

Investigating the Association Between Preschool Participation and Female Employment in Sweden

A panel data study of municipalities in Sweden with focus on foreign-born and low-income households



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Abstract

Women's labour force participation has historically been impeded by their traditional role of taking care of children, a problem that has been reduced with the emergence of formal daycare. However, one problem that remains is that many children in Sweden still do not participate in preschool. Among these children, there is an overrepresentation of foreign-born children and children from low-income households. This study investigates if there is a general association between preschool participation and female employment. We use panel data on municipalities in Sweden, spanning from 2005 to 2019. A fixed effects model with time dummies is applied to account for some unobserved factors. We find a small positive association between preschool participation and female employment. Moreover, we investigate if the association is different for municipalities with high shares of foreign-born women and low-income households by including interaction variables in the model. The results show that the association is weaker for municipalities with high shares of foreign-born women. No similar difference is found for municipalities with high shares of low-income households.

Keywords: Preschool participation, Female employment, Foreign-born women, Low-income households, Panel data, Fixed effects, Interaction variables.

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1 Introduction

Since the beginning of the 21st century, a consensus has emerged among researchers underlining the positive effect of reducing cost for preschool to promote female employment, equality and children's development (Andersson & Levine 1999; Baker, Gruber & Milligan 2008; White 2001; Baum 2002). Sweden was early to implement price reforms that subsidized preschool costs (Svensson 2008), reforms that other countries then have copied (Seibel & Fage Hedegaard 2017). Still, in 2019 Statistics Sweden (SCB) reported that 23 000 children in Sweden aged 3 to 5 do not participate in preschool. In 2018, the share of children aged 1 to 5 participating in preschool was 84.7 percent (Kolada 2021) and 1.7 percent participated in other forms of formal daycare (Swedish National Agency for Education 2018). This indicates that a large share of these 23 000 children is taken care of by parents. From an economic perspective, these parents can be seen as an unutilized resource to the labour supply.

Within every society, there is a constant strive to achieve higher employment to attain economic growth. It is therefore of interest to Swedish policymakers to reach this potential unutilized labour supply, in order to increase the labour force participation. As women traditionally have had the role of taking care of children (Stanfors 2017), this unutilized resource will most likely be overrepresented by women. Investigating whether preschool participation is associated with female employment would thus gain policymakers, as it could indicate that increasing preschool enrolment could lead to higher female employment.

Among the 23 000 children not enrolled in preschool, SCB (2019) reports that there is a disproportionate representation of foreign-born children, children from low-income households and children with parents of low education. They note that 20 percent are foreign-born, which should be seen in contrast to the whole population of children aged 3 to 5 where only 7 percent are foreign-born. Children from low-income households constitute 18 percent of the 23 000 children, while they only constitute 8 percent of the whole population (SCB 2019). Children with parents of low education show a smaller disproportion (10 % compared to 6 %, SCB 2019), indicating that the first two groups are most overrepresented among children not enrolled in preschool. Previous studies show that children in these groups participate in preschool to a lesser extent mainly due to differences in attitudes and the mother's education (Kesler 2020; Crosnoe, Purtell, Davis-Kean, Ansari & Benner 2016).

The share of foreign-born citizens and low-income households in Sweden has grown in recent years. Sweden has experienced a large inflow of immigration during the 21st century (SCB 2021a) which has increased the share of foreign-born families in the population (SCB 2021b). In addition, the share of people with low incomes in Sweden

has grown from 9.3 percent in the year 2000 to 15.1 percent in 2019 (SCB 2021c). At the same time, the Gini-coefficient has increased from 0.25 in 2003 to 0.3 in 2018 (World Bank), indicating an increase in income inequality. These trends point towards a potential future increase in children not participating in preschool, which possibly could have a negative impact on female employment. It is therefore relevant to focus on low-income households and foreign-born families when analysing the association, as it is interesting to see if the relationship between preschool participation and female employment differs for these groups.

This study aims to investigate if preschool participation is associated with female employment and whether this association differs for foreign-born households and low-income households. The literature regarding this relationship is scarce in a Swedish context and with this study, we aim to contribute to this research field by incorporating foreign-born and low-income households. Hence, the question of interest is:

Is preschool participation associated with female employment in Sweden? If so, does the association differ for municipalities with high shares of low-income households and foreign-born households?

In order to answer the question of interest, a regression analysis with municipality-fixed and time-fixed effects has been applied, analysing panel data for 290 municipalities in Sweden spanning from 2005 to 2019. Interaction variables are used to capture the potential impact of foreign-born and low-income households.

There are many topics related to the relationship between preschools and female employment, but not falling within the scope of this study. First, the topic concerning costs of preschool is not investigated since this does not apply to Sweden, where costs are aligned with the parents' income and are deemed relatively low¹. Second, the topic of women's wages and its relationship with female employment and preschool participation has not been covered due to time limits. Lastly, preschool participation is found to have a positive effect on children's development (e.g Currie 2001; Esping-Andersen, Garfinkel, Han, Magnuson, Wagner & Waldfogel 2012). However, this topic is not covered in this study.

The outline of the study is as follows. Chapter 2 describes earlier research on the subject. Chapter 3 defines the theoretical framework. Chapter 4 provides necessary information regarding the Swedish preschool system and female employment. Chapter 5 describes the data sample and outlines the variables used in the study. Chapter 6 specifies the fixed effects method and how it is used. Chapter 7 presents the results, which are later discussed and concluded in chapter 8.

¹For further information, see chapter 4.2

2 Earlier research

There is an extensive literature concerning the relationship between preschool enrolment and parental labour force participation. The historical pattern where women are responsible for taking care of the children has generated particular interest in women's labour force participation. Previous research has emphasized the cost of preschool enrolment and its effect on the female employment rate. During the last decades, some researchers have also started to investigate this relationship among different groups in society. This chapter outlines previous research on these aspects.

One of the more frequently researched areas within this field concerns the relationship between the cost and availability of preschools and women's labour force participation. The literature suggests that reduced costs for preschools have a clear positive effect on maternal labour force participation (Baker et al. 2008; White 2001; Baum 2002). However, as Morrissey (2017) emphasizes, there is heterogeneity in findings stemming from methodological differences as well as variations in culture, policy and historical background. These differences have generated different research results. For example, Han and Waldfogel (2001) found that reducing preschool costs by 25 percent in the US would increase married mothers' employment by 3 percent and unmarried mothers' employment by 5 to 6 percent. Another example from a Swedish study performed by Mörk, Lindqvist and Lundin (2006) investigates the effect of implementing a maximum cost for preschool in Sweden on parental labour force participation. They found that a decrease in preschool costs of at least 500 SEK (approximately 50 Euro) increases mothers' probability to participate in the labour force by 3 percent, while finding no similar effect for fathers. Despite differences in the size of the effect of preschool costs on female labour force participation, there seems to prevail consensus that reducing costs for preschool has a positive impact on female employment.

Further research has shown that the effect of preschool costs on female employment seem to differ between different groups. Anderson and Levin (1999) emphasize the economic aspects of this relationship. They focus in particular on low-income mothers in the US, using panel data from a household survey. Their findings show a significant negative effect of preschool costs on mothers' labour force participation, and the effect was larger for low-income mothers. This indicates that mothers with low-incomes benefit from cost reduction for preschools to a larger extent than mothers with higher income. Kesler (2020) studies preschool enrolment for children of age 3 to 5 and its effect on mothers' labour force participation in the US, with a specific focus on race, ethnicity and nativity. Her findings suggest a difference between native and immigrant mothers, where children of immigrant mothers are less likely to attend preschool. If they do attend preschool, their mothers are still less likely to participate in the labour force compared to native

mothers with children in preschool. This study is highly relevant to ours for two reasons. First, Kesler brings a dimension of foreign-borns and natives to the analysis. Second, she, like us, uses preschool enrolment as her variable of interest, and not the costs of preschool.

