CSIS Discussion Paper No. 114

Access to childcare and the employment of women with preschool-aged children in Tokyo*

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September, 2012

Abstract

This paper presents a geographical and empirical study on childcare accessibility and the importance of access to childcare in attaining preferred employment among women with preschool-aged children. The study area is the Tokyo's ward area, which has a large number of children on childcare waiting lists. Visualized accessibility reveals a considerable geographic mismatch between childcare center supply and demand, especially for children aged 2 years or below. Empirical results show that access to childcare is closely associated with a higher probability of attaining preferred employment among women with preschool-aged children. The association is remarkably strong when a woman has a very young child aged 0–2 years and when the childcare center is one that is desired. Adequate childcare provision, particularly for children under age 3, would increase active female participation in the labor market.

* This work was supported by the Grants-in-Aid for Scientific Research [20330045, 22510140] from the Japan Society for the Promotion of Science. The author is grateful to the Bureau of Social Welfare and Public Health of the Tokyo Metropolitan Government, local municipalities, and individual childcare centers for the valuable childcare data they provided for this study. The author would like to thank Yukiko Abe, Yukako Ono, and participants in conferences, seminars, and workshops for their valuable suggestions. Any errors in this paper, however, are my sole responsibilities.
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1. Introduction

With the increasing participation of women in the labor market, work-life balance has become an important policy issue in many countries (Crompton and Lyonette, 2006; OECD, 2008). Families attempting to balance their work and family life face numerous challenges and one of these is to find appropriate childcare for their children while they work. If adequate childcare is unavailable, many parents may abandon the employment they prefer. Other parents may have no choice but to use undesirable (e.g., distant and low quality) childcare out of necessity, which can hamper not only the work-life balance but also children's well-being and development. The lack of adequate childcare is reported to be a problem in various areas around the world (Apps and Rees, 2005; Blau, 2001; Del Boca and Vuri, 2007). Apps and Rees (2005) argue that childcare shortage is a result of market failure, representing a strong case for public intervention.

The lack of access to childcare arises not only because of a supply shortage but also because of a geographical mismatch between supply and demand for childcare. Even when a slot in a childcare center is available, that opening may remain inaccessible unless the center is located within a reasonable distance from home. However, the geographic mismatch of childcare arising from considerations of a reasonable distance from home has not been sufficiently examined, perhaps due to data limitations. Childcare accessibility, often termed childcare availability, has been examined for relatively large geographic areas such as counties and regions (Davis and Connelly, 2005; Gordon and Chase-Lansdale, 2001; Kreyenfeld and Hank, 2000).[1] Webster and White (1997) use a more detailed geographic area—a circular area with a radius of 800 meters—when measuring accessibility of childminders. However, there is

[1] Gordon and Chase-Lansdale (2001) use data at the zip-code level; however, the supply-demand mismatch is presented at the metropolitan level.

only limited research that addresses the accessibility of childcare centers, taking into account not only the supply but also the demand that spatially competes for the supply (i.e., spatial competition). Moreover, very few studies differentiate children's ages in measuring childcare accessibility, although the level of childcare services can differ considerably by age.

In many countries, considerably more women with young children wish to participate in the labor market than actually do. In most EU countries, among couples with children under the age of 6, more women express a desire to participate in the labor force than actually do (Jaumotte, 2003). A national survey in Japan shows that among women with preschool children aged 4 or 5, the majority (72%) wish to work, but less than half of that figure (37.4%) actually work (Gender Equality Bureau Cabinet Office of Japan, 2007). The large disparities between desired and actual employment patterns indicate substantial potential for the promotion of female labor force participation. There is a large body of literature suggesting that the lack of access to childcare is a problem affecting the balance between work and family. Thus far, however, the extent to which access to childcare is important in the attainment of *preferred* employment is an empirical question that has not been fully explored.

The objective of this research is to shed new light on these under-researched aspects of childcare access and work-life balance. Specifically, this study addresses the following two questions. First, does a geographic mismatch exist between the supply of, and demand for, childcare centers, and does it differ according to the age of children? Second, is access to childcare centers important in attaining preferred employment among women with preschool-aged children?

To answer the first question, the accessibility of childcare centers incorporating

the geographic mismatch of their supply and demand was calculated and visualized for each infant age group. Unlike previous childcare studies, this research takes into account spatial competition in the accessibility, incorporating a concept of reasonable distance for childcare trips. The accessibility is calculated at the block level—a micro area—using detailed spatial data and a geographic information system (GIS). With regard to the second question, probit models are estimated using a unique survey dataset on balancing work and child rearing and accessibility to childcare centers. This study also examines whether the importance of access to childcare differs according to the following three variables: status of preferred employment (full-time versus part-time), age of youngest child (younger versus older preschool child), and type of childcare (desired versus other-than-desired). The study area is Tokyo's 23 wards, which have a large number of children on childcare waiting lists.

The remainder of the paper is organized in the following manner. A review of the literature is presented in Section 2 and Section 3 describes the study area and the rise in demand for childcare in Tokyo. The methodology is described in Section 4, and the results are presented in Section 5. The findings and policy implications are discussed in Section 6.

2. Childcare access and preferred work-family balance

This section reviews the literature on access to childcare and work-family balance and clarifies the research questions raised in this paper. First, I discuss why the geographic mismatch of childcare may is important in balancing work and family; I then describe why access to childcare may be significant in attaining preferred employment among women with young children.

2.1 Geographic mismatch of childcare

A geographic mismatch of childcare bespeaks an imbalance between the locations of childcare facilities (childcare supply) and childcare users or seekers (childcare demand). The geographic mismatch matters since the location of childcare facilities is important for many families who rely on childcare to reconcile work and family life (Tivers, 1988). Travel to childcare facilities adds substantial time to work commutes. In addition to reduced mobility with young children, a parent has to take the child to childcare in one place and then travel to another place to work. Thus, it is not surprising that proximity to home is often an important consideration when selecting childcare, particularly among women (Hanson and Pratt, 1990; Kawabata, 2010).

Two theories can explain why the geographic mismatch of childcare may impede work-family balance. First, the geographic mismatch is a factor that contributes to the creation of childcare waiting lists, which may negatively affect the attainment of work-family balance. Certain areas have childcare waiting lists, which reflect excess demand in those areas. Placement on a waiting list is likely to have a negative impact on attaining preferred work-life balance, although empirical evidence is limited.

