with four-year-old children living in Switzerland, the so-called Population and Households Statistics (STATPOP). We link the latter with data coming from the old-age and survivors' insurance (OASI) in Switzerland by a unique identifier. STATPOP provides information on the stock and structure of the Swiss resident population from 2010 to 2018. This enables us to examine the population of mothers whose youngest child is four-year-old and living in a canton with mandatory kindergarten. Furthermore, the data contain personal characteristics from the mother, their children, and the father of the four-year-old child. Two variables are central for our regression discontinuity approach (RDD): Firstly, the canton of residence to determine whether the four-year-old lives in a canton with mandatory kindergarten in the current year. Secondly, the exact date of the birth of the four-year-old determines whether a child was born prior (= treated) or after (= control) a specific birthday cut-off date. Additionally, other personal characteristics such as the marital status, country of birth, resident permit of the mother, father, and the children are also contained in the dataset.

The OASI data contain information about the income, unemployment benefits, disability indemnities for every insured person in Switzerland from 2010 to 2017. Based on these data, we calculated the "Income from work" as the total income minus transfer payments (for instance, unemployment insurance and welfare benefits) and minus other indemnities (like the compensation for military service) for the following subgroups: (i) employees whose employer resides in Switzerland, (ii) voluntary insured employees whose employer is not liable for contributions in Switzerland, and (iii) self-employed persons.⁹ Subsequently, we generated the variable "In labour force", which is 1 if a person earns income from work or if she receives unemployment benefits and 0 otherwise. We calculated the dummy "Out of labour force" as 1 minus the value of "In labour force". Furthermore, we constructed the dummy variable "Employed", which turns 1 if the person earns an income from work and participates in the labour market and is 0 otherwise. Vice versa, a person is indicated as "Unemployed" if she participates in the labour force but is not employed. The variable "Income from dependent employment" gives the sum of the income for mothers working in dependent employment, whereas the variable "Income from dependent employment (binary)" indicates whether a mother works in dependent employment. In the last step, we matched this database with cantonal information about the unemployment rates, the yearly birthday cut-off date of the mandatory kindergarten, and an indicator of whether a canton joined the "HarmoS" concordat. The "HarmoS" concordat is an association of some cantons to harmonise mandatory education like the uniform school entry age.¹⁰

The database contains a total of 687,749 mothers with at least one four-year-old child between 2010 and 2018. Since the last period in the OASI data is 2017, we drop the STATPOP observations from 2018 such that 606,434 observations remain. Another data restriction is based on the empirical literature, because childcare seems to not affect the mothers' labour market outcomes when there is a younger sibling of the four-year-old child in the household (see, for example, Berlinski and Galiani (2007),

⁹ excluding agriculture.

¹⁰ More information about the institutional background can be found in Online Appendix B.1.

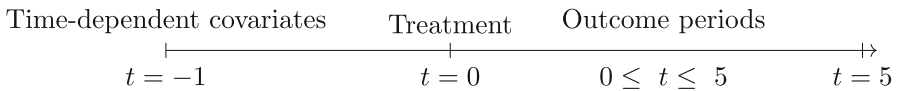


Fig. 1 Timeline of measured variables *Note:* The timeline shows the time points at which the variables were measured relative to the treatment

Fitzpatrick (2012), and Gelbach (2002)). We overcome this concern by restricting the subsample to mothers whose youngest child is four years old, which decreases the sample size to 360,234 mothers. Three cantons with mandatory kindergarten did not determine a birthday cut-off date, hence we exclude observations from Aargau, Fribourg prior to 2013, and all the municipalities of the canton Bern except the federal city of Bern, after that 289,728 observations are in the sample. Furthermore, we drop observations with negative income entries¹¹ in the OASI data and keep 289,631 observations. We exclude observations, which live in cantons without a mandatory kindergarten for four years old. Since two sources¹² reported two consecutive days as birthday cut-off dates in Basel-Stadt, we took the later cut-off date and excluded observations on the previous day from our analysis.¹³ Finally, 201,993 observations remain in our evaluation dataset.

Figure 1 provides a timeline for the measurement of the key variables in our analysis, with t denoting a specific year. The running variable will be henceforth denoted by D and depicts whether the child turns four prior ($D = 1$) or after the cut-off date ($D = 0$), measured in the baseline period ($t = 0$). The outcome periods start in the year the child turns four ($t = 0$) and end five years later ($t = 5$). Personal characteristics (e.g. number of children), are measured one year before the child turns four ($t = -1$).