3 Theoretical framework

There is no general theory on female labour force participation and preschool participation. However, many theories within the labour-leisure choice framework can be applicable for preferences regarding the choice of staying at home with children or working. Enrolling children in preschool would thus be positively correlated with a stronger preference for working. We present three theories within the labour-leisure framework. The first theory is the classic labour-leisure model, the second extends the first model by incorporating the household and the third theory looks at the labour-leisure choice over the life cycle.

When analyzing the choice of working or not working, the most fundamental model is the neoclassical model of labour-leisure choice. It is a very general model and therefore appropriate to initiate the analysis with. Borjas (2020) describes the model, which assumes that an individual gets utility from two activities - consumption and leisure. The utility the individual receives is notated by U in a simple utility function $U=f(C,L)$, where C is consumption (received from working) and L is leisure. He explains that individuals maximize utility by allocating time between consumption and leisure, based on preferences of these two activities. Preferences are determined by indifference curves, illustrating different combinations of leisure and consumption that all give the individual the same utility (Borjas 2020). A steep indifference curve indicates that leisure is valued highly and much consumption would be needed in order to give up time from leisure (Borjas 2020). In this general model of labour-leisure choice, parents' childcare is seen as leisure. Women who prefer to stay at home to take care of children would then have a steep indifference curve, where leisure is valued highly. However, classifying childcare as leisure is too simplistic and should instead be seen as a form of work.

Gary Becker (1965) is a Nobel prize economist who expanded the labour-leisure choice model by viewing the household as an entity. He underlines that time can be used in various ways, not only for working and leisure, and emphasizes that unpaid work within the household should not be seen as leisure. This type of work includes for example activities such as childbearing, cooking and cleaning the house. Becker (1974) further states that the allocation of time spent on work in the labour market and in the household will be divided among the household members depending on their bargaining power. The

household member with a lower potential wage will resume working in the household since they have a smaller bargaining power than a household member with a larger wage. This maximizes utility for the household (Borjas 2020).

In Sweden today, women earn on average less than men (Sweden National Mediation Office 2020), which in line with Becker's (1974) theory implies that women have less bargaining power in the household. Consequently, women are more responsible for household work, while men instead work in the labour market. Dribe and Nystedt (2017) extend this reasoning by emphasizing that married women in western countries are, on average, two to three years younger than their husbands. They suggest that this gives the husband an advantage in the household bargaining power due to longer participation in the labour market, giving rise to a better labour market position and thus a higher earnings potential.

It is also relevant to look at labour market participation across the life-cycle when analysing labour market participation and child rearing. Heckman (1974) is prominent in this field, stating that the value of leisure varies over the life-cycle. He implies that the offered wage is lower than the wage asked when leisure is valued highly. Borjas (2020) describes this theory as the intertemporal institution hypothesis. He gives the example of a household with small children, where the person in the household responsible for childcare might value their time in the household sector higher when the child is small. He suggests that this explains why many married women participate in the labour force prior to having children, then quit the labour force when the child is small to then return to the labour force when the child is older.

This chapter has presented three theories of the labour-leisure choice model, which facilitates a deeper understanding of the relationship between preschools and female employment. The first theory explains how preferences illustrate the trade-off between working and leisure, while the second theory is more relevant to this study as it recognises work within the household and who performs it. This provides insights into women's preferences regarding the choice of either participating in the labour force or not. The third theory contributes with an intertemporal perspective where the choice to work differs within the life cycle, illustrating how women's preferences of working could be affected by having a child.

4 Background

In order to grasp the relationship between preschool participation and female employment, some background information is needed. This chapter provides a detailed explanation of the Swedish preschool system's history, constituents and costs. The former and present state of female employment in Sweden is then briefly introduced, followed by a section regarding reasons behind low preschool participation among foreign-born and low-income households.

4.1 The history of the Swedish daycare system

The formal daycare system in Sweden has grown immensely in importance and size during the last hundred years. The possibility to enrol children in preschool has developed from being an exception to instead act as a fundamental cornerstone in the Swedish welfare state. Hatje (2013) has studied the development of the Swedish daycare system. She explains that daycare initially was an activity for children in higher social classes, but a rapid demand for female labour in the beginning of the 20th century led to a corresponding increase in demand for daycare. Hatje (2013) continues by emphasizing that even though the Swedish daycare system started to get public funding already in 1935, women still had the overriding responsibility for the children. Daycare was then mostly seen as a solution among women that had to work to make a living.

Hatje (2013) states that it was not until the 1960s the view on formal daycare advanced and became a general solution for families of all classes. As a consequence, there was an increase in public funding leading to enhanced access to formal daycare. She further emphasizes that this primarily benefited women in the middle class, who could start working and studying to a larger extent when they were not obliged to be home with their children. In 1985, the Swedish parliament finally legislated that all children from age 1.5 until school age are guaranteed a place in formal daycare (Hatje 2013).

4.2 The preschool system of today

The daycare system has changed character in the 20th century, going from being mainly an informal system to the formal preschool system of today (Stanfors 2013). Although 85 percent of children in Sweden in 2020 were enrolled in preschool (Kolada 2021), there are still multiple options available:

- *Preschool* is the most common form that the majority of children participate in and can be public or private. Preschools have to follow the pedagogical plan provided by the government and have personnel with appropriate university education (Swedish National Agency for Education 2020).

-*Other pedagogical activities* is the term used when children spend their day in a care holder's home, or many families share the responsibility with each other (Swedish National Agency for Education 2021a).

- *Open preschool* is a day-activity for children not enrolled in preschool, where children and parents visit together. The aim is to provide pedagogical group activities and support parents (Swedish National Agency for Education 2000).

-*Informal daycare* is when an individual, except the parents, takes care of a child during the day. It could for example be a family member, a friend or an au pair (European Commission 2018).

The Swedish daycare system was reformed in 2001 (SFS 2001:160). The reform aimed to increase the number of children participating in preschool. Prior to the reform, many children were unable to attend due to high costs, parents being unemployed or because of parents being on parental leave (Swedish National Agency for Education 2006). The reform therefore stated that children aged 3 to 5 should be guaranteed free preschool for 525 hours a year regardless of the parents' occupation (Swedish National Agency for Education 2021b). Additional hours, as well as preschool for younger children, should be based on the household's total net income, the number of children enrolled and the regulations of the municipality (Swedish National Agency for Education 2006).

In 2021, the fee for the first child was set at a maximum of 3 percent of the household's monthly net income (Swedish National Agency for Education 2021). However, there is a maximum fee for public and private preschool costs, updated once a year by the Swedish National Agency for Education (2006). In 2021 the cost ceiling for the first child was set to 1510 SEK (approximately 150 Euro) per month (Swedish National Agency for Education 2021c). Figure 1 illustrates the preschool enrolment ratio in the 21st century, suggesting that the reform was successful as the ratio has been rising from approximately 60 percent in the year 2000 to above 85 percent in 2020.

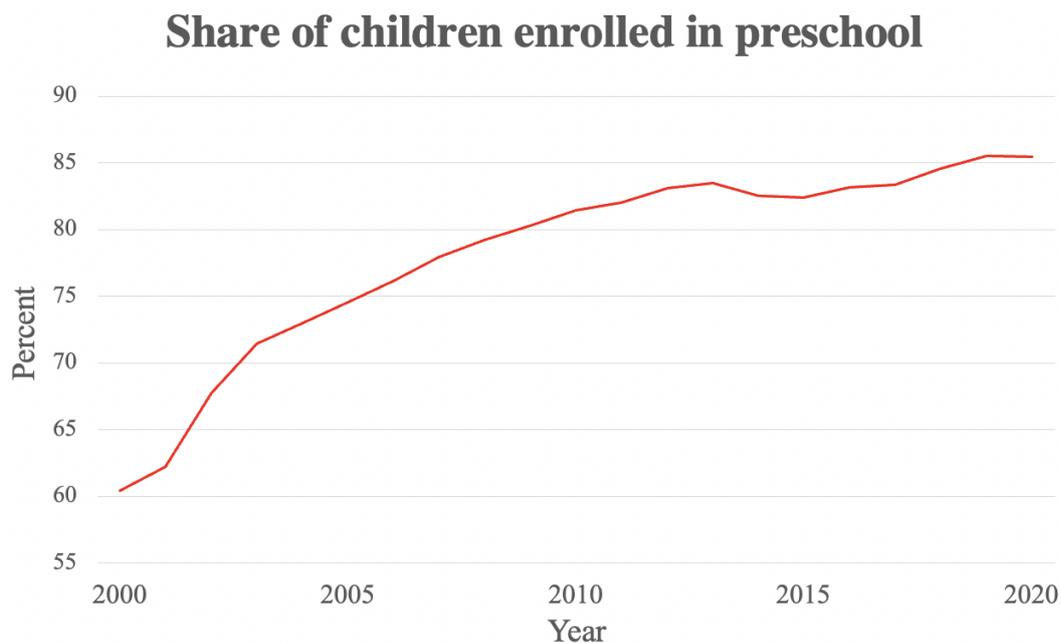


Figure 1: The share of children participating in preschool between 2000 to 2020.