Second, the geographic mismatch of childcare may be a significant hindrance to job access. For many families, access to childcare is a prerequisite for access to jobs (Kwan, 1999: van Ham and Büchel, 2006; van Ham and Mulder, 2005). The geographic mismatch creates areas where childcare is scarce, which may place severe constraints on job search and employment options. As the distance to childcare increases, the job search cost is likely to be higher and job opportunities are likely to become fewer. The constraints of travel to childcare are likely to be stronger for women than for men

(Kwan, 1999; Pickup, 1988), since mothers are most likely the primary carers in households (de Meester et al, 2011; Schwanen *et al*, 2007). Indeed, many employed women work closer to home or the local labor market and their commutes are shorter than those of men (Pickup, 1988).

2.2 Childcare access and work-family balance

While work-life balance is an important policy in many countries, a large discrepancy between preferred and actual employment persists, particularly among women with young children (Jaumotte, 2003). Studies suggest that a lack of adequate childcare is a major barrier to attaining preferred employment among women with preschool-aged children. For example, a number of studies find that greater availability of childcare increases female participation in the labor market (Gordon and Chase-Lansdale, 2001; Herbst and Barrow, 2008; Stolzenberg and Waite, 1984; van Ham and Büchel, 2006; van Ham and Mulder, 2005; Webster and White, 1997). Surveys in the UK and US indicate that many more women would work or work longer hours if satisfactory childcare was available (Presser and Baldwin, 1980; Tivers, 1988).

Some literature suggests that the problem of childcare shortage may be significantly greater for full-time rather than part-time employment, younger rather than older children, and desired rather than less-desired childcare. For example, inadequate childcare spending is found to be more of a constraint for full-time participation in the labor market than for part-time participation (Jaumotte, 2003; Powell 1998). It is widely recognized that constraints on women's employment due to children are stronger for younger than older children (Leibowitz *et al.*, 1992; Stolzenberg and Waite, 1984). Several studies report that when desirable childcare centers are unavailable, many

women with young children do not work or work lesser number of hours (Kawabata 2010; Presser and Baldwin, 1980). Thus, the importance of access to childcare in the attainment of preferred employment may significantly differ between full-time and par-time employment, younger and older children, and desired and less-desired childcare.

3. Study area and rise in childcare demand in Tokyo

The study area comprised Tokyo's 23 wards, which encompass the central and densely populated area of Tokyo Metropolis, a metropolitan prefecture in Japan (Figure 1). The study area covers 622 square kilometers with a population of 8.5 million people in 2009. In the remainder of this paper, this area will be referred to as the "Tokyo ward area," while "Tokyo" will indicate the entire Tokyo Metropolis.

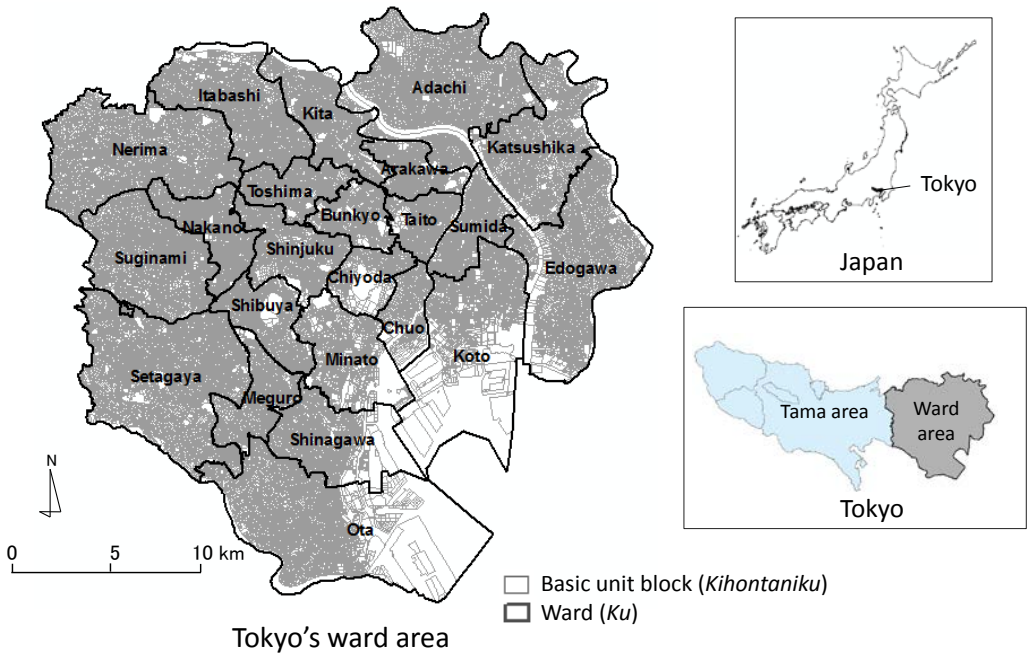

Figure 1. The study area.

For more than a decade, the Japanese Government has strived to increase childcare services to eliminate waiting lists at childcare centers throughout the country. In 2001, the Cabinet endorsed the 'Zero Wait Listed Children Strategy,' and in 2008, the government implemented the 'New Zero Wait Listed Children Strategy.' Nonetheless, the rise in demand has far outpaced the increase in supply; during fiscal year 2009, childcare waiting lists in Japan grew by 891 children, even though the total supply of childcare slots increased by approximately 26,000 (MHLW, 2010).

Childcare waiting lists are an urban problem in Japan. As of April 2010, most waiting lists were found in urban areas, with Tokyo alone accounting for 32% of the total number of children on childcare waiting lists nationwide (MHLW, 2010). Between 2005 and 2010, Tokyo has witnessed a dramatic increase in licensed daycare waiting lists (Figure 2), data for which were obtained from the Bureau of Social Welfare and Public Health of the Tokyo Metropolitan Government (TMG). The total number of children on waiting lists rose by 62% (from 5,221 to 8,435), with the period 2008–2009, in particular, showing a remarkable increase. The rise in demand among younger children aged 0–2 years is noteworthy. Between 2005 and 2010, waiting lists for children ages 0, 1, and 2 years grew by 199%, 109%, and 36%, respectively, whereas the lists decreased by 26% for age 3 years and 65% for ages 4 years and above. Consequently, the proportion of 0- to 2-year-olds on waiting lists rose from 76% to 91%. The 1-year-old group was predominant, accounting for almost half the total number on waiting lists in 2010.

