

The Impact of Pre-Primary Enrolment on Maternal Labour Supply in South Africa

Erik Wallström
Lund University
Sweden

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Supervisor:
Jan Bietenbeck

Abstract

I provide evidence on the impact of pre-primary school expansion on maternal labour supply in the context of South Africa. I draw on administrative data from the South African National Census in 2001 and 2011, and a Community Survey in 2007, to extract household information. My identification strategy exploits the staggered timing and intensity in the expansion of pre-primary school facilities across municipalities in an instrumental-variables regression. I find a robust impact from the implicit child care subsidy induced by the expansion on maternal labour supply ranging from 10.4% to 13.7%. My findings suggest that early childhood development reforms aimed at raising pre-primary enrolment rates can go beyond the scope of the child, raising incentives for women to actively take part in the labour market.

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1 Introduction

In almost all countries around the world, female labour force participation rates lag behind their male counterparts (UN, 2015). A couple of reasons behind this is that mothers often take more responsibility for raising children than fathers do, and the difficulty of combining child-rearing with market work. In fact, mothers tend to spend twice as much time on household work and four times the time on child care than men, resulting in large opportunity costs, and leaving more time for men to be employed in the formal sector (Duflo, 2012). The provision of child care and pre-school facilities are potentially a powerful remedy for this, and many countries have recently made such investments (OECD, 2015). While several recent studies have shown that such expansions can lead to increased female labour force participation in the context of developed countries (see, for example, Dustmann, et al., 2013; Berlinski and Galiani, 2007; Jaumotte, 2003), comparable evidence is still scarce for developing countries, which are often characterized by particularly low female labour force participation and high fertility rates (ILO, 2014).

In this paper, I study how the expansion of pre-primary schools in South Africa impacted the labour supply of mothers¹. Pre-primary education for children aged 5 to 6 in South Africa consists of a reception year called Grade R, preceding Grade 1. Grade R is compulsory, although not all public schools offer it, and aims to build a solid foundation for children before entering primary school. South Africa raised awareness of the lack of school enrolment in Grade R in 2001 with the release of the action plan “White Paper 5 on Early Childhood Education”. The plan was South Africa’s response to the worsening schooling situation among the young population in poor areas as well as increasing poverty gaps. It called for an expansion of Grade R classes, mainly in public schools. Community-based centres were also part of the plan but aimed at children younger than four years of age (Department of Education, 2001). The expansion led to doubled enrolment rates, from 36% to 72%, for children aged 5 to 6 in educational institutions between 2001 and 2011 (Department of Basic Education, 2014).

My empirical analysis relates the labour force participation of mothers to the pre-primary school enrolment of their 5-6-year old children. It uses administrative data from two South African National Census datasets, one in 2001 and one in 2011, together with a Community Survey in 2007. In order to circumvent omitted-variable bias in my estimates, e.g. due to

¹ I use the terms ‘pre-primary education’ and ‘Grade R’ interchangeably throughout the paper in the context of South Africa

mothers with high unobserved earnings potential being more likely to enrol their children in pre-school, I exploit the staggered timing and intensity of the roll-out of Grade R across municipalities. In particular, I instrument individual-specific enrolment with municipality-level attendance rates in the same year. With the inclusion of municipality and year fixed effects, this strategy identifies the effect of interest using only within-municipality cross-cohort variation in pre-school attendance, which is likely to be driven by the differential speed of hiring of pre-school teachers and construction of Grade R classrooms and to be exogenous. This strategy can be thought of as a differences-in-differences instrumental variable strategy.

My results show that mothers' labour market decisions are sensitive to changes in pre-primary school enrolment of their children. I find that increased enrolment rates have significantly positive effects on maternal labour supply in the range of 10.4% to 13.7%, resulting from a 0.1 unit increase in the fraction of children attending pre-primary education. Moreover, the presence of additional household members, educational attainment as well as the mother's age turn out to be important determinants of her likelihood to engage in paid work. Furthermore, my estimates suggest the presence of a negative, non-random selection bias stemming from enrolment rates measured on the household level. With this study, I hope to contribute to the limited amount of literature surrounding the impact of pre-primary enrolment on the labour market supply of women in less developed regions by providing evidence in the context of a large developing country such as South Africa.

The rest of the paper is organized as follows: in Section 2, I outline the previous research and empirical literature surrounding child care and maternal employment. Section 3 consists of background information about early childhood development and the labour market in South Africa. In Sections 4 and 5, I present the descriptive statistics and the implemented identification strategy used in my analysis. Finally, my results are presented in Section 6, followed by a concluding discussion in Section 7.

2 *Empirical Literature*

2.1 *Public Expenditure on Education*

Although pre-primary school attendance continues to be far from universal, resources aimed at children ages 4 to 6 involve large pay-offs which go beyond the scope of the child, alleviating conditions for families and sometimes whole communities (Garcia, Pence and Evans, 2008). A report by Heckman (2006) proves that the human capital gains from investing in preschool programs are considerably higher than those in schooling and job training. In addition to the direct effects on children's development, the study further supports the fact that programs are often diverse in their domains, providing large spill-over effects on households (Gaag and Tan, 1999).

Esther Duflo (2000) evaluated a policy experiment in Indonesia targeted at the education system, more specifically primary schools. The Indonesian Government launched a large-scale school expansion strategy back in 1973, leading to the construction of more than 61,000 primary schools. The program itself was designed to reduce existing differences in enrolment rates between cohorts, allocating more resources to disadvantaged areas. Indonesia accomplished increased school enrolment by 15% for boys and 13% for girls. In her study, Duflo made use intensity and time variation across cohorts to estimate the effects of the expansion on education and earnings. Her findings report not only significantly increased years of schooling by 0,12 to 0,19 years for children aged 2 to 6 for every new school built per 1,000 children, but also pure economic returns ranging from 6.8% to 10.6% from the expansion.