Source: Kolada 2021

4.3 Female labour force participation

Female labour force participation has increased drastically in Sweden the last fifty years, which can be seen in Figure 2. The figure shows that in 1970 the female employment rate was only 60.2 percent, and has then increased to 74.7 percent in 2020 (SCB 2021d). The figure also highlights that female employment rate nowadays is close to the employment rate for males of 78.7 percent in 2020. Looking further back in history, Stanfors (2017) reports that in 1900, the share of working women (aged 15 and older) was 19.1 percent. She further shed light on the historical difference between married and unmarried women in the labour market. Unmarried women participated in the labour market to a larger extent than those who were married. Married women were instead supposed to take care of the household unless they needed to contribute to the household's economy (Stanfors 2017). Silenstam (1970) explains that after 1920 there was an increase in female employment rate, which to a large extent was a result of married women entering the labour market. He suggests that when modern home appliances made their way into the household, work in the household became more efficient and enabled women to spend more time on the labour market. However, Silenstam emphasized that women still were held back by their duties of taking care of their children.

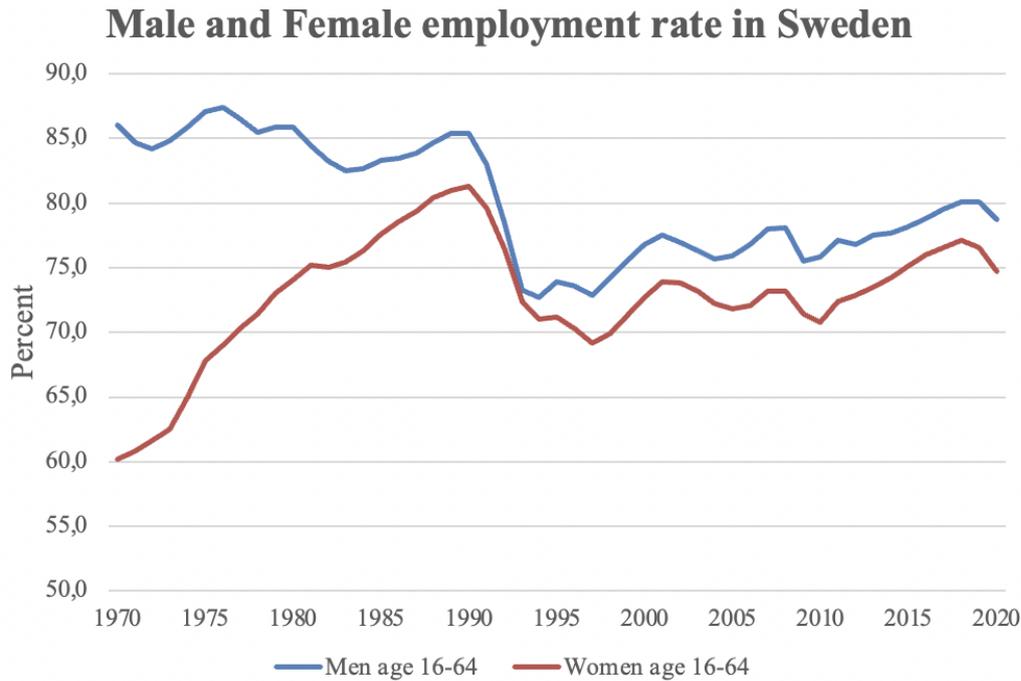


Figure 2. Male and female employment in Sweden between 1970 to 2020

Source: SCB 2021d

Institutional reforms were introduced in the 1970s with the aim of increasing female labour force participation. Svensson describes these institutional reforms in a report from 2008. He explains how the tax system changed in 1971, from taxing married couples on their total income to instead be taxed separately in accordance with their wages. This was favourable for the person with the lower earnings. Svensson (2008) continues by explaining that preschools became subsidized in the 1970s. This facilitated the possibility for women with lower economic standards to enter the labour market. In the same century, additional family policy reforms were introduced, which allowed parents on parental leave to receive 90 percent of their wages (Stanfors 2017). This reform ensured that women did not have to formally leave the labour market when having children, but could instead keep their employment during their parental leave (Svensson 2008).

4.4 Reasons for lower preschool enrolment among foreign-born and low-income households

As previously mentioned, children from both foreign-born families and low-income households are not participating in preschools to the same extent as other children (Swedish National Agency for Education 2018). While the reasons behind this go beyond the scope of this study, they are still relevant to acknowledge as they could have a potential indirect impact on female employment.

A study by Seibel and Fage Hedegaard (2017) examines the relationship between enrolment in preschool and attitudes in Denmark, Germany and the Netherlands. They suggest that migrants to a larger extent than natives prefer informal daycare rather than formal daycare. They further emphasize that differences in attitudes towards formal daycare stem from migrants with origins in countries of a weaker welfare state. Seibel and Fage Hedegaard (2017) also notes that migrants from countries with more traditional values were less positive about formal daycare, suggesting this as another reason for migrants using formal daycare to a smaller extent. Traditions and attitudes thus appear to be a reason why migrants refrain from enrolling their children in preschools.

Crosnoe et al. (2016) examine reasons why low-income households enrol their children to a lesser extent than others in the US. They found that the mother's employment and education predicted low-income children's preschool enrolment. Other factors found to be important were access to local childcare, the total number of children in the household and the desire to prepare the children for school. However, it must be noted that these are factors determining preschool enrolment within the group of low-income households. Differences between factors determining preschool enrolment for low-income households and other households are not captured by Crosnoe et al. (2016), and studies on that particular subject are scarce. Nonetheless, reasons for lower enrolment among low-income households could be traced to factors like the mother's employment and education.

To conclude this section, the role of preschools in Sweden has steadily gained in importance throughout the 20th century and is today a fundamental part of the Swedish welfare system. This development has resulted in a larger possibility for women to enter the labour market. The current role of the Swedish preschool system has been made possible through several expansions and heavily subsidized costs for enrolment, which has facilitated enrolment of children from households of all income levels. Costs for preschool should hence not be seen as a major reason behind the choice of not enrolling a child in preschool in the Swedish context, those reasons could instead be traced to the parents' attitudes, values, traditions and education.

5 Empirical strategy and data

5.1 Data

In this study yearly aggregate data for all 290 municipalities in Sweden are used, spanning from 2005-2019 (some only spanning from 2009-2019). We have chosen this time span since we want to study preschool participation in a modern context, and the majority of the data are available from 2005. Even though some data are only accessible from 2009, we have chosen to not restrict the whole sample to this smaller time period as it would imply a large loss of observations. Data are primarily collected from the Kolada database, which is provided by The Council for Local Government Analysis, an association created as a collaboration between the Swedish public administration and The Swedish Association of Local Authorities and Regions. In addition, some data from Statistics Sweden (SCB) are included.

5.2 Variables

This section provides descriptions of all variables used in the analysis with some additional motivation for their relevance, supported by earlier research. A list of all variables and their sources is provided in Appendix A.