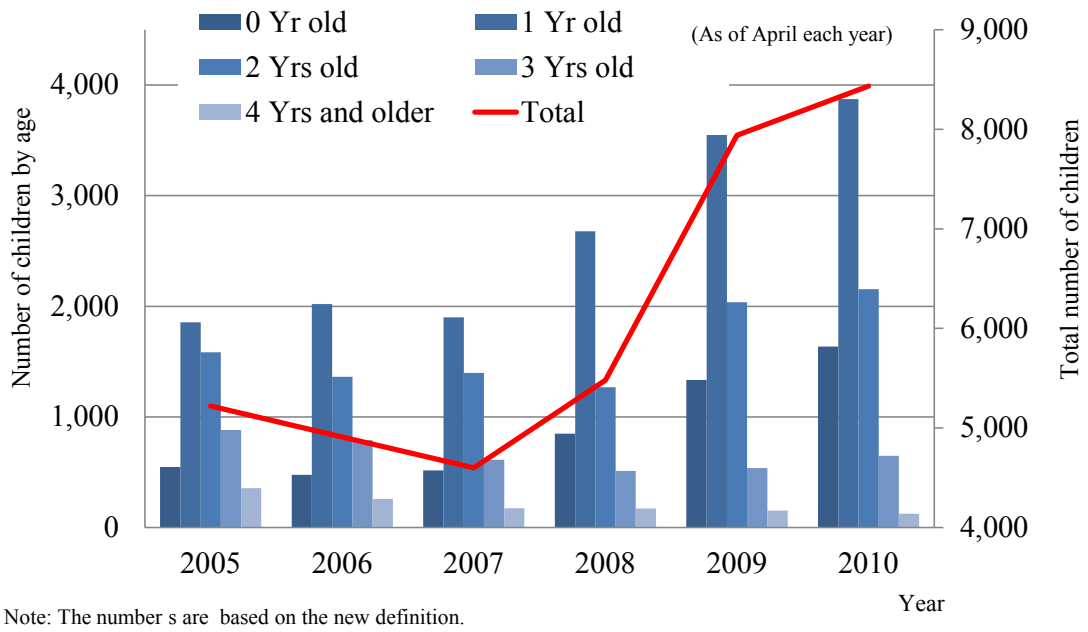

Figure 2. The number of children on waiting lists for licensed daycare centers in Tokyo, 2005–2010.

Note that the actual demand for childcare centers is likely to be much greater than indicated by the waiting list numbers in Figure 2, as suggested in Zhou and Oishi (2005). This is due to a number of reasons. First, waiting list data are available only for licensed daycare centers, and the relevant figures for other types of childcare centers are not included. Second, the publicly available numbers do not include licensed daycare applicants who are enrolled in non-licensed centers receiving public agency support or applicants who requested a single licensed daycare center (as opposed to multiple selections) in their applications for desired facility. Since many users of non-licensed daycare centers also apply for licensed daycare centers, the eliminations of those applicants results in demand from the perspective of users being underestimated. Third, licensed daycare waiting lists released are usually as of April, when the lists tend to be shortest. Since most licensed daycare facility enrollments are made at the start of the

fiscal year in April, the waiting lists tend to grow toward the end of the fiscal year. Finally, many people do not apply for positions on waiting lists, put off by the difficulty in enrolling in licensed daycare centers. Licensed daycare centers use rigorous selection standards, prioritizing applicants employed full-time over part-time workers and job seekers, for instance. Thus, the potential demand not reflected by publicly released data may be enormous.

Increasing the number and capacity of childcare centers is a pressing policy issue in Japan. In order to resolve the problem of childcare waiting lists, the TMG is aiming to increase childcare capacity by 22,000 spots over three years from 2010 (TMG Bureau of Social Welfare and Public Health, 2011).

4. Method

This study uses a two-part methodology. The first part examines the geographic mismatch between childcare center supply and demand, and the second part analyzes the importance of access to childcare centers in the attainment of preferred employment among women with preschool-aged children. Each part will be described below.

4.1 Geographic mismatch of childcare centers: accessibility and data

In order to examine the geographic mismatch between childcare center supply and demand, accessibility is calculated for each basic unit block (*kihontaniku*). The basic unit block is the smallest geographic unit for which census population data are available. There are 115,501 basic unit blocks within the study area (Figure 1). Accessibility is measured in various ways depending on its purpose (Handy and Niemeier, 1997; Morris *et al*., 1979). In order to meet the goals of this study, I measured accessibility in a

manner that can indicate not only the mismatch between childcare supply and demand but also their geographic mismatch, using the following measurement:

$$A_i^a = \sum_{j:d_{ij}<d_0} \frac{S_j^a}{\sum_{k:d_{kj}<d_0} r^a P_k^a}, \qquad (1)$$

where a is the age of children; A_i is the accessibility for a resident zone i; S_j is the supply of a childcare center j; d_{ij} and d_{kj} are the respective distances by road between resident zones i and k, on the one hand, and a childcare center j, on the other; d_0 is the threshold distance for commuting to childcare centers; r is the ratio of those requiring childcare centers to the entire population; and P_k is the population in a resident zone k.

An important point is that the accessibility measurement takes into account spatial competition, as described in Harris (2001); the proposed measurement incorporates not only the spatially accessible supply but also the demand spatially accessible to the supply. This accessibility measurement is similar to the two-step floating catchment area method employed by Luo and Wang (2003) and Wang and Luo (2005), among others, in that the measurement combines the following two steps: 1) at each location of a childcare center, the ratio of supply to its surrounding demand (within a threshold distance to the childcare center) is calculated; and 2) at each demand (residential) location, the ratios (derived in the first step) surrounding (within the same threshold distance from) the demand location are summed. Therefore, an accessibility value, in essence, represents the supply-demand ratio; accordingly, an accessibility value of 1 represents a supply-demand balance, whereas a value of greater or less than 1 indicates excess supply or demand. An accessibility measurement that allows such interpretation is intelligible and useful for policy making. Note that the

population-weighted average of accessibility for the whole area equals the supply-demand ratio for the whole area. It should be pointed out that not taking into account the supply and demand outside the study area can distort the supply-demand ratio, particularly around the border of the study area; however, this is unlikely to be a major problem in this study, since most childcare centers prioritize applicants living in the same ward or Tokyo.