More importantly however, the estimation strategy is superior to many previous studies in the same category. A barrier for many researchers in this area of study has been identifying variables to replace individuals' education level, as this is most likely to be endogenous investments in schools. Duflo manages to overcome this by efficiently controlling for non-systematic differences between regions before the implementation due to the fact that the construction program varied by region and date of birth (Duflo, 2000).

Nonetheless, it is hard to draw a conclusion regarding returns to infrastructure investments in developing countries as there are a range of other factors which could very well be counteracting the advancements. Perhaps the most prominent being the demand for education. Several aspects of a family's life have been shown to influence education decisions in less

developed countries such as socioeconomic status, resources and family background and structure (Buchmann and Hannum, 2001). Findings such as the above could thus be of importance to decision-makers in developing countries when designing policy frameworks.

2.2 *Pre-Primary Attendance and Maternal Employment*

There are several studies which have looked specifically at the indirect effects of these programs on household behaviour and the labour market supply of women. Most of the previous literature focuses on the elasticity of child care costs on maternal employment. In a large majority of these studies, child care costs are measured either as area averages or as household expenditures. While differing in characteristics and magnitude, most studies find that mothers' decision to work seems to respond positively to reduced child care costs and increased access of facilities (see Kimmel 1998; Lokshin, 2000; Baker, Gruber and Milligan, 2005; Lefebvre and Merrigan, 2008).

These papers constitute a large contribution to the empirical work on female labour supply in the developed world, and provide sizeable evidence for potential gains from policies aimed at reducing child care costs. Unfortunately, little attention is devoted to identifying any differences between married and single mothers, as the majority of papers only focus on the prior. Kimmel (1998) reports elasticities in the range of -4.54 to +1.38, proving that there is no clear relationship to be found.

Although many early childhood interventions have taken place in developing countries, to date, very few papers provide any evaluation of the outcome of these programs (see, Berlinski and Galiani, 2007; Wong and Levine, 1992; Connelly, DeGraff and Levinson, 1996; Lokshin, 1999).

Notably, a study conducted by Lokshin, Glinskaya and Garcia (2000) investigates the case of early childhood development in Kenya. Kenya experienced a large increase in the number of ECD facilities between 1963 and 1990, after their independence, which led to the enrolment of nearly 1.2 million children. In line with previously mentioned studies, they find that high child care costs discourage households from investments, thus having a negative effect on the labour supply decision of mothers. Their estimations also provide evidence of an income and substitution effect within the household, namely that of a mother's wage and the school participation of her children. In fact, a dominating income effect is found for sons, while daughters are associated with a stronger substitution effect. In other words, girls

substitute education for chores at home to a significantly larger degree than boys as a result of decreased maternal wages. The authors thus conclude that the presence of ECD centres positively affects enrolment of girls as they are freed from responsibilities in the household.

Such parental consumption choices, together with intra-household resource allocation, have been investigated many times before. Thomas Duncan (1990) uses survey data on family health and nutrition in Brazil to investigate how parents' consumption patterns change with different income distributions. Duncan finds evidence of certain gender preference. Mothers tend to spend more on both sons and daughters than fathers. Moreover, maternal income effects are larger for daughters than sons, while the opposite is true for fathers.

In Kenya, household structures have shown to be of importance for other children in the same family. Teenage girls aged 14 to 17 are 41% less likely to enrol in school if there is a child below the age of 3 in the household. Teenage boys in the same situation report a reduced probability of only 5%. This study provides evidence of the role of siblings in households where child care services are limited or unavailable (Deolilakar, 1998).

In summary, research on the topic of child care and maternal labour market decisions is diverse. For the most part, under the assumption of a household model, empirical evidence on enrolment rates and maternal labour supply in industrialized countries suggest the presence of a positive and linear relationship. However, apart from Galiani and Berlinski (2007) and Lokshin, Glinskaya and Garcia (2000), there is very limited evidence on the impact of pre-primary enrolment rates on maternal employment that comes from less industrialized countries such as South Africa. Nonetheless, these authors suggest a positive and significant elasticity between pre-primary enrolment and mothers' employment. These papers also support the incidence of an underlying household model and its surrounding assumptions, essential to the analysis of a mother's decision making process.

3 *Background*

South Africa is a middle-income, developing country with a GDP per capita of \$2.705 in 2001. The country stood out with one of the worlds largest shares, 20% of GDP, of public investment in education in 2001. The gross enrolment ratio in primary education in the same year was 103% and the gender parity index 1.01, indicating almost perfect gender equity.

Remarkably, pre-primary enrolment experienced a dramatic increase from 36% in 2001 to 72% in 2011 (WDI, 2016). Nonetheless, poverty remains the biggest challenge facing South Africa, with 6 out of every 10 children categorised as poor, mainly in rural areas. Large improvements have been made, however, ever since the transition to democracy in 1994. With it came the establishment of a new constitution which turned the focus towards human rights, gender equality and poverty reduction.

Economic growth has averaged 3.6% between 1994 and 2008, and in terms of fighting gender inequalities, apart from the labour market, South Africa has reached most of its equality targets included in the Millennium Development Goals. However, albeit the progress, there are still many factors which need to be addressed. Labour market gender gaps have stayed consistent, as well a range of other challenges facing women's empowerment (United Nations, 2012). Undermining the low levels of socio-economic development are also obstacles such as inadequate nutrition, lack of access to quality healthcare, HIV/Aids and education (Department of Education, 2001a).