The dependent variable is measured by the share of employed women between 25 and 34 years old. When using aggregate data we can not locate which women are mothers of children in preschool age (age 1 to 5). This makes it essential to choose an age span where it is reasonable that women have children in the ages of 1 to 5. A preferred variable would therefore be to have an employment rate for women between approximately 25 and 40 years old. However, due to data limitations, the most appropriate age span for this variable is women in ages 25 to 34. An advantage of this measure is that it excludes women under 25. As the dependent variable captures employment, including this group would be misleading as it is likely that many women under 25 still are studying.

The independent variable of interest is the share of children participating in preschool (age 1 to 5). Preschool does in this context mean the standard public or private preschool most common in Sweden, i.e alternative forms of daycare are not included. This is motivated by the fact that only 1.7 percent of children in Sweden participated in other forms of pedagogical activities in 2018 (Swedish National Agency for Education 2018). Participation in open preschool is not included, as the parent joins the child in this form of preschool, thus participation in open preschool will have no positive effect on the mother's employment. Informal daycare is also excluded, as data on this is unavailable.

Control variables are used to account for additional factors affecting women's employment rate. The first control variable is the share of individuals that have received financial aid during the year. This share is according to Mörk (2011) associated with unemployed individuals and the variable is thus expected to have a negative effect on female employment. The second control variable considered is the median net income for individuals twenty years or older (logged). Median net income is likely to be strongly related to employment, thus the variable is included to isolate the relationship. The third control variable is the share of women born outside of the European Union (EU) and European Free Trade Association (EFTA). Research shows that foreign-born women tend to have more difficulties entering the labour market (Jansson 2020; Nordic Council of Ministers 2018), indicating an expected negative effect on the female employment rate. This variable is also valuable for the analysis regarding different associations between preschool participation and female employment.

Furthermore, the fourth control variable is the share of individuals with low income for each municipality, available from 2009 to 2019. As our study partly focuses on low-income households, this variable is included since its interaction with preschool enrolment is of importance for the analysis. The fifth covariate is the share of women with post-secondary education, included as higher education has been shown to have a positive impact on female employment (Borjas 2020). The last variable is the share of women aged 25 to 34 that are married². This variable can be assumed to have a negative effect on female employment since it enables women to refrain from working, given that the household still has the husband's income.

Two interaction variables are included to capture the association between preschool participation and female employment conditional on a third variable. In this study, the interaction variables serve the purpose of answering the second part of the research question by examining whether there is an additional effect of preschool participation on female employment conditional on different shares of foreign-born women and low-income households. Interaction variables can also be important to include in a model, as excluding them may lead to a misinterpretation of the effects that the independent variables separately have on the dependent variable which could potentially generate bias (Kasim 2008).

The first interaction is a product of the share of foreign-born households and the preschool participation rate. This interaction variable is included since being foreign-born is likely to not only have an impact on the female employment rate but also on the choice to enrol children in preschool. The second interaction variable captures the product of the

²Calculated by dividing the number of women that are married (age 25-34) in each municipality by the total number of women (age 25-34) in the same municipality

preschool participation rate and the share of people with low income. Data for this interaction variable is only available from 2009 to 2019 and the analysis of this variable is therefore a sub-sample of the main data set. Table 1 illustrates the descriptive statistics of the variables included.

Table 1. Descriptive statistics

Label	Variable	Observations	Mean	SD	Min	Max
Share of Employed Women aged 25-34	working_25_34_f	4 350	74.778	5.187	55.118	90.152
Share of children enrolled in preschool aged 1-5	preschool	4 295	81.272	6.159	42.857	100
Share of individuals having received financial aid during the year	econgrants	4 306	4.073	1.718	0.224	12.843
Median net income, logged	ln_median_inc	4 350	12.176	0.159	11.777	12.806
Share of women born outside of EU/EFTA	foreignborn_f	4 350	6.722	4.198	0.700	31.952
Share of people with low income	lowinc_share	3 187	19.905	4.554	5.287	38.076
Share of women with post-secondary education	higheduc_f	4 350	40.898	9.742	19.432	76.279
Share of married women	married_f	4 350	32.137	6.066	51.526	51.567

6 Method

This study uses panel data, spanning across municipalities and over time. When working with data analysis, one has to consider the issue with endogeneity i.e that the error term is correlated with the independent variables. There are several problems related to endogeneity. The first problem is the omitted variable bias, which occurs when an independent variable is excluded, causing biases in the estimates of the coefficients as well as inconsistent estimates. In this study it is reasonable to assume that even when including covariates in the regression, unobserved variables affecting the outcome variable may still exist, giving rise to such biases and inconsistencies.

In order to account for some of the unobserved factors, we apply a fixed effects model with year dummies.³ This method will account for both unit-specific effects and time-specific effects. Unit-specific effects are effects that do not vary over time in a municipality, where an appropriate example is geography. Time-specific effects are captured by including year dummies, which control for trends that are common for all (or most) municipalities over

³The choice of using a fixed effects and not a random effects model was ensured by performing a Hausman test, which suggested that fixed effects should be used.

time. Such trends can for example be the general rise in preschool participation that has occurred in Sweden in the last decades (Kolada 2021), as well as the refugees' crisis in 2015 where Swedish municipalities in a short time period received a large number of refugees (SCB 2021a).

Equation 1 shows a general linear regression specification. When applying a fixed effects model with year dummies the error term consists of three parts, as seen in equation 2. The purpose of a fixed effects model is to generate an exogenous specification by accounting for unit-specific effects (γ) and time-specific effects (v) (Angrist Pischke 2008). This will enhance the prospects of reducing bias and provide better estimates closer to the true causal effect of interest. However, changes within municipalities over time cannot be controlled for in this model and could therefore be a potential cause of bias.

$$E[Y_{i,t}|X] = \beta_1 + \beta_2 * X_{i,t} + \eta_{i,t} \quad (1)$$

$$\eta_{i,t} = \gamma_i + v_t + \epsilon_{i,t} \quad (2)$$

Another endogeneity problem highly relevant for this study is the problem of simultaneity, where the causal effect is suspected to run in both directions. Ideally, we would have preferred to analyse the causal effect of preschool participation on the female employment rate. However, it is likely that the model might capture the opposite effect, i.e that an individual not succeeding in finding a job could choose to keep their child at home since that individual does not have an occupation anyway. This simultaneity problem could have been avoided with access to micro data or an appropriate instrument variable (IV) (Angrist & Pischke 2008). However, finding an instrument that only affects female employment through preschool participation is difficult and not a possible solution in the context of this study.

As a result, we have not been able to distinguish the two effects from each other, but the association between preschool participation and female employment is still highly interesting to analyse. A significant relationship would suggest that preschool participation and female employment are intertwined. This indicates that policymakers performing active labour market policies targeting women should take into account the preschool enrolment rate. The positive association would imply that increasing the preschool participation could increase the female employment rate. Vice versa, if a policymaker would want to increase preschool enrolment they should also take into account the female employment rate.

6.1 Method specification

The model specification used in this study is outlined as follows:

$$\textit{Female employment rate}_{i,t} = \beta_1 + \beta_2 * \textit{preschool}_{i,t} + \beta_3 * X_{i,t} + \gamma_i + v_t + \epsilon_{i,t} \quad (3)$$

The dependent variable is the female employment rate, and β_2 captures the effect of the independent variable of interest *preschool*, which runs across municipalities i and years t . Furthermore, β_3 represents the coefficients of $X_{i,t}$, a vector capturing the covariates, that also run over municipalities and time. When using a fixed effects model with time dummies the error-term is split into three parts. Gamma (γ) captures the municipality-fixed effects, upsilon (v) accounts for the year-fixed effects and epsilon (ϵ) is the remaining error term.