There are various types of childcare in Tokyo. This analysis focuses on three types of childcare centers: licensed daycare centers (*ninka-hoikujo*), TMG-certified daycare centers (*Tokyo's ninsyo-hoikujo*), and authorized childcare centers (*nintei-kodomoen*). These three types of centers were selected for the following reasons: their quality and affordability are ensured at certain levels by national or TMG standards,[2] they are the major providers of childcare services in Tokyo, and relevant data on the other non-licensed childcare centers were unavailable. Quality and cost are often the primary concerns in countries where childcare services are provided in the private sector such as the US (Blau, 2001; Blau and Robins, 1988), whereas availability seems to be more of an issue in countries where most childcare services are publicly subsidized, such as Germany, Japan, and the Netherlands (Del Boca and Vuri, 2007; Kreyenfeld and Hank 2000; van Ham and Mulder, 2005).

Data on the three types of childcare centers categorized by age were obtained from the Bureau of Social Welfare and Public Health of the TMG, ward offices, and individual childcare centers. Spatial data on basic unit blocks in the 2005 census were provided by the Statistical Bureau of Japan. For the supply of childcare centers (S_j), I used

[2] The costs of the three types of childcare centers are regulated so that their maximum monthly fees are set at approximately 80,000 yen (about $1,000 at JPY/USD80). Fees for licensed daycare centers are determined depending on family income and the age of the child, from no fee at all (for welfare recipients, for example) to approximately 80,000 yen per month. Suzuki (2010) estimated that the average monthly fee paid for licensed daycare centers is 20,000–30,000 yen (approximately $250–$375).

the capacity, as of April 2009, of the three types of childcare centers. Capacity tends to be smaller for younger children. The total capacity for children aged 0 is 10,158 spots, aged 1 is 18,592 spots, aged 2 is 21,876 spots, aged 3 is 22,954 spots, and aged 4 and above is 45,885 spots.

The distance by road between basic unit blocks and childcare centers (d_{ij} and d_{kj}) are calculated using the 2009 road network data and GIS. Here, locations of basic unit blocks are the centroids of those blocks, and locations of childcare centers are the spatial points created using the detailed address matching service of the Center for Spatial Information Science at the University of Tokyo.

The ratio of those requiring the three types of childcare centers to the population (r) is set at 20% for infants aged 0 and 35% for children aged 1 year and older.[3] The population by basic unit block (P_k) for each age was estimated using 2009 population data by age for each subdivision (*chocho-aza*) of a city. The subdivision, which is larger than a basic unit block but smaller than a ward, is the smallest geographic unit for which population data by age were available for the year 2009. The data for subdivisions were disaggregated into the data for basic unit blocks on the basis of the proportional distributions of the 2005 census population at the basic-unit-block level, which were provided by the Statistics Bureau of Japan.

Figure 3 shows maps visualizing the spatial distributions of childcare centers and estimated numbers of preschool-aged children by basic unit block. Both childcare

[3] These figures are based on the 2009 ratios in the Tokyo ward area that were estimated on the basis of available data, using the following equation:

$$r^a = (S_l^a + S_{ta}^a + Q_l^a - E_{ta}^a) / P^a \quad (2)$$

where a denotes the age of children, S_l the number of children enrolled in licensed daycare centers, S_{ta} the capacity of TMG-certified and authorized childcare centers (since the number of children enrolled in these two types of centers were not obtainable), Q_l the number of applicants for licensed daycare centers minus the number of applicants admitted, E_{ta} the number of children in Q_l but enrolled in TMG-certified or authorized childcare centers, and P the population. The estimated ratios are 17% (for age 0), 34% (1 year), 37% (2 and 3 years), and 35% (4 and 5 years).

centers and preschool-aged children are widely distributed in the Tokyo ward area, except for nonresidential areas such as rivers and parks. Note that the dots in the figure indicate the locations of the total of 1,477 childcare centers, and the number of the locations is smaller for a particular age group.

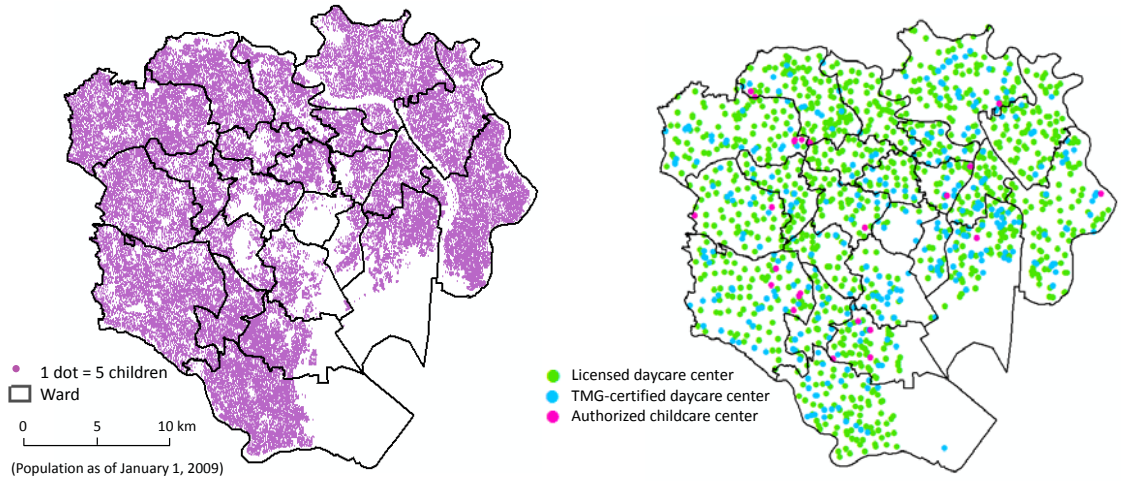

Figure 3. Spatial distributions of childcare centers (a) and preschool children (b) in the Tokyo ward area, 2009.