3.1 Education and Early Childhood Development Provisioning

In 2009, education in South Africa was divided into two governing structures, the Department of Basic Education (DBE) and the Department of Higher Education and Training (DHET). The DBE is now responsible for primary and secondary education as well as ECD centres, while the DHET is in charge of higher education and further training. More importantly, the Department of Social Development (DSD) is responsible for the registration of community-based ECD facilities. Prior to the division, the National Department of Education (DoE) was responsible for all types of schooling. Now, each of South Africa's nine provinces has its own education department (Department of Education, 2015).

Formal provisioning of Grade R began in 1994, a critical point of time historically for South Africa. Two years later, in 1996, the country reached a turning point with the introduction of compulsory education for all children aged 7 to 15 (Grade 1–9), as stated in the constitution. Later on, in the post-apartheid period, policymakers realized the importance of accessibility and affordability of public education as a tool to diminish the widespread poverty (Constitution of South Africa, 1996).

In particular, two vital policies were designed in 1996 and 2007 to help alleviate schooling conditions for the poor, the School Fee Exemption policy and No-fee schools.

Parents are eligible for full fee exemption from schools only if their combined annual income is lower than ten times the annual school fee per learner. No-fee schools work in a different setting, offering free schooling for the poorest 40% in areas with schools from Grade R to Grade 9. Still, however, up to 37% of children aged 14-17 years do not attend school as a result of schooling fees. In high-schools, 50% of students drop out for the same reason (Children's Institute, 2016).

Pre-primary education has only since the beginning of the 20th century gained much attention from policymakers. In 2001, together with the White Paper 5 on Early Childhood Education (2001), South Africa quantified the lack of ECD provisioning. Out of 6 million children in the age group 0-6, only 1 million were enrolled in some sort of ECD site. In particular, less than half of the population in the 5-6-year age cohort attended such facilities.

A global, as well as national, recognition of its impacts reflect the recently increased devotion to ECD from the South African government. This has led to a rapid increase in subsidies from the provincial departments to this sector (UNICEF, 2011). Since 2001, both the number of children enrolled in Grade R and government budgets to education and social development have increased dramatically. Between 2001 and 2011, Grade R enrolment increased more than threefold, from approximately 230,000 to 730,000 students. Yet far from universal, substantial progress has been made (Department of Basic Education, 2012).

Moreover, not only are these interventions now seen as efficient development mechanisms for children for future learning, but also for reducing gender and racial gaps, a consistent barrier since the time of apartheid. This is also thought to be a result of the United Nations Conventions on the Rights of the Child (CRC), after which South Africa put children on top of the agenda as a national priority (Department of Education, 2001a).

A pilot project was launched in 1997 by the Department of Education with the ambition to test a pre-designed ECD policy. Among others, one objective was to research the most effective way of delivering a reception year. Provinces were given ear-marked funds to be spent on community-based ECD sites and educator training. The project covered over 2,730 sites and 66,000 learners. Results clearly indicated the need for increased provision of Grade R nationally, as well as making it compulsory. Additionally, improving the quality of ECD services, especially for younger learners, was identified as another critical policy implication (Department of Education, 2001b).

Today, guidelines for funding and policies regarding ECD are determined centrally, although provincial education departments are allowed to tailor their own policy products. The Departments of Basic Education (DBE) are responsible for Grade R in public schools,

while the Departments for Social Development (DSD) are in charge of community-based ECD sites (UNICEF, 2011).

The proposals introduced in Education White Paper 5 in 2001 directly target the most disadvantaged in the South African society, offering support in the form of increased state resourcing and quality assurance in public schools, with the goal of full coverage for Grade R (Department of Education, 2008).

3.2 *The South African Labour Market*

From an economic perspective, the South African labour market has played an important role historically. It has formed the modern South African society in many ways, although its contributions have been ambiguous and sometimes recognized as harmful.

In 1994, after the first democratic elections took place, the labour market in South Africa went through a variety of fundamental changes. During the time of apartheid, it was characterized with high levels of segregation. Blacks were not allowed the same amount of involvement in the working force as their white counterparts, limiting their ability to take part in the labour market and thus improve their standards of living. Several legislations laid out the discriminating foundation for non-whites and their poor working conditions at that time. The Group Areas Act of 1950 and the Black Labour Act of 1964 are examples of such, both limiting the rights of Blacks while reserving highly-paid and highly-skilled occupations to the white population. Black union rights were deeply undermined and could not provide any legal protection to their members, nor any bargaining power. As a consequence, the large discrepancies within the labour market led to sustained high levels of unemployment, low rates of labour force participation between groups as well as enhanced social inequalities (Festus, Kasongo, Moses and Yu, 2015).

However, the development of the South African labour market took a turn through the radical adjustments that occurred after 1994, the beginning of the post-apartheid era. Although major structural changes followed with the new policies and legislations, the deep roots of discrimination and inequality were still apparent. Surprisingly, globalization and trade liberalization were not efficient in eradicating these fundamental imbalances many years after, possibly due to the lack of previous experience of market integration.

More recently, the focus of the South African government has been on exposing the labour market internationally while effectively maintaining competition and performance

domestically. Poverty and inequality challenges are still highly relevant, as the country has reported increasing aggregated Gini coefficients between 1993 and 2008. Income inequality has only increased after 1993, leading to worsened conditions for wage earners in the bottom deciles. Unemployment rates have also been ambiguous, adding to the population division. Workers in the top deciles are less unemployed, while the opposite is reported in the bottom four deciles. On a positive note, however, racial discrimination has decreased by 21% between 1993 and 2008 (Leibbrandt, Woolard, McEwen and Koep, 2010).