7 Results and analysis

This chapter presents results and analysis to answer our research question. First, some baseline estimates are presented which provides an initial analysis of the relationship between preschool participation and female employment. Further, covariates are added to the regression to increase the precision of the model. This is followed by an analysis with interaction variables to evaluate whether the association is different among foreign-born and low-income households. Lastly, two robustness checks are performed. Throughout this chapter, significance levels of 5%(*), 1%(**) and 0.1%(***) are used. These levels are applied as the effects of the coefficients often show strong significance, which legitimise the use of more precise significance levels.

7.1 Initial analysis with baseline estimates

Table 2: Baseline estimates

	(1)	(2)	(3)
preschool	-0.0265** (0.00943)	-0.0260** (0.00955)	0.0327** (0.0116)
_cons	76.91*** (0.810)	76.86*** (0.777)	72.50*** (0.874)
Observations	4295	4295	4295
R ²	0.0018	0.00185	0.240
Municipality FE	No	Yes	Yes
Time FE	No	No	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In Table 2 baseline estimates are presented to gain some initial understanding of the association between the variable of interest *preschool* and female employment. These baseline estimates are also used to verify the choice of applying a fixed effects model. The results show that preschool participation has a small but significant association with female employment in all three specifications. When performing a simple OLS regression in column 1 the association is negative, and the sign remains unchanged when adding municipality-fixed effects in column 2. The negative sign is unexpected as it contradicts previous research. This suggests that these models are too simplistic, which is supported by the distinctively low R-squared. Nevertheless, the association becomes positive, and is estimated to 0.0327, when including time-fixed effects in column 3. A positive preschool coefficient is in line with earlier research and with our expectations. The positive sign, together with a large increase in the R-squared, supports the choice of using a fixed effects

model with time dummies. However, these baseline estimates are insufficient to establish an association between preschool participation and female employment, covariates must therefore be included.

7.2 The general association between preschool participation and female employment

Table 3: Main results with covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
preschool	0.0566*** (0.0108)	0.0332** (0.0108)	0.0144 (0.0109)	0.0590*** (0.0108)	0.0554*** (0.0110)	0.0341** (0.0109)	0.0334* (0.0133)
ln_median_inc	27.98*** (2.344)	19.40*** (2.401)	28.00*** (2.381)	29.99*** (2.436)		22.94*** (2.514)	21.55*** (4.359)
econgrants	-0.820*** (0.0476)	-0.669*** (0.0482)		-0.826*** (0.0476)	-1.006*** (0.0461)	-0.668*** (0.0487)	-0.509*** (0.0581)
foreignborn_f		-0.492*** (0.0396)	-0.633*** (0.0391)			-0.507*** (0.0436)	-0.250*** (0.0546)
higheduc_f				-0.0757** (0.0252)	0.00998 (0.0247)	-0.119*** (0.0253)	-0.119*** (0.0321)
married_f						-0.969 (1.740)	-2.348 (2.084)
lowinc_share							-0.280*** (0.0559)
_cons	-259.8*** (28.04)	-154.2*** (28.78)	-257.4*** (28.54)	-281.3*** (28.92)	74.41*** (1.168)	-192.1*** (29.95)	-176.6*** (53.14)
Observations	4252	4252	4295	4252	4252	4164	3026
R ²	0.350	0.374	0.343	0.351	0.326	0.380	0.341
Time interval	2005-2019	2005-2019	2005-2019	2005-2019	2005-2019	2005-2019	2009-2019

Standard errors in parentheses. All regressions are performed with municipality-fixed and time-fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 describes regressions performed with covariates. *Preschool* keeps a positive association in all regressions, but its significance varies. The table shows that the estimates improve when *econgrants* and *ln_median_inc* are included. In column 3 *econgrants* is excluded, resulting in a non-significant estimate for *preschool* and a lower R-squared than in column 2, where *econgrants* was included. This indicates that *econgrants* is an important control variable. Further, columns 4 and 5 include the same covariates except for excluding *ln_median_inc* in column 5, resulting in a lower R-squared in that regression. *Ln_median_inc* is thus shown to be an important control variable as it has a large and significant association in all regressions where it is included. In column 7 all covariates are included and the estimates are in general lower. The R-square is small and *preschool* is less significant, which can be deducted to the lower amount of observations in this regression.

The main regression of interest is shown in column 6. In this column all covariates with data ranging from 2005 to 2019 are included, resulting in the highest R-square in Table 3. The variable of interest *preschool* should be interpreted as follows: an increase in preschool enrolment rate by 1 percentage point should increase female employment by 0.034 percentage points. Worth noting is that the estimate is significant at a 0.01 significance level. However, we cannot establish a causal effect due to the large likelihood of simultaneity. It is therefore the association between preschool participation and female employment that this study focuses on. The coefficient should instead be interpreted as that the average association between preschool participation and female employment in Swedish municipalities is positive. This supports the labour-leisure choice model, indicating that women receive more time for working when enrolling children in preschool.

A positive relationship between *preschool* and female employment suggests that they are highly intertwined and the variables can affect each other in both directions. This indicates that the positive association can be interpreted in two ways; either that preschool participation has a positive effect on female employment, or that female employment has a positive effect on preschool participation. The positive association confirms earlier research within the field, where reduced preschool costs have a positive effect on female employment (Baker et al. 2008; White 2001; Baum 2002). The fact that these researchers have managed to find this causal effect makes the first interpretation of the association more plausible.

Further analysis of Table 3, suggests that all covariates except *higheduc* take the sign as expected. *Ln_median_inc* keeps a clear positive significant effect throughout all regressions where it is included, while *econgrants*, *foreignborn_f* and *lowinc_share* shows negative and significant effects. *Married_f* is negative as expected, but not significant. Surprising was the negative, and often significant, effect of higher education on female

employment, where a positive effect was expected. A potential explanation could be that female employment measures from age 25 to 34 and it is therefore reasonable that individuals still study or have not found employment yet.

7.3 The interactions with foreign-born women and low-income households

In order to answer the second part of our research question, regarding low-income and foreign-born households, additional specifications are needed. The aim is to capture the association between preschool participation and female employment conditional on these two groups, to see if it differs for them. To achieve this, interaction terms are included to extend the model. The model specifications with interaction terms looks as follows:

$$\begin{aligned}
 \textit{Female employment}_{i,t} = & \beta_1 + \beta_2 * \textit{preschool}_{i,t} + \\
 & \beta_3 * (\textit{preschool} * \textit{foreignborn_f})_{i,t} + \\
 & \beta_4 * X_{i,t} + \\
 & \gamma_i + \nu_t + \epsilon_{it}
 \end{aligned} \tag{4}$$

$$\begin{aligned}
 \textit{Female employment}_{i,t} = & \beta_1 + \beta_2 * \textit{preschool}_{i,t} + \\
 & \beta_3 * (\textit{preschool} * \textit{lowinc_share})_{i,t} + \\
 & \beta_4 * X_{i,t} + \\
 & \gamma_i + \nu_t + \epsilon_{it}
 \end{aligned} \tag{5}$$

Two specifications with different interaction terms are presented in equations 4 and 5. These interaction terms are included to investigate whether the association differs among foreign-born and low-income households. In these specifications, β_3 captures the joint relationship of the two variables in the interaction and β_4 captures the association from the covariates. The other terms have the same interpretation as in equation 3 in section 6.1.

As can be seen in equations 4 and 5, the variables included in the interaction term is included twice, both in the interaction term and as a constitutive term. One may therefore fear the presence of multicollinearity. This problem would cause larger standard errors and decreases the likelihood of significant coefficients. One may therefore be tempted to exclude the constitutive term from the regression in order to decrease the multicollinearity. However, it is according to Brambor, Clark and Golder (2006) fundamental to still include the constitutive terms in order to avoid a misspecification. They further underline that the problem of multicollinearity often is overstated and does not justify an exclusion of the constitutive terms.