For the threshold distance to childcare centers (d_0), I used 500, 750, and 1,000 meters, given that over 90% of travel times to childcare facilities in Tokyo are approximately 15 minutes or less (Miyazawa, 1998; Kawabata, 2010). Assuming a walking speed of approximately 50 meters per minute with young children in tow (Segawa and Sadahiro, 1996), the three thresholds are approximately 10, 15, and 20 minutes on foot, respectively.[4]

The calculated accessibility measurements are then visualized using GIS. The visualization is effective for identifying the geographic mismatch, particularly when the

[4] In the Tokyo ward area, the most common means of traveling to childcare centers is by bicycle on days when weather permits but by foot on days with inclement weather (Kawabata, 2010). Pinch (1984) and Webster and White (1997) use a similar threshold, about 800 meters (half a mile), which Pinch considers a reasonable duration given travel challenges on bad weather days.

study area consists of a large number of locations (blocks).

4.2 Childcare access and attaining preferred employment: the model and data

The importance of access to childcare centers in attaining preferred employment by women with preschool-aged children is examined by estimating probit models. With regard to preferred employment, this study addresses two employment statuses—full-time and part-time employment. It is assumed that preferred employment is attained if a woman who prefers to work full-time is working full-time or if a woman who prefers to work part-time is working part-time. The sample is from a unique Internet-based questionnaire survey on balancing work and child rearing and accessibility to child-care centers, which was conducted over the period November 20–25, 2009. The survey data include answers from 311 respondents among 650 women with preschool-aged children living in the Tokyo ward area. The respondents are widely distributed across the 23 wards and their basic demographic statistics are not very different from the 2005 census data.[5] The survey data indicate a considerable discrepancy between preferred and current employment status. Of the 311 women, 263 (85%) prefer to work and are the population of interest, while less than half of that—113 (36%)—are actually working. Among those who prefer to work, part-time is preferred to full-time employment. Our models use 261 women who prefer to work and answer all the relevant question items. Of the 261 women, 71 (27%) prefer full-time employment while the rest, 190 (73%), prefer part-time employment.

The probit models take the following form:

$$P(y=1 \mid X, Acc, Acc \cdot D) = \Phi(\alpha + \beta X + \gamma Acc + \delta Acc \cdot D) \quad , \qquad (3)$$

[5] Details regarding the survey are documented in Kawabata (2010).

where y is the binary response variable 1 if preferred employment is attained, and 0 otherwise. X is a set of individual and neighborhood characteristics—age, number of children, presence of a very young child, presence of full-time husband or partner, working experience, and female unemployment rate, which are likely to be relevant to women's employment outcomes based on the labor market literature. *Acc* comprises the variables on access to a childcare center, and D denotes either a dummy indicating preference for working full-time or a dummy indicating the presence of a child aged 0–2 years.

Table 1 explains variable descriptions and descriptive statistics. The four variables on access to childcare centers are (i) access to a childcare center (*acc1*), (ii) access to a desired childcare center (*acc2*), and (iii) access to an other-than-desired childcare center while unable to have access to a desired childcare center (*acc3*), and (iv) the accessibility of childcare centers at the ward level for the youngest child (*acc4*). The variables *acc2* and *acc3* are used to examine whether the importance of childcare centers differs between desired and other-than-desired childcare centers. The accessibility variable, *acc4*, is at the ward level, larger than the basic unit block level, since the residential information of the sample is limited to the ward level. The interaction terms, $Acc \cdot D$, are introduced in order to examine two further aspects—whether the importance of access to a childcare center differs by the type of preferred employment (full-time and part-time) and the presence of a very young child aged 0–2 years.

Table 1. Variable descriptions and descriptive statistics.

Variable	Description	Mean	s.d.
Attained preferred employment	1 if preferred employment attained; 0 otherwise	0.31	
Age 30-34 years	1 if between 30 and 34 years old; 0 otherwise	0.35	
Age 35-39 years	1 if between 35 and 39 years old; 0 otherwise	0.38	
Age ≥ 40 years	1 if 40 years old or older; 0 otherwise	0.16	
2 or more children	1 if living with 2 or more children; 0 otherwise	0.55	
Child age 0-2 years	1 if child is aged 0–2 years; 0 otherwise (child aged 3–5 years)	0.55	
Full-time partner	1 if living with a husband or partner who is working full-time as a regular employee; 0 otherwise	0.85	
Work experience before childbirth	1 if working up to (less than one year before) birth of the youngest child; 0 otherwise	0.56	
Full-time work preference	1 if preferring to work full-time; 0 otherwise (preferring to work part-time)	0.27	
Access to childcare center (*acc1*)	1 if using childcare center for the youngest child; 0 otherwise	0.32	
Access to desired childcare center (*acc2*)	1 if using desired childcare center for the youngest child; 0 otherwise	0.25	
Access to other-than-desired childcare center (*acc3*)	1 if using other-than-desired childcare center for the youngest child because unable to use desired childcare center; 0 otherwise	0.07	
Accessibility of childcare centers, ward-level, 750m, value×100 (*acc4*)	Population-weighted average of accessibility of childcare centers using the 750-meter threshold, for the youngest child, at the ward level (value×100)	97.5	20.9
Female unemployment rate (ward level, %)	Female unemployment rate (%), at the ward level	4.96	0.81
Number of observations		261	

5. Empirical results

First, I present the results of the geographic mismatch between childcare center supply and demand. Next, the importance of access to childcare centers in attaining preferred employment for women with preschool-aged children is explained.

5.1 Geographic mismatch of childcare centers

Figure 4 shows visualized results of the accessibility of childcare centers by basic unit block for the commuting threshold of 750 meters. The maps reveal a considerable geographic mismatch in childcare center supply and demand. It is striking that many blocks have accessibility values below 1 (excess demand, or childcare shortage), particularly for younger children aged 0–2 years. A closer examination with the spatial distributions of preschool-aged children and childcare centers (Figure 3) reveals that blocks with low accessibility have the following three patterns in general. First, there are no childcare centers nearby (within the commuting threshold). Second, centers nearby do not provide care for a particular age group. Third, demand exceeds supply for a particular age group, although centers nearby do provide care for that age group.