We check the balance of labour market relevant covariates as suggested in Lee (2008), by running several RDD estimations where each covariate serves as an outcome. Table 1 reports the sample mean, the balance checks, and the relative number of missings for each variable at the threshold. Mothers', fathers', and cantonal covariates are generally well balanced, which points to a quasi-random assignment of mandatory kindergarten at the threshold. We also see from the table that mothers close to the threshold have on average 1.87 children, are predominately born in Switzerland, and live in a relationship. Furthermore, 73% of these mothers are employed, earn on average 32,760 Swiss francs (CHF) per year, which mainly stem from dependent employment. Fathers labour market characteristics show with 90% a very high employment rate, an annual mean gross income of 94,342 CHF, and 86% of this income comes from dependent employment. The cantonal characteristics reveal a rather low mean unemployment rate (3.6%) and a high probability of participating in the HarmoS concordat (94%).

Table 2 reports the balance checks for cantonal dummies at the threshold. Due to the different birthday cut-off dates in the German- and the French-speaking part of the canton Valais, we analyse Upper Valais and Central/Lower Valais separately.

¹¹ for example due to adjustment entries.

¹² see "Regierungsratsbeschluss betreffend Stichtag für die Einschulung für die Schuljahre 2011/12 bis 2015/16 (§56 Abs. 1 Schulgesetz)" and "EDK/IDES-Kantonsumfrage" for the years 2011 to 2016.

¹³ to run a Donut-RDD for this canton.

Table 1 Balance check: covariates

	Sample mean	Coefficient	Standard error	p-value	Relative number of missings in %
<i>Mother's characteristics:</i>					
Number of children	1.87	0.00	0.02	0.93	0.00
Born in Switzerland	0.52	0.00	0.01	0.99	2.76
<i>Nationality:</i>					
Resident permit B	0.11	-0.00	0.01	0.88	6.70
Resident permit C	0.26	0.01	0.01	0.59	6.70
Other resident	0.63	-0.00	0.01	0.99	6.70
<i>Age:</i>					
Age	35.62	0.01	0.14	0.92	6.70
<i>Relationship status:</i>					
In relationship	0.82	-0.01	0.01	0.24	6.70
Not in relationship	0.14	0.01	0.01	0.21	6.70
Terminated relationship	0.05	0.00	0.01	0.92	6.70
<i>Mother's labour market characteristics:</i>					
Out of labour force (binary)	0.26	0.01	0.01	0.67	5.90
Employed (binary)	0.73	0.00	0.01	0.72	5.90
Unemployed (binary)	0.01	0.00	0.00	0.75	5.90
Total income from work (in CHF)	32,760.09	-1345.75	944.46	0.15	5.90
Income from dependent employment (binary)	0.70	-0.01	0.01	0.53	5.90
Income from dependent employment (in CHF)	31,204.52	447.98	1066.99	0.68	5.90
<i>Father's labour market characteristics:</i>					
Out of labour force (binary)	0.09	0.00	0.01	0.86	5.90
Employed (binary)	0.90	0.00	0.01	0.84	5.90
Unemployed (binary)	0.01	0.00	0.00	0.97	5.90
Total income from work (in CHF)	94,342.30	-440.71	2505.84	0.86	5.90
Income from dependent employment (binary)	0.86	0.01	0.01	0.49	5.90
Income from dependent employment (in CHF)	88,951.52	-35.00	2584.53	0.99	5.90
<i>Cantonal characteristics:</i>					
HarmoS member	0.94	0.00	0.01	0.98	0.00
Unemployment rate	3.55	0.04	0.03	0.25	0.00

Note: The table presents the balance check of the labour market relevant covariates as suggested in Lee (2008). The data comes from STATPOP (2010–2017) and OASI (2010–2017), the calculations are done by the authors. Income is deflated, the base year is 2011. The official currency in Switzerland is the Swiss Franc (CHF), which had an average exchange rate of 1.04 USD/CHF in the last decade. Residence permit B allows foreign nationals in Switzerland for specific purposes with a five-year validity, while Residence permit C grants unrestricted residency after five or ten years of lawful stay, with specific agreements for citizens of certain EU/EFTA countries

Table 2 Balance check: cantonal dummies

	Sample mean	Coefficient	Standard error	<i>p</i> -value
Basel-Stadt	0.04	−0.00	0.01	0.60
St Gallen	0.10	−0.01	0.01	0.59
Thurgau	0.06	−0.00	0.01	0.98
Zurich	0.32	0.00	0.02	0.81
Fribourg	0.05	−0.00	0.01	0.80
Geneva	0.10	0.01	0.01	0.16
Glarus	0.01	−0.00	0.00	0.60
Neuchâtel	0.04	0.00	0.01	0.76
Basel-Land	0.05	−0.02	0.01	0.01
Jura	0.01	−0.00	0.00	0.40
Solothurn	0.04	−0.01	0.01	0.30
Bern	0.02	0.00	0.00	0.87
Vaud	0.12	0.00	0.01	0.67
Schaffhausen	0.01	0.00	0.00	0.11
Ticino	0.03	0.01	0.00	0.00
Upper Valais	0.01	0.00	0.00	0.91
Central and Lower Valais	0.02	−0.01	0.01	0.37

Note: The table presents the balance check of the cantonal dummies as suggested in Lee (2008). The data comes from STATPOP (2010–2017) and OASI (2010–2017), the calculations are done by the authors

In most cases, our tests do not reject the null hypothesis that the cantonal dummies are balanced around the birthday cut-off, with the two exceptions of Basel-Land and Ticino.¹⁴ For visualisation, Figures A.1 to A.5 in the Online Appendix provide plots of the conditional mean of each of the baseline covariates against the running variable.