As previously mentioned, poverty is still one of South Africa's barriers. Labour market participation is often seen as one of the more effective tools of poverty reduction. However, the government has yet not succeeded with the process of integrating individuals from poor areas into the labour market. Instead, welfare programs have managed to support the poorest population surprisingly well. Studies have shown that the social grants issued by the government have worked as a main source of income for a large amount of the poor households, many times leading to significantly improved standards of living. As a result, declines in poverty rates could have very little to do with labour market interventions for individuals in the poorest deciles (Leibbrandt, Woolard, McEwen and Koep, 2010).

Much like racial inequalities, gender inequalities are multifaceted. Many different aspects of a society can influence the size of the gap between men and women. As previously mentioned, labour markets often act as important determinants. A common belief is that economic growth, by design, is accompanied by improved conditions for everyone involved. This is not necessarily the case. Although economic growth is an important driver of social transformation, the outlining structures and regulations of labour markets can go a long way in terms of alleviating conditions for disadvantaged women (UNRISD, 2010).

Female labour force participation in South Africa has experienced a large increase since the end of apartheid, growing by a staggering 38% up until 2011. The current rate (48%) is still low in an international context however, and stays persistent below that of men (61%). An explanation to the increase is provided by Kingdon and Knight (2008), who highlight a few contributing factors. According to their study, it is the combination of improved education, fewer employed males, lowered HIV/AIDS mortality rates as well as a rise in the number of female household heads leading up to the increase. Consequently, due to the many channels in which female labour force participation is determined, it is an interesting area to further investigate.

4 *Data and Descriptive Statistics*

This study is based on data drawn from the South African National Census and a Community Survey between the years 2001, 2007 and 2011. The first census was released in 1996, followed by a second in 2001 and the postponed release of a third dataset in 2011. In 2007, a Community Survey was undertaken as a complement to the delayed third National Census (Statistics South Africa, 2007).

Both the Community Survey and the National Census consist of a range of questions capturing comprehensive details on individuals and household structures at a municipality level. The reason for not including any data prior to 2001 is due to the implementation of White Paper on Education 5 in the years following 2001 as well as the lack of reliable and appropriate data.

4.1 *Sample Selection*

In order to carry out the econometric analysis, information about household members, employment status, characteristics of mothers as well as other household properties is extracted from the raw dataset. Firstly, mothers in the age group 16-45 in households are identified in the sample. These mothers are then sampled to see if they have at least one child between 5 and 6 years of age enrolled in pre-primary education. Whether or not the mother is also the household head is not distinguished between in this analysis. Secondly, a fraction of children aged between 5 and 6 enrolled is created to more efficiently measure how the enrolment rates have increased over the years. This is measured both at the household level as well as the municipality level.

Furthermore, mothers are considered to be employed if they earn a positive wage. This means that they are not limited only to market work but can also start their own business or work from home. In other words, the time gained from increased school enrolment can be allocated freely, as long as a positive income is generated.

Important surrounding household properties and characteristics of mothers are also included. These consist of age dummies, employment status and income earned, as well as controls for the presence of other household members such as an income-generating husband. The decision to include these control variables is simply based on their effect on a mother's

labour market decisions. A more detailed discussion about their individual significance to my model is included in Section 5.1.

Table 1 provides an overview of the sample and all of the included variables. The total number of households in the raw data amounts to 9,000,108. After extracting the subset of households central to this quantitative analysis, the baseline sample consists of 462,203 households in which there is a mother with at least one child in the age group 5-6, spread across 220 different municipalities. In each of the following analyses, the observations are weighed according to their occurrence in the random sample.

4.2 *Data-Related Issues*

Several previous researchers have tried to identify proper instrumental variables or other alternative measures related to education in order to accurately capture changes not related to household characteristics or family decisions².

As mentioned in Section 2, these papers have used either data on public investments in education or data on the number of school buildings constructed as exogenous sources of variation. However, in the case of South Africa, barriers in the form of inaccurate and inconsistent annual reports limit the provision of data on provincial pre-primary expenditure and supply. Although some provinces report sufficient data over all of the years, the lack of coverage and observations in other regions would most likely bias the results. In fact, due to some of the Grade R classes being offered in unregistered community-based sites with even less administrative data customs, numbers often constitute larger approximations, seldom separated from public schools. Similarly, data collection on constructed schools or classrooms has not been made available solely for Grade R for all of the relevant years and provinces.

As a consequence of these discrepancies, there are very few studies on any long term outcomes from the investments in pre-primary schooling not based on local surveys or smaller subsamples of schools. It is also evident from available papers that basic data regarding Grade R in particular needs major quantitative and qualitative upgrades³.

Labour force data is widely available from several sources. A big advantage with using the National Census datasets and the Community Survey are the detailed and accurate questionnaires on the working status and incomes of individuals in combination with the large

² See, for example, Duflo, 2000; Galiani and Berlinski, 2007; Lokshin, Glinskaya and Garcia, 2000

³ For recent studies, see: Van der Berg et al., 2013; UNICEF, 2011

coverage on municipality level. Alternative sources include the National Income Dynamics Survey (NIDS), which is measured on a monthly basis, and the Quarterly Labour Force Survey (QLFS). These latter two datasets do not cover as many observations nor include any other household questions compared to the Census or the Community Survey. A third option is the General Household Survey (GHS) which contains a wide range of questions on both individual and household characteristics (including employment); however is limited by its geographical aggregation to province and metro level⁴.

On a final note, it is worth mentioning that the administrative data has gone through considerable improvements in recent years with the creation of new datasets and more accurate records. A big part of this progress should be accredited to the Nationwide Audit of ECD Provisioning, published in 2001, in which the Department of Education sought to raise awareness of the lack of sufficient research and information about these programs. One of the main objectives with the release of this paper was to gather more quantitative data and to broaden the knowledge base in order to stimulate policy development (Department of Education, 2001a).