The sensitivity to the two alternative commuting thresholds of 500 and 1,000 meters was examined. When the 500-meter threshold was used, the number of blocks with considerably low accessibility values below 0.25 increased substantially, particularly for children aged 0, for whom both the number and capacity of childcare centers are limited; many blocks do not have childcare centers within the 500-meter threshold. On the other hand, when the 1,000-meter threshold was used, the number of blocks with considerably low accessibility decreased because many blocks have childcare centers within 1,000 meters. However, there were still many blocks with accessibility below 1. This result indicates that even when parents can travel a distance to a childcare center, many areas still have childcare shortage. Thus, although alternative thresholds led to different spatial variations in accessibility, the finding that low accessibility exists in many blocks was consistent.

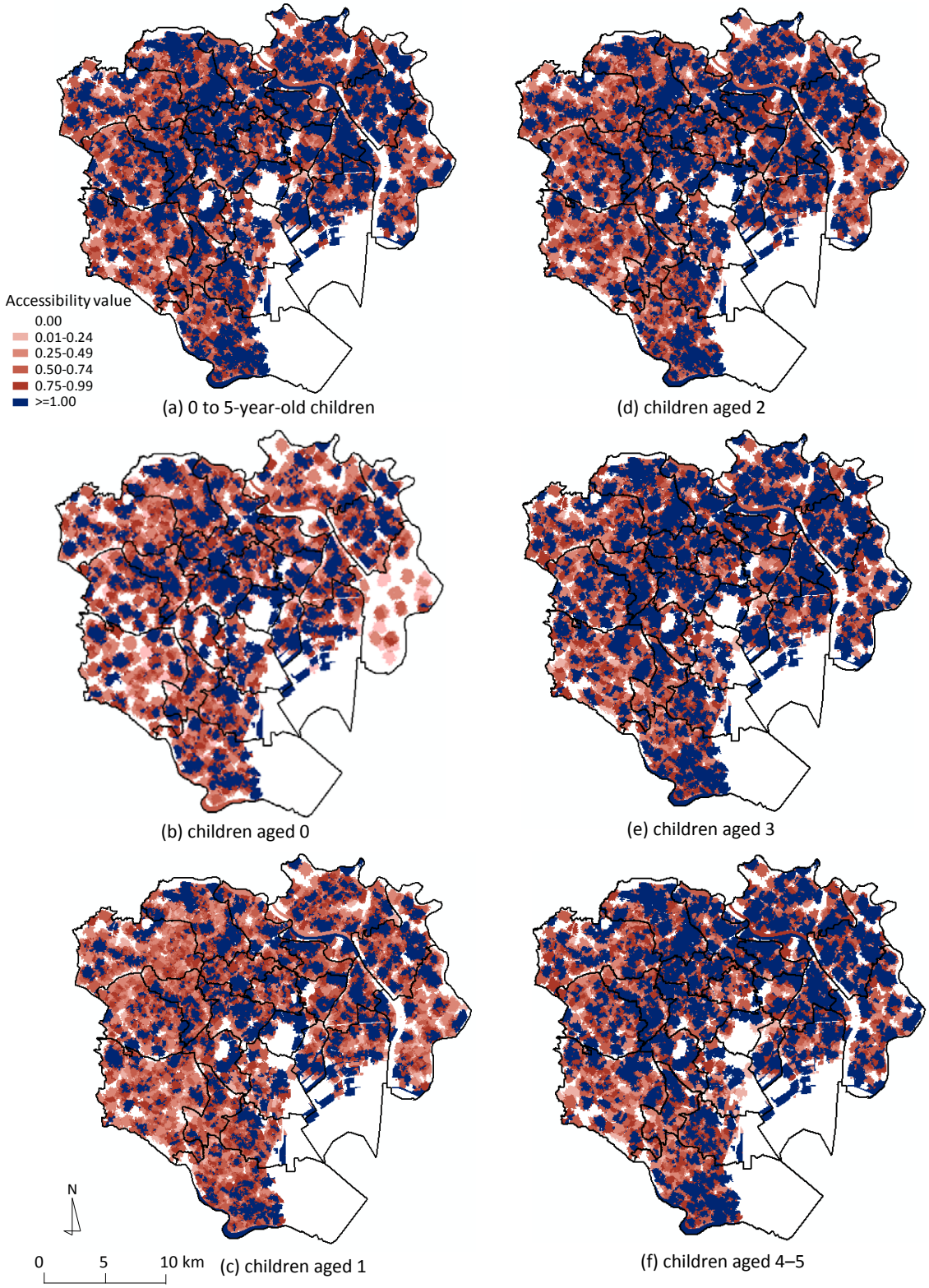

Figure 4. Accessibility of childcare centers in the Tokyo ward area (commuting threshold of 750 m), 2009.

The considerable geographic mismatch for younger children appears to be related to the large numbers on childcare waiting lists for younger children (Figure 2). I investigated this relationship by using simple linear regression models relating the accessibility measurement to the number on the waiting list in 2009 at the ward level for each age group. Here, since the smallest spatial unit for which waiting list numbers were available was the ward, the population weighted-average accessibility at the ward level was used for the regression. Regression estimates are summarized in Table A2 (Appendix). As expected, poorer accessibility was significantly associated with a larger waiting list for children under the age of 3 years, and the most significant association was found for the 1-year-old group for which the waiting list was the largest. On the other hand, the association for children 3 years and older was smaller in magnitude and insignificant. The weak association for the children 3 years and older may be related to the fact that they can be accommodated in kindergartens, which reduces childcare waiting lists.

5.2 Childcare access and attaining preferred employment

Table 2 presents the estimation results of probit models examining the importance of access to a childcare center in attaining preferred employment by women with preschool-aged children. The five models using different sets of variables were estimated to examine whether the importance of access to a childcare center differs between (1) a desired childcare center and an other-than-desired childcare center, (2) a woman preferring to work full-time and a woman preferring to work part-time, and (3) a woman with a very young child aged between 0–2 and a woman whose youngest child is in the age group of 3–5 years.