Table 3 provides the mean outcomes per period for the whole sample and reveals that the outcome means are rather stable over time. In period 0, on average 76% of mothers work in the labour market and almost all of them are employed. They earn an average gross annual income of 33,902 CHF, with the largest part (32,353 CHF) stemming from dependent employment. Figure A.6 in the Online Appendix plots the conditional mean of each outcome, which is pooled over the outcome periods, against the running variable (difference between the cut-off date and the birth date of the child) when controlling for baseline covariates.

5 Econometric approach

We use an RDD for evaluating the effect of mandatory kindergarten on mothers' labour market outcomes. The setting of our paper implies an RDD, because of the following rule of the treatment (*D*): All children who turn four prior to or exactly at the cut-off are supposed to enter kindergarten in the current year ($D = 1$), whereas children who turn four after the cut-off are supposed to enter kindergarten in the

¹⁴ Ticino is the only canton implementing mandatory kindergarten offer for three-year-old children.

Table 3 Mean outcomes per period

	Mean					
	Period 0	Period 1	Period 2	Period 3	Period 4	Period 5
Out of labour force (binary)	0.24	0.23	0.23	0.22	0.22	0.23
Employed (binary)	0.75	0.76	0.76	0.77	0.77	0.76
Unemployed (binary)	0.01	0.01	0.01	0.01	0.01	0.01
Annual work income (in CHF)	33,902.41	34,490.92	35,035.26	35,681.94	36,080.12	35,992.51
Income from dependent employment (binary)	0.72	0.73	0.73	0.74	0.74	0.74
Income from dependent employment (in CHF)	32,353.25	32,879.31	33,407.43	34,080.92	34,553.32	34,750.57

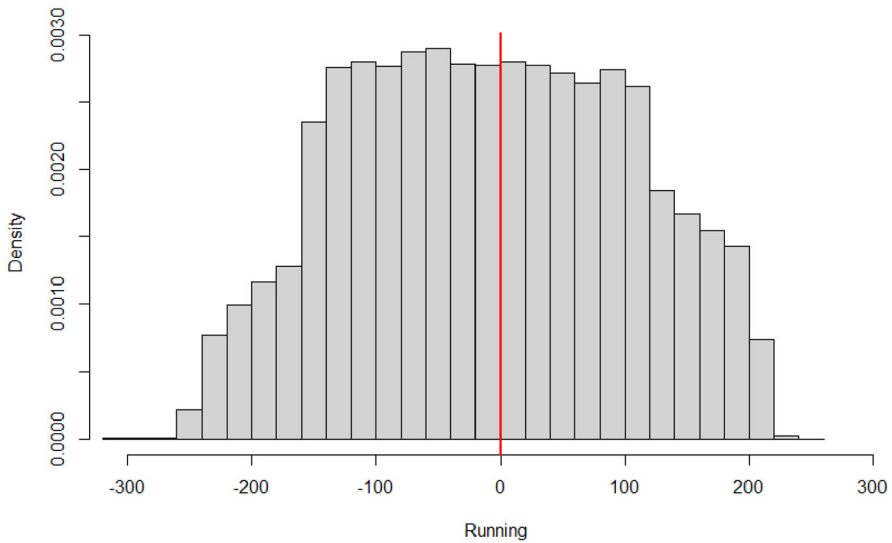
Note: The table presents the mean outcomes from period 0 to 5. The data comes from STATPOP (2010–2017) and OASI (2010–2017), the calculations are done by the authors. Income is deflated, the base year is 2011

following year ($D = 0$). In this case, we identify the average treatment effect (ATE) at the threshold (see Lee and Lemieux (2010)), i.e. among mothers, whose children are born at the cut-off. Due to this rule, it is not possible to observe children born on the same day, simultaneously in the treatment and control group. To make the treatment and control group as comparable as possible in terms of covariates, we analyse only those observations within a specific bandwidth around the cut-off date.

One concern of identifying the ATE at the cut-off in our setting is the so-called “red shirting behaviour”, i.e. parents postpone the kindergarten entrance of their children by one year. Since there is no micro-data about kindergarten attendance in Switzerland, we can neither evaluate whether red shirting takes place nor instrument the kindergarten attendance (see, for example, Hahn et al. (2001)) if this is the case. Therefore, we can only identify the intention-to-treat-effect (ITT) in our setting.