5 *Identification Strategy*

I seek to investigate the size of the causal effect from increased enrolment rates on maternal labour supply. In my estimation strategy, I make use of individual and household data provided by the National Census datasets in 2001 and 2011 and the Community Survey in 2007 to retrieve households relevant to the study. As the focus lies on changes in the mother's employment status over time, the most basic specification will include data purely on mothers' incomes and children's schooling. The scope is then broadened to include other surrounding factors which are likely to affect a mother's choice.

The methodological approach is a differences-in-differences specification used to observe non-systematic changes over time and across municipalities. The model, its surrounding properties and limitations will be discussed in detail in Section 5.2.

⁴ South African Data Archive, 2016

5.1 *Conceptual Framework*

The underlying theoretical framework in this study is based on two bodies of literature, the economics surrounding household decision making in developing countries, as well as the relationship between maternal labour market decisions and children's schooling. In the study of education inequalities in less developed countries, models often contain a demand and a supply side. The prior consists on the dynamic interrelationships within households regarding education and the latter constitutes the provision of educational institutions (Buchmann and Hannum, 2001).

I assume the presence of a household model in which mothers undertake a utility maximizing strategy based on themselves and the well-being of their children, constrained by available time and resources. More importantly, provision of Grade R is seen as a form of out-of-home child care arrangement. Mothers can choose to either take part in the labour force or to allocate their time to domestic care giving. The underlying assumptions will be explained in more detail below.

In terms of household utility, raised attendance rates resulting from an increased supply of public pre-primary schools can be seen as a form of child care subsidy. Consequently, this will give rise to an income and a substitution effect due to changes in household's budget constraints, given that the non-family child care option offered is preferred. The size of the income and substitution effect will thus act as determinants for whether or not the mother engages in paid work (Gelbach, 2002).

An alternative utility comparison can be found in a study by Heckman (1974) in which a method is presented of directly estimating changes in money income and non-market time. Heckman specifically uses the example of work-related child care and specifies a function for the mother's marginal rate of substitution. Thus, both of these studies suggest a household production model in which mothers actively take part in the labour force as market productivity surpasses home productivity.

Surrounding circumstances are also of importance to the mother's decision making process. The presence of other children, as well as wage-earners, in the household could be a cause of behavioural changes. Moreover, fertility decisions in households could potentially be seen as endogenous in terms of child care and labour force participation. However, Connelly, et al. (1996) observe insignificant changes in maternal labour force activity with fertility included in the model. It is therefore treated as an exogenous variable, not of relevance to my

final model.

Given the incidence of a utility maximizing household, we can identify some key factors determining pre-primary school take-up. Firstly, the presence of other household members earning a positive income might affect the mother's budget constraint ambiguously. For example, if the husband is a wage earner within the household, this is likely to reduce the incentives for mothers to actively take part in the labour force due to resource pooling. On the other hand, other household members can also function as additional caregivers, freeing up time for mothers to engage in paid work. Secondly, I assume that highly educated mothers are more keen to enter the labour market than those with lower educational attainment due to a higher wage earning potential. Thirdly, control variables for additional children below the age of 5 and between ages 7 to 15 are also included in the full specification due to their relevance in terms of domestic child care.

A mother is considered less likely to join the labour force if she alone constitutes the only source of care for her child. Siblings in the age of 7-15 could thus act as additional caregivers. However, this is likely to be dependent on the enrolment status of these children. Instead, if children require more care at home, I expect to find the opposite effect. Similarly, additional children within the household under the age of 5 are assumed to have a negative impact due to the increased childcare demand (Connelly, et al., 1996).

Lastly, I add dummies for the age of the mother as well as a measure of technological advancement to the basic model in order to explore any differential effects across age groups and the potential impact of economic development on employment across municipalities.

5.2 *Baseline Specification*

In the empirical analysis, I use repeated cross-sectional data from the South African National Census in 2001 and 2011, and the Community Survey from 2007, to estimate the impact of children's enrolment in early childhood education on their mother's labour supply.

The baseline specification is estimated by Ordinary Least Squares (OLS) as follows:

$$Y_{ijt} = \alpha + \beta_{ijt}Enrol_{ijt} + \alpha_1 X_{ijt} + \varphi_j + \gamma_t + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} measures maternal employment in the form of earning a positive wage in household i , in municipality j , at time point t ; $Enrol_{ijt}$ is our variable of interest, namely the fraction of children aged 5-6 in households attending Grade R; α is the intercept at time point $t = 0$, X_{ijt} is a vector of a mother's characteristics; β_{ijt} measures the elasticity of household Grade R enrolment on maternal employment; φ_j is a vector of municipality fixed effects, γ_t are year fixed effects and ε_{ijt} are independent mother-specific error terms across municipalities.

This basic specification, however, constitutes an interpretational barrier due to potential unobserved selection issues of children into child care. Consequently, it is likely that a mother's decision to enrol her child, which is based on several characteristics, could introduce a bias into our estimates. On the one hand, high potential earning capabilities of mothers are assumed to lead to an upward bias of my estimates. However, this assumption might be more prevalent in developed countries where poverty is not as widespread. Alternatively, due to the introduction of a publicly funded large-scale National School Nutrition Programme (NSNP) in 1994, my results could instead be biased downwards⁵. Thus, in the context of a developing country such as South Africa, the likelihood of the latter effect occurring could be perceived as higher.

In an attempt to overcome these potential biases, I exploit the roll-out of Grade R across municipalities in a differences-in-differences framework. This strategy requires a municipality-level measure of the availability of Grade R, such as classrooms or the number of Grade R teachers⁶. Unfortunately, such data is not readily available for municipalities in South Africa. Instead, I propose to use the municipality-level fraction of 5 to 6-year old children who are enrolled in Grade R classes as a proxy for Grade R provision. This proposed measure is obviously highly correlated with the number of Grade R places available, and it can readily be extracted from the South African National Census and Community Survey. When introducing this aggregate measure, I also make the assumption that children compete for Grade R places with all other children in the same age in their cohort. A disadvantage of using this proxy, however, is that it might not only reflect the supply of Grade

⁵ The National School Nutrition Programme (NSNP) is publicly funded by the Department of Basic Education and provides learners from Grade R to Grade 7 with daily free meals.