Model 1 examines the importance of access to childcare center in attaining preferred employment. Access to a childcare center is significantly associated with a higher probability of attaining preferred employment. The estimated marginal effect (at the mean) indicates that the probability of attaining preferred employment is 38.7 percentage points higher when an otherwise-average woman has access to a childcare center. Model 2 divides childcare centers into desired and other-than-desired. Both access to a desired childcare center and access to an other-than-desired childcare center have positive and significant associations with the attainment of preferred employment.

In Model 3, an interaction term is included in order to examine whether the association between access to a childcare center and the attainment of preferred employment differs between full-time and part-time as the preferred employment. The results indicate that the association does not differ significantly according to the status of preferred employment. Model 4 includes an interaction term to examine whether the association differs by the presence of a very young child in the age group of 0–2 years. Indeed, the association is greater for a woman with a very young child in the age group of 0–2 years than for a woman whose youngest child is in the age group of 3–5 years. For an otherwise-average woman with a very young child in the age group of 0–2 years, the probability of attaining preferred employment is 40.8 percentage points higher when she has access to a childcare center. On the other hand, when the youngest child is in the age group of 3–5 years, the difference is much smaller—26.3 percentage points. Model 5 divides childcare centers into desired and other-than-desired centers and adds two interaction terms to examine whether the association between access to each of the two types of centers and the attainment of preferred employment differs by the presence of a very young child in the age group of 0–2 years. A significant difference emerges when

the childcare center is the desired center. For an otherwise-average woman whose youngest child is in the age group of 0–2 years, the probability of attaining preferred employment is 61.9 percentage points higher when she has access to a desired childcare center, whereas for a woman whose youngest child is in the age group of 3–5 years, the difference is much smaller, 23.5 percentage points. When the childcare center is an other-than-desired center, the association is not made significantly different by the presence of a child in the age group of 0–2 years.

It should be noted that the estimated results cannot prove the causality due to potential bias arising from endogeneity between access to childcare centers and employment. However, the estimated results do offer evidence suggesting at least that access to childcare and the attainment of preferred employment are strongly associated.

In all the models, the ward-level accessibility of childcare centers using the commuting threshold of 750 meters shows weak and insignificant association with the attainment of preferred employment. The insignificant result holds true when alternative accessibility with the threshold of 500 or 1,000 meters is used. The results may be partially due to using accessibility measurements at the ward level rather than at the basic unit block level (Figure 4), on account of the limited residential area information of the sample. The particularly tight childcare market (excess demand) might also play a part in the insignificant result. In a tight market, a woman might put extra effort in overcoming the spatial barrier by finding other childcare help or moving residence.

Other variables that are significantly associated with the probability of attaining preferred employment in all the models are discussed below. Living with two or more children is positively associated with the attainment of preferred employment, which might suggest that having more than one child causes a greater financial need to

work. The presence of a very young child (under the age of 3) is negatively associated with the attainment of preferred employment. Living with a husband or partner who is working full time is also negatively associated with the attainment of preferred employment. Working experience before childbirth is related to a higher probability of attaining preferred employment. These results are reasonable given the existing labor market literature.

Table 2. Probit estimates of attaining preferred employment.

	Model 1		Model 2		Model 3		Model 4		Model 5	
Age 30-34 years	-0.077	[-0.025]	-0.076	[-0.024]	-0.069	[-0.022]	-0.117	[-0.036]	-0.057	[-0.018]
	(0.349)		(0.349)		(0.349)		(0.358)		(0.363)	
Age 35-39 years	0.129	[0.042]	0.130	[0.042]	0.138	[0.045]	0.069	[0.022]	0.124	[0.040]
	(0.353)		(0.353)		(0.353)		(0.361)		(0.366)	
Age ≥ 40 years	-0.287	[-0.086]	-0.284	[-0.085]	-0.298	[-0.089]	-0.320	[-0.092]	-0.332	[-0.099]
	(0.406)		(0.407)		(0.408)		(0.411)		(0.418)	
2 or more children	0.512**	[0.161]	0.514**	[0.162]	0.505**	[0.158]	0.560***	[0.171]	0.471**	[0.149]
	(0.208)		(0.209)		(0.208)		(0.213)		(0.218)	
Child age 0-2 years	-0.430*	[-0.140]	-0.429*	[-0.139]	-0.457*	[-0.148]	-0.874***	[-0.277]	-0.936***	[-0.199]
	(0.235)		(0.235)		(0.238)		(0.304)		(0.310)	
Full-time partner	-0.779***	[-0.282]	-0.780***	[-0.282]	-0.756***	[-0.273]	-0.835***	[-0.299]	-0.902***	[-0.330]
	(0.243)		(0.243)		(0.246)		(0.248)		(0.250)	
Work experience before childbirth	0.669***	[0.207]	0.670***	[0.208]	0.644***	[0.199]	0.653***	[0.197]	0.594***	[0.186]
	(0.217)		(0.217)		(0.219)		(0.221)		(0.223)	
Full-time work preference					0.158	[0.059]				
					(0.303)					
Access to childcare center (*acc1*)	1.123***	[0.387]			1.066***	[0.373]	0.691***	[0.230]		
	(0.196)				(0.238)		(0.258)			
Access to desired childcare center (*acc2*)			1.111***	[0.395]					0.605**	[0.474]
			(0.213)						(0.270)	
Access to other-than-desired childcare center (*acc3*)			1.160***	[0.433]					1.234**	[0.453]
			(0.335)						(0.536)	
Full-time work preference × *acc1*					0.065	[0.408][a]				
					(0.420)	[0.359][b]				
Child age 0-2 years × *acc1*							0.983**	[0.514][c]		
							(0.392)	[0.263][d]		

(Cont'd)