The identification of the effect relies on the assumption that the potential outcomes must be continuous around the cut-off (Hahn et al. 2001). This assumption implies the comparability of mothers in their characteristics on both sides of the cut-off. In our setting, the assumption holds if the difference between the cut-off date and children’s birth date is as good as randomly assigned at the cut-off. In other words, the continuity assumption is fulfilled if parents cannot precisely sort their children in the treatment or the control group and is violated otherwise.

In our case, the running variable specifies the difference between the birth date of the child and the cut-off date and is therefore a discrete value. A standard test for checking the plausibility of the continuity of the potential outcomes at the cut-off is the McCrary test which analyses the continuity of density of the running variable at the cut-off. A discontinuity of the density at the cut-off would point to selective sorting (also known as bunching) and, therefore, likely violate the continuity of potential outcomes. This test works well if the running variable is continuous, yet it is in general inconsistent when the running variable is discrete. For this reason, we use Frandsen’s test instead, which delivers a consistent result even in the presence of a discrete running variable. Frandsen’s test uses only data points, which are exactly at or adjoining to the threshold, whereas the McCrary Test extrapolates in areas away from the threshold, which leads to inconsistency if the running variable is discrete (Frandsen 2017).



Manipulation test ($k = 0$) p -value = 0.34

Manipulation test ($k = 0.1$) p -value = 1.00

Manipulation test ($k = 0.2$) p -value = 1.00

Fig. 2 Density plot of running variable and Frandsen’s manipulation test *Note:* The figure presents the density plot of the running variable and the Frandsen’s test for the non-sorting assumption at the birthday cut-off. The running variable is defined as the difference between the birthday cut-off date and children’s birth date. K corresponds to the self-defined maximum of the probability mass function (pmf) curve which is still considered as “non-sorting” (see Frandsen (2017)). Data stems from STATPOP (2010–2017) and OASI (2010–2017), calculations are done by the authors

The upper part of Fig. 2 depicts the density plot of the running variable. Since the density below and above the birthday cut-off (depicted as red line) is very similar, it does not point to sorting behaviour. To analyse manipulation more precisely, the lower part of Fig. 2 reports the results of Frandsen’s test, where K corresponds to our self-defined maximum of the probability mass function (pmf) curve which is still considered as “non-sorting” (see Frandsen (2017)). K must at least equal zero, meaning that a non-linearity is not allowed in the pmf (Frandsen 2017), which represents our first specification. Furthermore, to allow for a non-linearity, K equals 0.1 and 0.2, as robustness tests in the following two specifications. The associated p -value indicates whether there is a statistical difference in the pmf of both sides of the threshold. Figure 2 indicates no significant deviation from the expected density of the running variable, regardless of the specification of K . In short, we do not find any sorting behaviour around the birthday cut-off, pointing to a as good as randomised treatment.

If the continuity assumption holds, the ATE (or in our case the ITT) at the threshold is non-parametrically identified given the bandwidth approaches zero (see Hahn et al. (2001)). Equation 5.1 presents the identification result, where γ gives the parameter of interest, Y_d denotes the potential outcome (e.g. hypothetical employment) under

treatment status $d \in \{1, 0\}$, R the running variable, and r the cut-off value ($r = 0$).

$$\gamma = E[Y_1 - Y_0 | R = r] \quad (5.1)$$

We use the following local linear regression to estimate the parameter of interest within a specific data window around the cut-off of the running variable:

$$Y_i = \alpha + \beta_0 D_i + \beta_1 R_i + \beta_2 R_i * D_i + \beta_3 Z_i + \epsilon_i \quad (5.2)$$

Y_i denotes the outcome (e.g. labour force status), D_i represents the treatment status, and R_i the running variable centered around the cut-off ($=0$) of individual i . β_0 is the average treatment effect of the mandatory kindergarten on mother's labour market behaviour at the threshold and β_1 and β_2 give the average effect of the running variable on the outcome. Z_i is a vector of additional covariates for individual i .¹⁵ We control for covariates to get lower standard errors, which is possible because the covariates (e.g. maternal total income one year earlier) are good predictors of the outcomes (e.g. maternal total income one year later). For the estimation, we use the "rdrobust" command from the eponymous package for the statistical software R (Calonico et al. 2021), with a uniform kernel function and a heteroskedasticity-robust plug-in residuals variance estimator without weights. As recommended by Gelman and Imbens (2019), we estimate a local linear regression ($p = 1$) and use a local quadratic regression ($q = 2$) to perform bias-correction. The bandwidth h is computed in a data-driven way by using a MSE-optimal bandwidth (companion command "rdbwselect").