⁶ For example, Berlinski and Galiani (2001) exploit a large-scale construction program of pre-primary school facilities in Argentina. Similarly, Duflo (2000) relies on public investments in primary school facilities in Indonesia.

R, but also demande-side factors, which could be correlated with other municipality-level characteristics. I deal with this problem below.

A differences-in-differences specification reads as follows:

$$Y_{ijt} = \alpha + \beta_{jt}\widehat{Enrol}_{jt} + \alpha_1 X_{ijt} + \varphi_j + \gamma_t + \varepsilon_{ijt} \quad (2)$$

where \widehat{Enrol}_{jt} is the aggregated fraction of children aged 5-6 in municipalities attending Grade R, only allowed to vary by municipality j , at time point t ; β_{jt} measures the elasticity of municipality-level Grade R enrolment on maternal employment. More specifically, I implement the aggregated Grade R attendance rates as an Instrument Variable (IV) for children aged 5 to 6 in municipality j at time point t .

Due to the inclusion of municipality and year fixed effects, this regression identifies the effect of interest only from changes within municipalities over time. The assumption is that in the absence of a “treatment”, i.e. a differential rise in the fraction of 5 to 6-year olds enrolled in Grade R, maternal employment in all municipalities would follow a common and systematic trend, determined by their characteristics and underlying properties. In other words, in contrary to the OLS regression, Eq. (2) removes all child-specific variation in Grade R attendance within municipalities which is likely to be driven by the previously mentioned endogenous selection issues. Instead, the IV estimator exploits variations in attendance rates across municipalities, expected to be driven by the expansion of schools, differing in intensity and timing across cohorts. Consequently, there should be no non-random and time-varying factors at the municipality level that determine both the fraction attending Grade R and maternal labour supply. This assumption, often known as the common time trend assumption, grows in significance as the geographical aggregation becomes narrower (Dustmann et al., 2013). The reported F-statistic testing for the strength of my instrumental variable is 2980, yielding a highly significant p-value of 0.

Nonetheless, aggregated municipality level attendance rates may still be exposed to sources of bias. For example, the timing and magnitude of the expansion of pre-primary classes in municipalities might be correlated with underlying child development trends. If these trends are systematically correlated, my estimates will be biased upwards. Moreover, the roll out pace of Grade R classes could potentially be driven by municipal macroeconomic traits, affecting both maternal labour supply and pre-primary attendance. A third source of

bias could stem from children being exposed to changes in family composition. Such changes are likely to have an impact on pre-primary attendance regardless of available Grade R slots.

In order to deal with these potential biases, and to make sure that my estimates can be interpreted as causal effects, I conduct a robustness check along with a heterogeneity analysis in Section 6.3.

6 Results

6.1 OLS Regressions: Baseline Results

Can we identify any causal relationship between pre-primary attendance and maternal labour supply? I report my baseline OLS results in Table 2. The dependent variable consists of mother's earning a positive wage throughout all regressions. Similarly, all specifications are conditioned on municipality and year fixed effects. Moreover, all reported sets of standard errors are clustered at the municipality level.

Both the standard OLS and the IV estimations show that the increased Grade R attendance rates have a positive effect on maternal employment. The higher the potential enrolment rate, the more likely the mother will participate in the labor force. Mothers in households with additional wage earners, older mothers, and more skilled mothers are more likely to work.

In the first column of Table 2, the estimates with the household fraction of children attending Grade R as my independent variable suggest a positive linear relationship between pre-primary enrolment and maternal labour supply. Thus, in the most basic specification, excluding all control variables, the observed outcome is 0.0612, indicating an impact of 6.1% towards women earning a positive wage stemming from an additional 0.1 unit increase in the fraction attending. However, due to potential selection issues, a causal impact is not identifiable.

In Column (2), I take into account the presence of other wage earners within the household. The positive and significant coefficient suggests that additional household members earning a positive income increases the likelihood of mother's engaging in market work. A likely explanation to this is the incidence of other wage earners acting as substitute caregivers to the mothers, allowing mothers to gain more free time.

Controlling for more than one 5-year old child in the household as well as additional children between ages 7 and 15 reveal negative impacts on mothers employment decisions. Statistically significant coefficients are observed in both cases of -0.0385 and -0.0133 respectively. In line with my expectations, other children younger than 5 years of age in the household require more time for child care from mothers, thus reducing the likelihood of employment. The second coefficient, however, is probably highly dependent on whether or not children in ages 7 to 15 attend school. Considering a situation where primary attendance is high, such as in South Africa, these children will likely not be able to act as support to their mothers in terms of domestic child care, impacting maternal employment negatively.

Furthermore, in line with previous research, the educational attainment, or skill, of mothers is positively correlated with their employment decisions. Column (5) shows a strong and significant coefficient of 0.143 from completed level of schooling. This is simply due to higher wage earning potentials accruing from higher levels of completed years of schooling.

Moreover, as seen in Column (6), I also find that older mothers are more sensitive to changes in enrolment rates of their young children in South Africa. In addition to the households characteristics and mothers properties, I include dummy variables for the availability of a telephone and electricity in households, aggregated to the municipality level in order to control for potential technological advancements across cohorts driving variation in enrolment rates. Displayed in Column (7), these measures show positive and significant coefficients, indicating that infrastructural development is likely to have an impact on enrolment and female labour supply. Moreover, this effect is probably stronger in developing countries due to potential large disparities in levels of technological development between regions or municipalities.