	Model 1		Model 2		Model 3		Model 4		Model 5	
Child age 0-2 years × *acc2*									1.321***	[0.619][c]
									(0.440)	[0.235][d]
Child age 0-2 years × *acc3*									-0.033	[0.419][c]
									(0.705)	[0.454][d]
Accessibility of childcare centers, ward-level, 750m, value×100 (*acc4*)	0.004	[0.001]	0.004	[0.001]	0.004	[0.001]	0.003	[0.001]	0.001	[0.000]
	(0.006)		(0.006)		(0.006)		(0.006)		(0.006)	
Female unemployment rate (ward level, %)	0.050	[0.016]	0.047	[0.015]	0.035	[0.011]	0.074	[0.023]	0.126	[0.041]
	(0.129)		(0.131)		(0.131)		(0.132)		(0.138)	
Number of observations	261		261		261		261		261	
Percentage correctly predicted	78.9		78.9		79.3		77.4		79.3	
Log-likelihood value	-118.9		-118.9		-118.5		-115.7		-114.1	
McFadden's pseudo R-squared	0.26		0.26		0.26		0.28		0.29	

Constant is not reported. Standard errors are in parentheses. Statistical significance is indicated as follows: ***p < 0.01; **p < 0.05; and *p < 0.10. Marginal effects at the mean of the sample are in brackets; marginal effects for dummy variables are for discrete changes from 0 to 1. Marginal effects for interaction variables are for discrete changes from 0 to 1 in variables related to access to childcare centers when a) full-time work preference is 1; b) full-time work preference is 0; c) child age 0–2 years is 1; and d) child age 0–2 years is 0.

6. Conclusion

In this study, visualized accessibility at the block level has revealed the existence of a considerable geographic mismatch between childcare center supply and demand, particularly for younger children aged 2 years or below. For these children, lower accessibility of childcare centers was significantly associated with a longer childcare waiting list. Key findings from the probit models are summarized in the following three points. First, access to a childcare center was significantly associated with a higher probability of attaining preferred employment among women with preschool-aged children. Second, the association was not significantly different according to the status of preferred employment—full-time versus part-time. Third, access to a childcare center, particularly a desired center, was significantly more important in attaining preferred employment for a woman with a child in the age group of 0–2 years than for a woman whose youngest child is in the age group of 3–5 years old.

The findings of this study have important policy implications. First, resolving the geographic mismatch for children in the age group of 0–2 years helps to reduce the number of childcare waiting lists. The placement of childcare centers within a city and the extent of the development of these centers are questions that no evident policy has addressed. The accessibility measurement for spatial micro areas can be a useful indicator in the development of such policy. For example, developing childcare centers in low-accessibility areas with high demand could be an effective approach to reducing the number of waiting lists.

Second, providing adequate childcare helps women attain their preferred employment while raising children. Such provision could encourage women's active

participation in the labor market. It would be beneficial in areas experiencing childcare shortage (excess demand) as well as promoting female labor market participation. There is great potential here, as indicated, for example, by the substantial gap between current and preferred employment statuses.

Third, providing quality and affordable childcare for very young children (under the age of 3) is particularly valuable for women's attainment of preferred employment. There is a substantial number of women who need childcare in order to continue working while raising children. The lack of access to reliable childcare can not only discourage such women from continuing working but also deteriorate their future employment prospects, since gaps in work history are a disadvantage for those who attempt to re-enter the labor market. In fact, the probit results show that continuous work experience is an important factor in the attainment of preferred employment. The probit results also suggest that for women with very young children, access to quality and affordable childcare are of particular importance for continued working. As is evident, the positive association between access to a *desired* childcare center and the attainment of preferred employment was significantly greater for a woman with a very young child in the age group of 0–2 years than for a woman whose youngest child is in the age group of 3–5 years. The survey data employed in this study could provide answers regarding the most desirable childcare service. Among women with children in the age group of 0–2 years, a strong majority (73%) selected licensed daycare centers, which provide relatively high quality and affordable childcare.

The results of this study warrant further research. The first direction is to refine the models to examine causal relationships between access to childcare and employment, which are likely to be endogenous. The second direction is to use, in the models, more

spatially micro-level data on the accessibility of childcare. Results that are more significant might emerge if sufficiently spatially detailed accessibility were incorporated into the models. The third direction is to incorporate fathers' roles in the analysis, as many countries attempt to encourage fathers' participation in childrearing (OECD, 2007). Further research in these directions would contribute to the literature on childcare access and work-life balance.

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Appendix

Table A1. Basic demographic statistics of the survey and 2005 census.

	Survey respondents		2005 census population of women with preschool children in Tokyo ward area	
	Number	Percent	Number	Percent
Age				
under 25	3	1	8,380	3
25–29	28	9	40,080	14
30–34	115	37	105,200	37
35–39	116	37	94,120	33
40–44	42	14	32,720	12
45 and older	7	2	3,700	1
Number of children living together				
1	145	47	138,170	49
2	142	46	113,740	40
3 and more	24	8	32,290	11
Age of youngest child				
0	57	18	58,560	21
1	66	21	57,820	20
2	58	19	49,330	17
3	59	19	44,700	16
4	34	11	38,250	13
5	37	12	35,540	13
Working	114	37 [a)]	96,260	34 [b)]
Housewives	175	57 [a)]	181,020	64 [b)]
Full sample size	311		284,200	

a) The proportions of those whose answers are valid (308). b) The proportions of those whose labor force statuses are determined (281,250).
Note: The census statistics were calculated using the order-made summary statistics provided by the National Statistics Center of Japan; the census statistics are different from the data created and made available by the administrative agencies.

Table A2. Regression estimates of the number of children on childcare waiting list.

	Age 0	Age 1	Age 2	Age 3	Age 4 and older	Total
Accessibility						
500m	-68.04**	-334.66***	-116.46**	-24.45	-1.80	-380.04*
	(32.07)	(120.97)	(56.39)	(16.61)	(4.52)	(196.02)
750m	-68.00**	-373.28***	-123.01**	-24.74	-2.37	-410.80**
	(32.83)	(119.07)	(58.85)	(17.34)	(4.65)	(196.27)
1,000m	-71.68**	-388.21***	-121.80**	-22.68	-2.07	-392.49*
	(35.66)	(126.83)	(59.26)	(17.63)	(4.65)	(202.14)
Adjusted R-squared						
500m	0.14	0.23	0.13	0.05	-0.04	0.11
750m	0.13	0.29	0.13	0.04	-0.03	0.13
1,000m	0.12	0.28	0.13	0.03	-0.04	0.11

Standard errors are in parentheses. *, **, and *** denote significance at the 10, 5, and 1 percent level, respectively. The number of observations is 23 for each model.