Table 4: Regression estimates with covariates and interactions

	(1)	(2)
preschool	0.0668*** (0.0156)	-0.161** (0.0595)
ln_median_inc	23.51*** (2.519)	22.02*** (4.353)
econgrants	-0.678*** (0.0488)	-0.503*** (0.0580)
foreignborn_f	0.117 (0.218)	-0.270*** (0.0548)
married_f	-1.412 (1.745)	-2.388 (2.080)
higheduc_f	-0.121*** (0.0253)	-0.106** (0.0323)
preschool_foreign	-0.00722** (0.00247)	
lowinc_share		-1.015*** (0.226)
preschool_lowinc		0.00906*** (0.00270)
_cons	-201.3*** (30.08)	-166.8** (53.12)
Observations	4164	3026
R ²	0.381	0.344
Time interval	2005-2019	2009-2019

Standard errors in parentheses. Both regressions are performed with municipality-fixed and time-fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4 shows regression estimates when interaction terms are included. However, when incorporating interaction variables in a regression, the interpretation of the coefficients has to be made with caution. Brambor et al. (2006) emphasize the difficulties in interpreting the coefficient of the constitutive terms. In our case, when including the interaction *preschool_foreign* in column 1, the effect from the constitutive term *preschool* should be interpreted as the effect when *foreignborn_f* is zero (Brambor et al. 2006). To understand the interpretation of the interaction variables better, we provide an algebraic explanation.

$$E[Y|X] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 (X_1 X_2) \quad (6)$$

$$\frac{\delta E[Y|X]}{\delta X_2} = \beta_2 + \beta_3 X_1 \quad (7)$$

Equation 6 and 7 displays an interaction term in a linear model. In order to interpret the association between X2 and Y we take the derivative of equation 6 with respect to X2 in order to retrieve the marginal effect of X2 conditional on X1, displayed in equation 7 (Gill & Tsai 2013).

Equation 7 is used to better interpret the two interactions in Table 4. First, the sum of the coefficient of *preschool* and *preschool_foreignborn* ($0.0668 - 0.00722 = 0.0596$) in column 1 is interpreted as the association between preschool participation and female employment when the share of foreign-born women is 1 percent. The association then decreases from 0.0668 to 0.0596 percentage points. This means that when the share of foreign-born women increases from zero to one percent, the association becomes weaker but remains positive. Second, we are interested in the association conditional on the share of low-income households which is displayed in column 4. The first thing to notice is the negative coefficient for *preschool*. While it should be interpreted with the unrealistic assumption of *lowinc.share* being zero, a negative sign is still peculiar. When the share of low-income households is 1 percent, the association decreases from -0.161 to -0.152 percentage points ($-0.161 + 0.009 = -0.152$). This indicates a weaker but still negative association between preschool participation and female employment. However, the negative association found is surprising as it goes against previous research.

7.3.1 Analysis at different shares of foreign-born women and low-income households

Table 4 gives an initial understanding of the conditional association. However, in line with the reasoning of Brambor et al. (2006), it is not enough to only analyse it conditional on shares of zero and one percent. These low shares, of for example foreign-born women, are uncommon in Swedish municipalities. We can see this when looking at the density

of shares of foreign-born women in Figure 4, where the shares prove to be substantially higher. A more extensive analysis can therefore be made by looking at the marginal effects on higher shares as well.

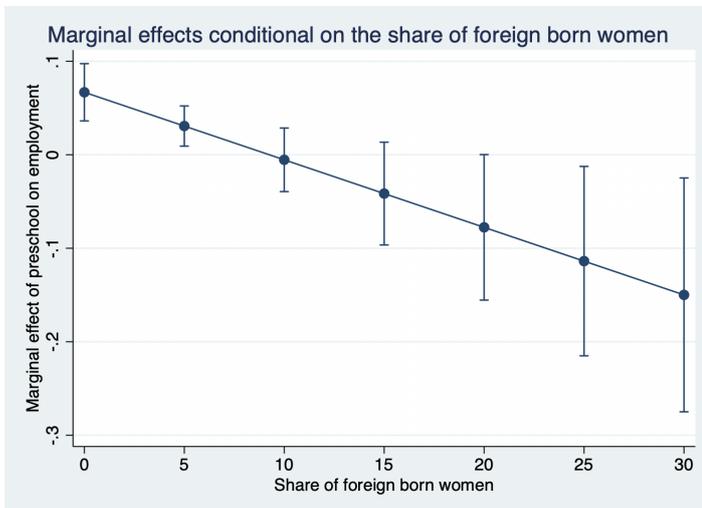


Figure 3: Marginal effect of preschool on female employment conditional on the share of foreign-born women.

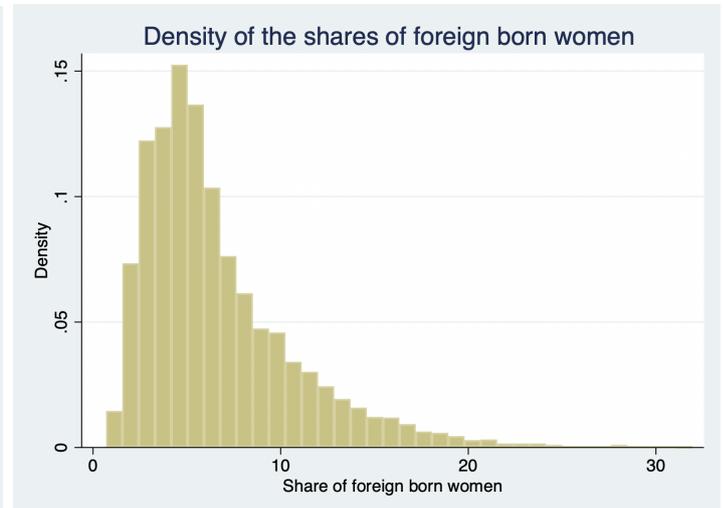


Figure 4: Frequency distribution of the shares of foreign-born women

Figure 3 shows the marginal effect preschool participation has on female employment for municipalities with different shares of foreign-born women. The shares span from zero to 30 percent, since all municipalities have shares of foreign born women within this range.⁴ It illustrates that the association goes from positive to negative as the share of foreign-born women in the municipalities increases. The association is significant except between 10 and 20 percent.⁵ When interpreting Figure 3, it is vital to take into account the frequency of *foreignborn_f* displayed in Figure 4. The latter figure indicates that most municipalities have shares of foreign-born women between zero and ten percent, suggesting that municipalities within this span are driving the association. At these shares, the association is positive and significant.

The municipalities with higher shares of foreign-born women are less common, which is why the variance seen in Figure 3 is larger for the higher shares. The figure indicates that the association could be negative for high shares, but we cannot draw such a conclusion since the municipalities with high shares are few and are not driving the association. It is also interesting to note that the majority of the municipalities with the highest shares are municipalities in urban regions.⁶ This could indicate that it is not only the share of foreign-born women that yield this trend towards a negative association, but also a

⁴See Descriptive Statistics in Table 1 for minimum and maximum values of the variable *foreignborn_f*

⁵Tables with significance levels for different shares of foreign-born are found in Appendix B

⁶A list of the hundred highest shares of foreign-born women are provided in Appendix D

potential urban effect. Nonetheless, the figure still shows a tendency that the association is weaker among municipalities with higher shares of foreign-born women, which is in line with Kesler’s (2020) findings.