6.2 *IV Regression: Municipality Level*

Next, in Table 3, I replace the household fraction attending with the municipality-level fraction of children attending pre-primary school in an IV. This is done to deal with the endogenous properties associated with the household variation. I specify the new, aggregated variable as an instrument variable (IV) to the household fraction. The same procedure as the one above is performed, where household composition and dummies for the mothers age and skill level, as well as measures of technological advancements, are added to the regression. Moreover, I condition on municipality and year fixed effects and standard errors are clustered

across all 220 municipalities. Both OLS and IV estimates consistently suggest that increased pre-primary enrolment improves maternal labour market outcomes.

All variables behave in a similar manner as in the OLS regressions, although the IV estimates of my independent variable are significantly larger. A likely explanation to this can be offered in the selection bias assumption in Section 5.2, stating that mothers in South Africa might be more prone to send their children to school in order to reap the benefits from the National School Nutrition Program (NSNP). After substituting the household fraction for the municipality fraction of children attending pre-primary school, significantly stronger positive effects are to be found in Table 3. Thus, in this setting, my findings suggest the presence of a negative bias stemming from non-random selection of children into pre-primary schooling.

In fact, Column (1) shows an impact of 13.7% with the new independent variable in place, indicating that enrolment explains significantly more of the observed variations in mothers earning a positive wage across municipalities. The estimates from the full specification, including all variables, are shown in Column (7). These numbers suggest that pre-primary school enrolment help explain variations in maternal employment for mothers between ages 18 and 49 by approximately 10.4%.

A big advantage of using the IV strategy over my baseline regression in Equation (1) to measure the impact is that my instrument now constitutes a source of exogenous variation, allowing me to interpret my results more efficiently. However, determining causality still requires an investigation of whether or not any underlying variations are systematically driving my results. I undertake such an analysis below.

6.3 Robustness Check and Heterogeneity Analysis

In order to determine the strength of my results, I perform a robustness check in Table 4. As mentioned in Section 5.2, there could be underlying factors driving my baseline results. In terms of both pre-primary enrolment and maternal employment, the general unemployment rate in municipalities, which constitutes a macroeconomic variable which might be correlated with the attendance rates in South Africa over time, could be an unobserved variable of interest to my analysis. Consequently, I include a measure of the aggregated unemployment rates for both men and women across municipalities in order to see how it affects my estimates. All of my reported coefficients in Table 4 tend to be similar in magnitude with only minor variations, confirming that unemployment rates do not have significant impacts on my

findings.

Moreover, family composition could constitute another unobserved factor driving my results. However, since I am able to identify and track the same households across all years and municipalities, along with the inclusion of control variables related to household characteristics, such variations should already be accounted for in my model.

In addition to the robustness check, I perform a heterogeneity analysis. This analysis consists of limiting my sample to educational attainment. I exclude all mothers who have completed less than a college degree. By doing so, I isolate the highly educated mothers which, in line with the assumption of higher wage earning potentials being correlated with educational attainment, is expected to yield higher estimates. The new subsample consists of 127,392 highly educated women with at least one child aged 5 to 6.

In Table 5, I report results based on my baseline specification in Equation (2), where I instrument the household fraction attending with the municipality fraction attending pre-primary school. My results appear to support the previously mentioned hypothesis as the point estimates are significantly increased throughout all columns, indicating that educational attainment works as a strong incentive for mothers to enrol their children in pre-primary school, and thus engage in paid work.

7 *Discussion and Conclusion*

In this paper, I study the impact of pre-primary enrolment in South Africa on maternal labour supply. My variable of interest consists of mothers who earn a positive wage. I draw on administrative data from two sets of Census Surveys, one in 2001 and another in 2011, as well as a Community Survey in 2007, in order to extract household information across 220 municipalities. As a response to the low enrolment rates in pre-primary education, South Africa implemented a childhood development plan in 2001 in order to raise attendance rates among children younger than 6 years of age. More specifically, a major goal of the plan was to expand the availability of Grade R classes for children aged 5 to 6. Moreover, women's labour force participation has stayed consistently below that of men in South Africa. I therefore find it interesting to study the potential relationship between enrolment rates in pre-primary education and mothers' labour market decisions.

To deal with potential selection issues and biases stemming from household characteristics, I exploit variations aggregated on municipality level. Optimally, information about the number of schools or classrooms built during the expansion would have been available for all municipalities. However, as this is not the case, the fraction of children aged 5 to 6 attending pre-primary education across municipalities is used as an instrument for the household fraction.

While controlling for household composition, mothers' characteristics and technological development, I find that increased enrolment rates on the municipality level have significantly positive effects on maternal labour supply. I observe an effect from a 0.1 unit increase in the fraction attending on the likelihood of a mother engaging in paid work of 10.4%, indicating that it is a strong predictor of the labour market behaviour of mothers in South Africa.

Furthermore, my results indicate that once I control for the staggered timing and intensity of the Grade R expansion through the municipal variation, my IV estimates are larger than their corresponding OLS values. I offer an explanation to these differences in the negative selection bias induced by mothers sending their children to schools where they are offered daily meals from the National School Nutrition Program (NSNP). It could be the case that such behaviour is more likely to occur in developing countries where high wage earning potentials among mothers is not as common due to widespread poverty.

Overall, the results of my study indicate that in addition to the benefits accruing from increased pre-primary school enrolment, programs such as an expansion of pre-school facilities in developing countries can offer positive effects on maternal labour force participation. This is achieved through releasing more time for mothers from domestic child care to enable them to engage in paid market work.