6 Results

This chapter provides the estimated results as well as the robustness checks. At first, we present the ITT when pooling the outcome periods, then the effects over the years, and finally the heterogeneous effects for different subgroups. Since we use an RDD approach, all effects are measured at the cut-off.

6.1 Average effects

Table 4 reports the ITT estimates at the cut-off for pooled outcome periods when including covariates and corresponding missing dummies. It suggests the sample mean of the outcome (not only at the threshold), the effects along with clustered standard errors at the individual level and p -values, the bandwidth size, the number of observations in the bandwidth. We do not find statistically significant effects of mandatory kindergarten on maternal labour market outcomes in the total sample.¹⁶

One potential explanation for the lack of impact on maternal labour supply might be that mandatory kindergarten crowds out informal childcare arrangements. In Switzerland, it is common for working parents to rely on the support of grandparents for the

¹⁵ We include all covariates listed in Tables 1 and 2.

¹⁶ With only a 1.5% rate of inter-cantonal movement in 2022 (Federal Statistical Office 2022), the minimal migration between cantons suggests a negligible impact on the RDD estimates.

Table 4 RDD: empirical results with covariates

	Sample mean	Coefficient	Standard error	<i>p</i> -value	Bandwidth	Observations within bandwidth
Out of labour force (binary)	0.23	-0.00	0.01	0.60	72.11	297,628
Employed (binary)	0.76	0.01	0.01	0.45	70.52	289,613
Unemployed (binary)	0.01	-0.00	0.00	0.16	52.99	214,832
Annual work income (in CHF)	34,860.92	591.87	756.10	0.43	52.11	214,832
Income dependent employment (binary)	0.73	0.01	0.01	0.29	67.27	277,425
Annual income from dependent employment (in CHF)	33,075.03	-52.90	594.99	0.93	69.82	285,555

Note: This table reports the local linear estimates of Eq. 5.2. The following control variables are included: Number of children, born in Switzerland, resident permit, age, relationship status, labour market characteristics of the mother and the father of the four-year-old child, cantonal characteristics, and dummies. Bandwidth shows the MSE-optimal bandwidth chosen by (Calonico et al. 2021). The standard errors are clustered at the individual level. Data stems from STATPOP (2010–2017) and OASI (2010–2017); calculations are done by the authors. Income is deflated, the base year is 2011. The official currency in Switzerland is the Swiss Franc (CHF), which had an average exchange rate of 1.04 USD/CHF in the last decade. Number of observations in total: 735,520. The number of observations within the specified bandwidth is displayed in the corresponding column

care of their children (Jacobs Foundation 2018). The mandatory kindergarten may have reduced the necessity of informal childcare options, but this did not affect the overall impact on mothers' labour supply. The effect of mandatory kindergarten might be also diminished by the presence of formal childcare services. However, daycare in Switzerland is known to be expensive compared to other countries (Stern and Felfe 2015), and there is a substantial demand surplus for childcare places (Bundesamt für Sozialversicherungen 2006). These factors contribute to a lower daycare attendance rate, with only 36% of children under the age of four currently attending daycare (Jacobs Foundation 2018). Finally, the labour force supply of mothers in Switzerland is already high, which might also explain the lack of a sensible effect of mandatory kindergarten on maternal labour market participation in the total sample of mothers. This finding is in line with other studies that have found either no effect or only a modest effect of childcare on maternal employment in the context of high maternal labor force participation (see, e.g. Lundin et al. (2008) and Havnes and Mogstad (2011)).

An important factor to consider when examining the lack of impact on maternal income is the limited flexibility provided by half-day mandatory kindergarten. With the majority of cantons offering half-day care, mothers are often faced with the challenge of balancing their work schedules around the limited hours of kindergarten. This constraint can significantly hinder their ability to pursue full-time employment opportunities. Furthermore, the reliance on alternative childcare arrangements for the rest of the day, such as private daycare, can come at an additional cost to mothers. These expenses, combined with the logistical challenges of coordinating multiple care providers, can create financial and logistical burdens that further discourage mothers from pursuing full-time employment. Therefore, the lack of access to full-day care following mandatory half-day kindergarten not only restricts the hours available for maternal employment but also introduces financial and logistical barriers that impede the potential increase in maternal income.

We check the robustness of our ITT effects by estimating the RDD approach without covariates (Table A.2 in the Online Appendix) and find rather similar point estimates, yet the precision decreases. Another check consists of varying the optimal bandwidth, we multiplied this by 1.5 and 2/3 (Tables A.3 and A.4 in the Online Appendix). Our findings indicate that the effect sizes remain relatively stable, with the exception of the effects on "Annual income from dependent employment", as shown in Tables A.3 and A.4 in the Online Appendix, and "Annual work income" as presented in Table A.4 in the same Appendix.