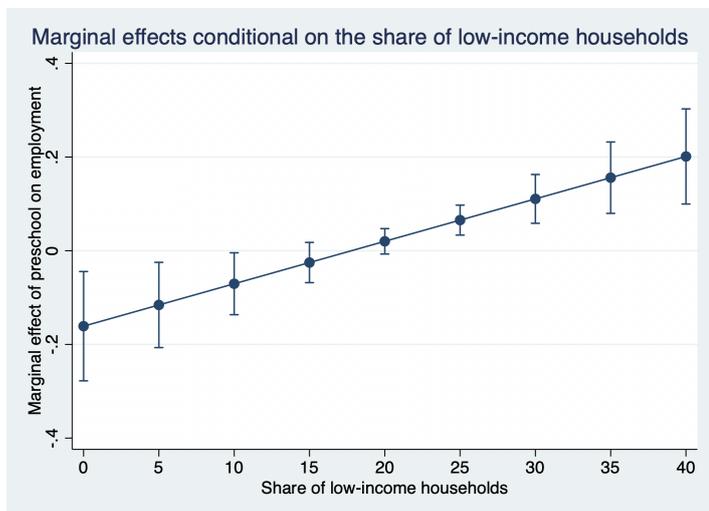


Figure 5: Marginal effect of preschool on female employment conditional on the share of low-income households

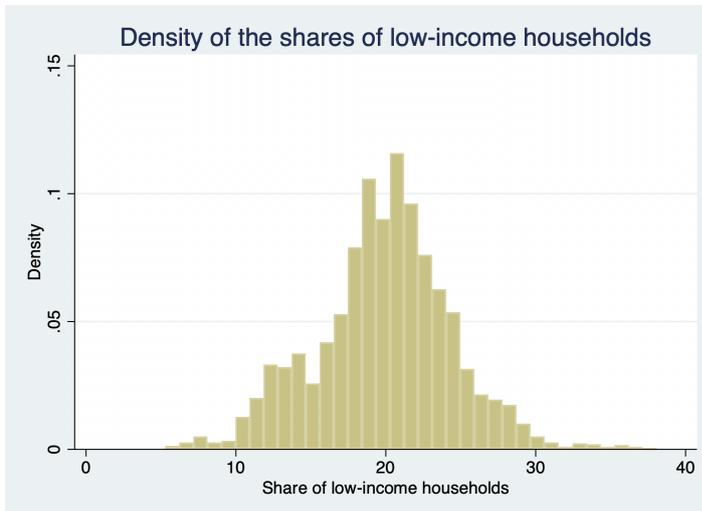


Figure 6: Frequency distribution of the shares of low-income households

Figure 5 shows the marginal effect preschool has on female employment for municipalities with different shares of low-income households. The shares range from zero to 40 percent.⁷ The figure illustrates that the association shifts sign from negative to positive as the share of low-income households increase (at approximately 17%). While the association in general is significant, it becomes insignificant when the share of low-income households is between 15 and 20 percent.⁸ As discussed above, it is important to be attentive to what levels of low-income households that drive the association. In Figure 6 we can see that most municipalities have shares of low-income households in the neighborhood around 20 percent. This implies that it is municipalities with shares of around 20 percent that drive the association, indicating an average positive association.

Figure 5 still shows that the association is negative for municipalities with small shares of low-income households. The frequency of municipalities with these low shares of low-income households is relatively small, which generates a larger variance. This tendency of a negative association could be due to these few outliers. This could explain the negative association found in Table 4, where only shares of zero and one percent of low-income households were considered. Outliers exist for municipalities with very high shares as well. Given these outliers, and that the mean is centered in the figure, we cannot establish if there is a different association between municipalities with different shares of low-income

⁷See Descriptive Statistics in Table 1 for minimum and maximum values of the variable *lowinc_share*

⁸Appendix C show tables with significance levels for different shares of low-income households

households. Nonetheless, the average association between preschool participation and female employment conditional on the share of low-income households is positive.

7.4 Robustness check

Two forms of robustness checks are included in order to verify whether the results are consistent. The first robustness check includes lags and the latter is based on sub-samples with quartiles of *foreignborn_f* and *lowinc_share*.

7.4.1 Robustness check with lagged independent variables

First, the independent variables have been lagged one year, shown in Table 5. It is reasonable to assume that preschool participation and covariates in period $t-1$ have an effect on the female employment rate in period t . In column 1 the variable *preschool* remains positive when lagged, but to our surprise it loses its significance. This implies less consistency of the positive association between preschool participation and female employment. Nonetheless, the positive coefficient still verifies the positive association found in Table 3. Regression estimates with lagged interactions are shown in columns 2 and 3. The interaction for *preschool_foreign* in column 2 verifies the result from table 4 by showing a significant negative coefficient similar to the non-lagged interaction. However, the interaction for *preschool_lowinc* stays positive but loses its significance when lagged, indicating a less consistent association when conditional on the share of low-income households.

Table 5. Regression estimates with lagged independent variables

	(1)	(2)	(3)
lag_preschool	0.0212 (0.0114)	0.0617*** (0.0163)	-0.0959 (0.0703)
lag_ln_median_inc	15.76*** (2.617)	16.43*** (2.620)	16.08*** (4.772)
lag_econgrants	-0.633*** (0.0524)	-0.644*** (0.0524)	-0.539*** (0.0629)
lag_higheduc_f	-0.115*** (0.0270)	-0.118*** (0.0269)	-0.108** (0.0347)
lag_foreignborn_f	-0.377*** (0.0480)	0.403 (0.231)	-0.0962 (0.0621)
lag_married_f	-0.140 (1.817)	-0.722 (1.822)	-2.108 (2.188)
lag_preschool_foreign		-0.00910*** (0.00263)	
lag_lowinc_share			-0.622* (0.268)
lag_preschool_lowinc			0.00534 (0.00319)
_cons	-105.7*** (31.18)	-116.8*** (31.30)	-101.8 (58.28)
Observations	3943	3943	2805
R ²	0.355	0.357	0.283
Time interval	2005-2019	2005-2019	2009-2019

Standard errors in parentheses. All regressions are performed with municipality-fixed and time-fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

7.4.2 Robustness check with sub-samples

The second robustness check is included to verify the association conditional on different shares of foreign-born women and low-income households. Sub-samples are created where *lowinc_share* and *foreignborn_f* are divided into quartiles. The first quartile for each variable includes municipalities with the 25 percent lowest share, whereas the fourth quartile includes the top 25 percent. Performing regressions within each of these quartiles provides the association between preschool participation and female employment conditional on different levels of foreign-born women and low income households. This restricts the observations and allows for comparisons between the sub-samples and the main results.

Table 6 shows that as the share of foreign-born women increases, the association between preschool participation and female employment goes from positive in the first three quartiles to negative in the fourth one. This is consistent with the results found in Figure 3, verifying that there is a weaker positive association for municipalities with high shares of foreign-born women than for municipalities with lower shares. The tendencies of a negative association for municipalities with high shares of foreign-born women remains. A negative association could indicate that increasing preschool participation would affect female employment negatively, which is a peculiar result that goes against previous research. We can therefore not establish such an association from the results in this study, as further research on this potentially negative association would be needed.

Table 6. Sub-samples with different shares of foreign-born women from lowest to highest

Foreign born	0-25%	25-50%	50-75%	75-100%
preschool	0.00830 (0.0214)	0.0643** (0.0231)	0.0139 (0.0251)	-0.0876*** (0.0242)
_cons	-338.0*** (63.56)	-259.4*** (67.17)	-172.9* (69.40)	-302.2*** (55.16)
Observations	1077	1068	986	1033
R ²	0.300	0.367	0.377	0.569

Standard errors in parentheses. All regressions are performed with municipality-fixed and time-fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 presents the quartiles of municipalities with different shares of low-income households. The table shows that the association is positive for all four quartiles, which strengthens our results from Figure 5 where a general positive association was found.

However, the estimates are insignificant for the three largest quartiles. The loss of significance could be traced to the lower sample size of the variable *lowinc_share*. The number of observations is reduced further when divided into sub-samples, which decreases the likelihood of significance. Surprisingly, the positive association is strongest and only significant in the first quartile, where the share of low-income households is the smallest. This contradicts the results from Figure 5, where the small shares of low-income households keep a negative and significant association. However, the negative association in Figure 5 is only significant for a few outliers (see frequencies in Figure 6) of municipalities with smaller shares of low-income households. Table 7 should therefore be seen as a verification of the general positive association between preschool participation and female employment conditional on low-income households.