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Table 1. Summary statistics for all included variables

Variables	N	Mean	SD	Min	Max
Earn positive wage	462,203	0.296	0.457	0	1
Household fraction attending	462,203	0.716	0.444	0	1
Municipal fraction attending	462,203	0.698	0.148	0.220	0.945
Other wage earners	462,203	0.222	0.416	0	3
Children below age 5	462,203	0.807	0.925	0	12
Children aged 7-15	462,203	1.320	1.275	0	23
Telephone available	462,203	0.142	0.349	0	1
Electricity available	462,203	0.760	0.427	0	1
Mother's aged 16-29	462,203	0.550	0.497	0	1
Mother's aged 30-39	462,203	0.328	0.469	0	1
Mother's skill level	462,203	1.316	0.521	1	3

Notes: Telephone available, Electricity available and Mother's age groups are all dummy variables taking on the value 1 if true, otherwise 0. Mother's skill level is measured as going from equal to 1 if the mother has completed at most primary school, 2 if she has completed at most secondary school and 3 if she has finished higher education.

Table 2. The impact of the fraction of children aged 5-6 attending Grade R in households on maternal employment

Dependent Variable: <i>Wage earning mothers</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HH fraction attending	0.0612*** (0.00595)	0.0586*** (0.00572)	0.0536*** (0.00544)	0.0530*** (0.00543)	0.0364*** (0.00418)	0.0317*** (0.00384)	0.0267*** (0.00345)
Wage earners		0.0931*** (0.00483)					
Children under age 5			-0.0370*** (0.00161)				
Children age 7-15				-0.0130*** (0.00129)			
Mother's skill level					0.143*** (0.00592)		
Mother's aged 16-29						-0.236*** (0.00523)	
Mother's aged 30-39						-0.0618*** (0.00447)	
Electricity							0.0266*** (0.00379)
Telephone							0.0559*** (0.00378)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	462,203	462,203	462,203	462,203	462,203	462,203	462,203
R-squared	0.046	0.053	0.058	0.060	0.083	0.125	0.128

Notes: OLS regressions. All standard errors are clustered on municipality level (220 clusters) in parentheses. Running the full specification in Column (7) does not alter any of the coefficients not presented in the table above.
*** p<0.01, ** p<0.05, * p<0.1

Table 3. The impact of the aggregated fraction of children aged 5-6 attending Grade R in municipalities on maternal employment

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Wage earning mothers</i>							
Muni fraction attending	0.1374** (0.0657)	0.1322** (0.0647)	0.1191* (0.0660)	0.1165* (0.0652)	0.1219* (0.0664)	0.1290** (0.0659)	0.1042* (0.0603)
Wage earners		0.0880*** (0.00630)					
Children under age 5			-0.0333*** (0.00204)				
Children age 7-15				-0.0115*** (0.00131)			
Mother's skill level					0.1321*** (0.00853)		
Mother's aged 16-29						-0.227*** (0.00611)	
Mother's aged 30-39						-0.0581*** (0.00345)	
Electricity							0.0194*** (0.00502)
Telephone							0.0519*** (0.00655)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	462,203	462,203	462,203	462,203	462,203	462,203	462,203
R-squared	0.008	0.014	0.019	0.021	0.041	0.083	0.088

Notes: IV regressions. All standard errors are clustered on municipality level (220 clusters) in parentheses. Running the full specification in Column (7) does not alter any of the coefficients not presented in the table above. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Robustness check. The impact of the aggregated fraction of children aged 5-6 attending Grade R in municipalities on maternal employment including municipality-level unemployment rates.

Dependent Variable: <i>Wage earning mothers</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Muni fraction attending	0.1375** (0.0675)	0.1370** (0.0656)	0.1243** (0.0655)	0.1247** (0.0648)	0.1219** (0.0657)	0.1252** (0.0651)	0.1099* (0.0624)
Wage earners		0.0880*** (0.00629)					
Children under age 5			-0.0331*** (0.00244)				
Children age 7-15				-0.0114*** (0.00130)			
Mother's skill level					0.1321*** (0.00847)		
Mother's aged 16-29						-0.2276*** (0.00604)	
Mother's aged 30-39						-0.0581*** (0.00344)	
Electricity							0.0191*** (0.00501)
Telephone							0.0515*** (0.00645)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemployment rates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	462,203	462,203	462,203	462,203	462,203	462,203	462,203
R-squared	0.007	0.014	0.019	0.020	0.042	0.083	0.087

Notes: IV regressions. All standard errors are clustered on municipality level (220 clusters) in parentheses. Running the full specification in Column (7) does not alter any of the coefficients not presented in the table above. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Heterogeneity test. The impact of the aggregated fraction of children aged 5-6 attending Grade R in municipalities on maternal employment for mothers who have completed at most college education.

Dependent Variable: <i>Wage earning mothers</i>	(1)	(2)	(3)	(4)	(5)	(6)
Muni fraction attending	0.2412** (0.1081)	0.2386** (0.1051)	0.2162** (0.1055)	0.2075** (0.1034)	0.2113** (0.1006)	0.1774** (0.0951)
Wage earners		0.1149*** (0.00986)				
Children under age 5			-0.0372*** (0.00299)			
Children age 7-15				-0.0157*** (0.00168)		
Mother's aged 16-29					-0.3047*** (0.01395)	
Mother's aged 30-39					-0.0921*** (0.01001)	
Electricity						0.0579*** (0.00703)
Telephone						0.0549*** (0.00854)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	127,392	127,392	127,392	127,392	127,392	127,392
R-squared	0.009	0.002	0.009	0.013	0.066	0.076

Notes: IV regressions. All standard errors are clustered on municipality level (220 clusters) in parentheses. Running the full specification in Column (7) does not alter any of the coefficients not presented in the table above. *** p<0.01, ** p<0.05, * p<0.1