6.2 Effects over years

In the next step, we analyse the effects in separate and consecutive outcome periods, relative to the year the child turns four. Figure 3 shows the results of the different outcomes, starting in period 0 (i.e. the year the child turns four) and ending in period 5. The dots depict the ITT at the cut-off and the bands represent the point-wise 95% confidence intervals based on robust standard errors. We do not find any statistically significant effect for the outcomes in comparison to the pooled estimates. This might be caused by lower power due to a decrease in the number of observations. Moreover, we find unstable point estimates, both the sign and the effect size change over periods.

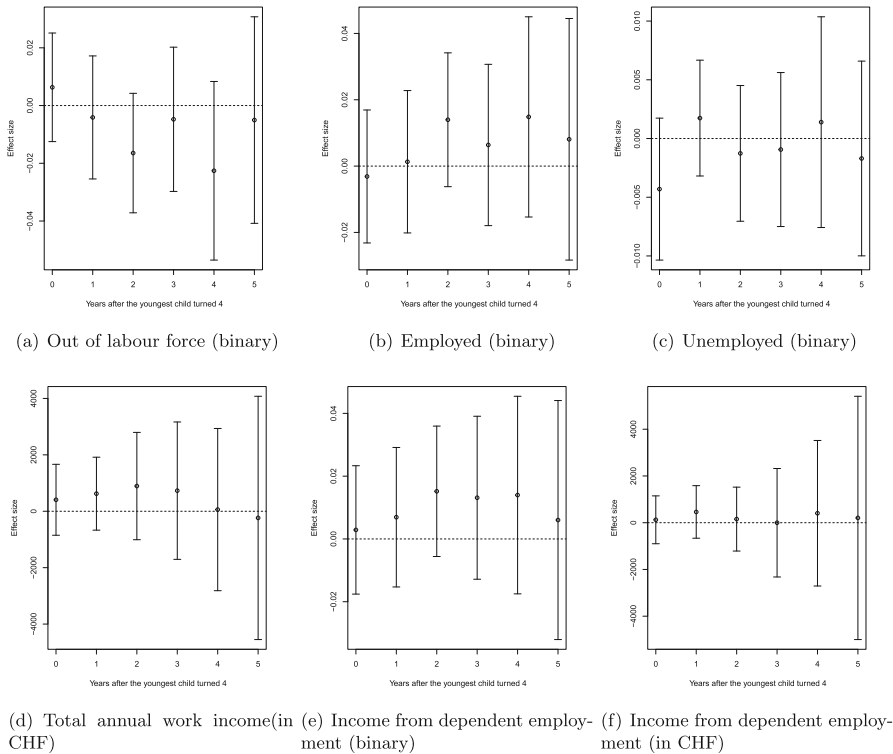


Fig. 3 RDD: Effects over years with covariates *Note:* This figure shows the effect of mandatory kindergarten on each outcome variable separately and over time. Dots represent ITTs at the threshold, bands correspond to 95% confidence intervals. The following control variables are included: Number of children, born in Switzerland, resident permit, age, relationship status, labour market characteristics of the mother and the father of the four-year-old child, cantonal characteristics, and dummies. Data stems from STATPOP (2010–2017) and OASI (2010–2017), calculations are done by the authors. Income is deflated, the base year is 2011. The official currency in Switzerland is the Swiss Franc (CHF), which had an average exchange rate of 1.04 USD/CHF in the last decade

The plots reveal further that the effects are, especially in the later periods, imprecisely estimated because of the decrease in the number of observations. Figure A.7 in the Online Appendix depicts the plots without covariates and shows similar results in terms of significance, point estimates, and precision.

6.3 Heterogeneous effects

From a policy perspective, it is interesting to know whether the effect of mandatory kindergarten differs for specific subgroups. Non-employed mothers may react differently to the kindergarten policy than employed mothers. Therefore, we split the sample according to the maternal labour force status one year before the youngest child turns four.

First, we start with the presentation of the tests for the RDD assumptions. Tables A.5 and A.6 in the Online Appendix show, similar as for the entire sample in Table 1, that the labour market relevant covariates are balanced for both sub-samples. Analogous to the balance checks for cantonal dummies of the entire sample in Table 2, we conclude from Tables A.7 and A.8 that in most cases, our tests do not reject the null hypothesis that the cantonal dummies are balanced around the birthday cut-off. In contrast to the result of the entire sample in Fig. 2, the results of the Frandsen's test in Figs. A.9 and A.10 in the Online Appendix suggests evidence for manipulation at the cut-off if we assume that the distribution around the cut-off must be precisely linear ($k = 0$), but does not point to manipulation if we allow for non-linearities ($k = 0.1$ and $k = 0.2$). We follow the argumentation of Oosterbeek et al. (2021), which states that the RDD becomes invalidated by manipulation only if there exist systematic disparities between mothers on either side of the birthday cut-off. However, Tables A.5 and A.6 in the Online Appendix reveal no discernible association between being born slightly after versus before the birthday cut-off and the predetermined covariates.