Table 7. Sub-samples with different shares of low-income households from lowest to highest

Low income	0-25%	25-50%	50-75%	75-100%
preschool	0.0733*	0.0223	0.00655	0.0431
	(0.0331)	(0.0248)	(0.0273)	(0.0268)
_cons	-201.2*	-167.3	-416.2***	-276.5**
	(95.87)	(93.84)	(114.0)	(103.9)
Observations	728	753	784	761
R ²	0.298	0.430	0.367	0.340

Standard errors in parentheses. All regressions are performed with municipality-fixed and time-fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

8 Conclusion

In this study, data were gathered for 290 municipalities in Sweden spanning from 2005 to 2019, resulting in a fairly large number of observations (approximately 4200). Applying municipality-fixed and time-fixed effects on this panel data has enabled an extensive analysis of the association between preschool participation and female employment for Swedish municipalities. We have shown that this association is small, but positive and significant. The result is in line with previous research (Andersson & Levine 1999; Baker et al. 2008; White 2001; Baum 2002) and has two implications; either enrolling children in preschool increases female employment or that higher female employment increases preschool participation. A positive association is highly interesting as it highlights that in the modern Swedish society, where several reforms have been implemented to increase equality, female employment is still connected with the care of children.

This study has also raised the less researched topic of whether the positive association between preschool participation and female employment differs among municipalities with different shares of foreign-born women and low-income households. Regarding foreign-born women, we have shown that there appears to be a difference for municipalities with higher shares of foreign-born women compared to lower shares. As the share of foreign-born women increases, the positive association weakens and even shows tendencies of becoming negative. This implies that in municipalities with high shares of foreign-born women, a low preschool participation rate might not decrease female employment to the same extent as in municipalities with lower shares of foreign-born women. In addition, the fact that municipalities with higher shares are located in urban regions to a large degree indicates that the association for these municipalities could capture a potential urban effect as well.

Regarding the association between preschool participation and female employment conditional on the share of low-income households, we find a general positive association. However, the positive association is to a large extent insignificant in the robustness checks, which makes this result less consistent. We are unable to determine if there is a difference between municipalities with high shares of low-income households and municipalities with lower shares. This is due to the low frequency of municipalities with very high or very low shares of low-income households. The driving forces of the positive association are instead the majority of the municipalities with shares of low-income households around 20 percent. This makes it difficult to establish a difference in the association at different shares, since the majority have approximately the same share of low-income households.

In terms of policymaking, our results suggest that active labour market policies focusing on increasing female employment could potentially gain from taking preschool

participation into consideration. However, compared to previous research from other countries, the association found in this study is small. This suggests that increasing preschool enrolment should not be the main focus when performing active labour market policies in Sweden. Regarding efforts to increase employment among foreign-born women, the weaker association indicates that preschool participation should be taken even less into consideration.

To conclude, there is a general, but small, positive association between preschool participation and female employment in Sweden, that is weaker for municipalities with high shares of foreign-born women. No similar difference can be found for municipalities with high shares of low-income households. The general positive association suggests that female employment is still connected to childcare even in a modern Swedish society. However, further research using micro data is needed in order to investigate causal effects and not only associations. In addition, the tendencies of a negative association for municipalities with higher shares of foreign-born women found in this study is interesting and should be investigated further.

Appendix A

Table 8: List of variables with specifications and sources

Variable name	Full name	Calculations	Specification	Source
<i>working_25_34_f</i>	Share of employed women aged 25-34	Number of employed women 25-34 in the municipality / total number of women 25-35 in the municipality	Dependent variable	Kolada
<i>preschool</i>	Share of children enrolled in preschool aged 1-5	Number of children in preschool 1-5 in the municipality / total number of children 1-5 in the municipality	Variable of interest	Kolada
<i>econgrants</i>	Share of individuals that have received financial aid during the year	Individuals having received financial aid during the year in the municipality / total number of individuals in the municipality	Control variable	Kolada
<i>ln_median_inc</i>	Median net income, SEK/citizen, 20 years or older	Median net income in the municipality	Control variable	Kolada
<i>foreignborn_f</i>	Share of women born outside of EU/EFTA	Number of women born outside of EU/EFTA in the municipality / total number of women in the municipality	Control variable	Kolada
<i>lowinc_share</i>	Share of people with low income	Number of individuals with income under 60 % of the national median net income in the municipality / total number of individuals in the municipality	Control variable (2009-2019)	Kolada
<i>higheduc_f</i>	Share of women with post-secondary education	Number of women 25-44 with post-secondary education in the municipality / total number of women in the municipality	Control variable	Kolada
<i>married_f</i>	Share of married women	Number of married women in the municipality / total number of women in the municipality	Control variable	Kolada & SCB
<i>preschool_foreign</i>	-	Preschool*foreignborn_f	Interaction variable	Kolada
<i>preschool_lowinc</i>	-	Preschool*lowinc_share	Interaction variable (2009-2019)	Kolada

Appendix D

Table 13: Highest shares of foreign-born women

Municipalities	Rank	% of foreign-born women	Municipalities	Rank	% of foreign-born women
Botkyrka	1	31.952304	Malmö	51	20.7
Botkyrka	2	30.991482	Sigtuna	52	20.47546
Södertälje	3	30.244437	Malmö	53	20.4
Botkyrka	4	30.046009	Huddinge	54	20.291777
Södertälje	5	29.365096	Göteborg	55	20.244106
Botkyrka	6	29.167699	Malmö	56	20.2
Botkyrka	7	28.622883	Sundbyberg	57	20.114993
Södertälje	8	28.460968	Burlöv	58	20.095803
Botkyrka	9	28.3	Upplands Väsby	59	19.973504
Botkyrka	10	27.8	Järfälla	60	19.964267
Södertälje	11	27.718431	Solna	61	19.906535
Botkyrka	12	27.3	Malmö	62	19.8
Södertälje	13	26.852094	Göteborg	63	19.626721
Botkyrka	14	26.4	Södertälje	64	19.6
Södertälje	15	25.9	Huddinge	65	19.593464
Botkyrka	16	25.7	Lessebo	66	19.560131
Botkyrka	17	25.1	Sundbyberg	67	19.5
Sigtuna	18	24.695732	Burlöv	68	19.426862
Södertälje	19	24.6	Malmö	69	19.4
Botkyrka	20	24.6	Sigtuna	70	19.4
Botkyrka	21	24.3	Eskilstuna	71	19.385321
Malmö	22	23.911653	Lessebo	72	19.335846
Sigtuna	23	23.78266	Sollentuna	73	19.321056
Botkyrka	24	23.7	Huddinge	74	19.224509
Järfälla	25	23.638761	Upplands-Bro	75	19.124887
Södertälje	26	23.6	Sundbyberg	76	19.1
Malmö	27	23.291485	Landskrona	77	19.013931
Botkyrka	28	23.2	Lessebo	78	18.98971
Sundbyberg	29	22.760375	Landskrona	79	18.963171
Södertälje	30	22.6	Helsingborg	80	18.928835
Järfälla	31	22.534049	Malmö	81	18.9
Sigtuna	32	22.524624	Järfälla	82	18.893013
Malmö	33	22.49745	Göteborg	83	18.856144
Burlöv	34	22.352817	Huddinge	84	18.8
Sundbyberg	35	22.188061	Upplands Väsby	85	18.790341
Burlöv	36	22.065779	Solna	86	18.782413
Solna	37	21.747578	Landskrona	87	18.732843
Malmö	38	21.696831	Burlöv	88	18.7
Sundbyberg	39	21.661842	Eskilstuna	89	18.640309
Södertälje	40	21.5	Sigtuna	90	18.4
Huddinge	41	21.475581	Huddinge	91	18.4
Sigtuna	42	21.425748	Södertälje	92	18.4
Burlöv	43	21.267322	Sollentuna	93	18.394399
Upplands Väsby	44	21.141776	Burlöv	94	18.3
Järfälla	45	21.081024	Burlöv	95	18.3
Malmö	46	20.993894	Sundbyberg	96	18.2
Huddinge	47	20.952225	Malmö	97	18.2
Sundbyberg	48	20.9319	Solna	98	18.148526
Solna	49	20.929082	Helsingborg	99	18.13463
Södertälje	50	20.7	Järfälla	100	18.1

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