Second, we report the estimation results. Table 5 represents the results for employed mothers, whereas Table 6 reports the effects for non-employed mothers. The results suggest that the effect is driven by non-employed mothers who start working when their youngest, one-year-old child is required to attend kindergarten. Three effects in Table 6 remain statistically significant at the 10% level after applying the Benjamini-Hochberg procedure.¹⁷ To further validate the robustness of our findings, we conduct an RDD with a fake cut-off set 30 days earlier than the actual threshold, and the results in Table A.9 in the Online Appendix indicate that the effects are insignificant.

Additionally, we employ a Donut-RDD approach in Table A.10 in the Online Appendix, which excludes observations with running variables close to the cut-off (values between -2 and 1). The results obtained under this design confirm that all estimated effects maintain the same direction as in the main analysis. However, the statistical significance of the effects is generally reduced. Specifically, only the effects on employment, out of the labour force, and income-dependent employment exhibit p -values close to 10%, while the remaining effects show p -values that are considerably beyond any conventional levels of statistical significance.

Third, we provide numbers on the effect of the kindergarten policy on reducing the labour shortage. As shown in Table 6, the effect of mandatory kindergarten on employment is an increase of 4 percentage points for the subgroup of previously non-employed mothers. If we extrapolate this local effect to all 179,895 non-employed mothers with four-year-olds in our sample, mandatory kindergarten results in 7196 additional employed mothers. When this number is compared to the total number of employees in Switzerland in the first quarter of 2010¹⁸ it corresponds to an increase in aggregate employment of 0.002 percentage points. Comparing these 7196 additional employed mothers to the job vacancies in Switzerland in the first quarter of 2010¹⁹ we

¹⁷ We inspect also the heterogeneous effects for older versus younger mothers as well as divorced mothers and do not find statistically significant effects.

¹⁸ 4,530,917; Federal Statistical Office: <https://www.bfs.admin.ch/bfs/en/home/statistics/industry-services/businesses-employment/jobs-statistics/jobs.assetdetail.32008419.html>,

¹⁹ 51,162; Federal Statistical Office: <https://www.bfs.admin.ch/bfs/en/home/statistics/industry-services/businesses-employment/jobs-statistics/vacancies.assetdetail.32008426.html>,

Table 5 RDD: heterogeneous effects: employed mothers

	Sample mean	Coefficient	Standard error	<i>p</i> -value	Bandwidth	Observations within bandwidth
Out of labour force (binary)	0.06	0.00	0.01	0.58	67.03	183,521
Employed (binary)	0.93	-0.00	0.01	0.72	67.66	183,521
Unemployed (binary)	0.01	-0.00	0.00	0.54	51.19	138,858
Annual work income (in CHF)	46,460.42	-531.87	698.65	0.45	72.22	196,930
Income dependent employment (binary)	0.90	0.00	0.01	0.96	61.60	167,217
Annual income from dependent employment (in CHF)	44,347.23	-606.55	650.57	0.35	62.65	170,025

Note: This table reports the local linear estimates of Eq. 5.2 only for previously employed mothers. Bandwidth shows the MSE-optimal bandwidth chosen by (Calonico et al. 2021). The following control variables are included: Number of children, born in Switzerland, resident permit, age, relationship status, labour market characteristics of the mother and the father of the 4-year-old child, cantonal characteristics, and dummies. The standard errors are clustered at the individual level. Data stems from STATPOP (2010–2017) and OASI (2010–2017); calculations are done by the authors. Income is deflated, the base year is 2011. The official currency in Switzerland is the Swiss Franc (CHF), which had an average exchange rate of 1.04 USD/CHF in the last decade. Number of observations in total: 484,153

Table 6 RDD: heterogeneous effects: non-employed mothers

	Sample mean	Coefficient	Standard error	<i>p</i> -value	Bandwidth	Observations within bandwidth
Out of labour force (binary)	0.70	-0.04	0.02	0.05	59.46	59,463
Employed (binary)	0.30	0.04	0.02	0.04	58.26	58,459
Unemployed (binary)	0.01	-0.00	0.00	0.39	59.39	59,463
Annual work income (in CHF)	5582.01	936.74	652.42	0.15	55.40	55,452
Income dependent employment (binary)	0.28	0.04	0.02	0.03	57.77	57,634
Annual income from dependent employment (in CHF)	4789.60	1030.41	596.34	0.08	54.96	54,394

Note: This table reports the local linear estimates of Eq. 5.2 only for previously non-employed mothers. Bandwidth shows the MSE-optimal bandwidth chosen by (Calonico et al. 2021). The following control variables are included: Number of children, born in Switzerland, resident permit, age, relationship status, labour market characteristics of the mother and the father of the 4-year-old child, cantonal characteristics, and dummies. The standard errors are clustered at the individual level. Data stems from STATPOP (2010–2017) and OASI (2010–2017), calculations are done by the authors. Income is deflated, the base year is 2011. The official currency in Switzerland is the Swiss Franc (CHF), which had an average exchange rate of 1.04 USD/CHF in the last decade. Number of observations in total: 179,895

see a reduction in vacant positions of 0.14 percentage points. We assume that the effects can be extrapolated. Therefore, it should be noted that this is only an approximation subject to errors. It's also worth noting that the administrative dataset lacks information on working hours or whether mothers work full- or part-time, making it impossible to calculate the employment increase in full-time equivalents.

Additionally, we exploit the spatial variation and the staggered implementation of the mandatory kindergarten in a Difference-in-Differences Approach. The description of the data, method, and results are presented in the Online Appendix. We find that labour market participation, employment, and the part-time rate of mothers increase because of mandatory kindergarten. However, the precision of these results is low due to a small sample size.

7 Conclusion

This paper analyses the impact of mandatory and cost-free kindergarten for four-year-old children on maternal labour market behaviour using Swiss administrative data. Our identification strategy exploits birthday cut-off dates as random assignment of the mandatory kindergarten and compares labour market responses for mothers whose children enter kindergarten in the current year versus the following year. We apply a non-parametric regression discontinuity design (RDD) and find statistically significant effects on the employment and earnings of previously non-employed mothers, but not of the total sample of mothers.

Our findings contribute to the literature on childcare and school entry by analysing the mandatory and free of charge kindergarten. Current literature suggests that attending childcare or school affects maternal labour force participation positively in countries with low maternal labour force participation and low childcare attendance rate (see, e.g. Nollenberger and Rodríguez-Planas (2015) or Bauernschuster and Schlotter (2015)). In Switzerland, maternal labour force participation exceeds the OECD average. Our study's result that mandatory kindergarten only sensibly affects labour market decisions of previously non-employed mothers, but not of other groups, is in line with no or only modest effects of childcare on maternal employment found in countries with a high maternal labour force participation (see, e.g. Lundin et al. (2008) and Havnes and Mogstad (2011)).

Furthermore, working parents mainly use the support of grandparents for childcare in Switzerland (Jacobs Foundation 2018). The insignificant impact of mandatory kindergarten on labour market response in the total sample of mothers might also be explained by a crowding out effect of informal childcare (see, e.g. Havnes and Mogstad (2011)). Since mandatory kindergarten is half-day care in most cantons, mothers are often faced with the challenge of balancing their work around the limited kindergarten hours or finding another (costly) care option. This circumstance might potentially account for the absence of a widespread impact of mandatory kindergarten on the earnings in the total sample of mothers. For future research, it would be interesting

to examine whether a mandatory full-day kindergarten impacts maternal labour force participation and earnings.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00148-025-01099-y>.

Acknowledgements We thank the editor, Kompal Sinha, and three anonymous referees for helpful comments and suggestions. The study has been realised using the data from the Federal Statistical Office (FSO) and the Central Compensation Office (CCO). We are grateful for the data provision as well as the linking and anonymizing of the data conducted by the FOS. Furthermore, we thank Maryna Ivets, Laura Ravazzini, Regina T. Riphahn, Jürg Schweri, and Andreas Steinmayr for their helpful suggestions on a prior version of this paper. We have benefited from comments by seminar participants in Fribourg, the Ski & Labour Seminar in Engelberg-Titlis, the 9th ifo Dresden Workshop on Labour Economics and Social Policy, the 10th International Conference of Panel Data Users in Switzerland in Lausanne, the Swiss Society of Economics and Statistics Annual Meeting in Geneva, the EEA in Manchester, the 3rd International BFH Conference on Discrimination in the Labor Market in Bern, the Verein für Socialpolitik - Annual Conference 2019, the 1st and 4th Workshop of the Swiss Network on Public Economics (SNOPE), and the Lunch-time Meeting at the University of Innsbruck 2021, COMPIE 2022, European Association of Labour Economists (EALE) 2024, 37th Annual Conference of the European Society for Population Economics (ESPE), Workshop on Labour Economics 2024, Trier, Germany and the Pre- and Postdoc Seminar at the Friedrich-Alexander-University Erlangen-Nürnberg.

Funding Open Access funding enabled and organized by Projekt DEAL.

Data availability This paper uses confidential data from the Federal Statistical Office (FSO) and Old-Age and Survivor's Insurance (OASI) in Switzerland. The data can be obtained by filing a request directly with the FSO (<https://www.bfs.admin.ch/bfs/de/home/dienstleistungen/datenverknuepfungen/fuer-dritte.html>).

Declarations

Conflict of interest The authors declare no competing interests.

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