Outsourcing Household Production: Demand for Foreign Domestic Helpers and Native Labor Supply in Hong Kong

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Abstract

Migration of women as domestic workers from developing to developed countries is a growing phenomenon. In Hong Kong, foreign domestic workers (FDWs) account for 6 percent of the labor force and among households with young children, more than one in three hires at least one. This paper investigates the effects of the availability of foreign domestic workers on Hong Kong women's welfare and decisions regarding labor supply.

As predicted by a simple time-use model, and exploiting variation at the individual level, we find that consumer surplus from hiring a FDW is largest for highly educated women, women with high unearned income, and mothers of young children. However, the largest treatment effect on labor force participation is found for low and medium skilled women, who before the introduction of the program could not afford to work outside the home.

Cross-country time-series evidence comparing Hong Kong and Taiwan suggest that the foreign worker program in Hong Kong increased labor force participation rates by 10 percentage points among mothers of young children relative to mothers of older children. The macro estimate is close to 25 percent higher than the implied by the micro estimates suggesting perhaps the presence of positive social interactions in female labor force participation decisions.

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1 Introduction

In the past decade, there has been a surge in the number of low-skilled female workers from developing countries such as the Philippines, Indonesia, Thailand, and Sri Lanka migrating to the "new" rich countries as domestic helpers. In Singapore, by 2000, there were approximately 100,000 migrant domestic helpers in the workforce, amounting to one foreign maid in eight households (Yeoh et al, 1999). In Hong Kong, the proportion of households hiring at least one foreign domestic worker (FDW) increased from less than 2% in 1986 to close to 8% in 2006. Among households with young children, more than one in three hired at least one FDW.

The economic implications of the temporary migration of private household workers can differ substantially from that of conventional low-skilled migrants. First, since these temporary domestic helpers generally substitute for household production, they potentially influence the time-use decisions of women, particularly the highly skilled. Second, given that domestic workers provide relatively inexpensive childcare, they might also affect the fertility decisions of natives. This is particularly relevant as Hong Kong has one of the lowest fertility rates in the world. Finally, we would not expect foreign domestic workers to have a large effect on the labor outcomes of natives of similar skill level, given that they are not allowed to work in any other occupation.[1]

This paper's goal is to investigate the effects of the availability of foreign domestic workers (FDW) on Hong Kong women's welfare and their decisions regarding labor supply. Future work will address the impact of FDWs on fertility. Our research agenda will help expand the understanding of women's preferences for work and children, and our analysis might provide potential lessons for immigration policies in the West. This form of migration has become increasingly prevalent in some western countries as a result of demographic changes and increasing demand as women seek to enter the labor market; for example, Canada has a Foreign Live-in Caregiver Programs and Israel a special visa program for foreign caregivers. Guest Worker Programs, in general, have also been discussed as part of immigration reform in the United States.[2]

Our empirical strategy is based on two complementary approaches - the first exploits variation at the individual level (micro approach) while the second exploits variation at the country-year level (macro approach). The advantage of having both is two-fold; first, a comparison of the estimates from both approaches allows us to check whether our estimates are sensible. Secondly, the macro approach factors in general equilibrium effects and positive social multipliers that are not reflected in the micro estimates.

[1] Another economic implication, suggested in Kremer and Watt (2006) it that by allowing high-skilled native women to increase market labor supply, this type of immigration increases the wages of low-skilled natives and provides a fiscal benefit by correcting tax distortions toward home production.

[2] For example, in 2006, Senator Arlen Specter, introduced a Bill that will create a Guest Program, where workers would not have the right to become permanent residents or citizens.

The macro approach exploits time-series variation in the expansion of the program and on the relative price of hiring a foreign domestic worker. Our period of analysis (1976-2007) coincides with Hong Kong experiencing very high rates of growth, thus, our main empirical challenge is to separately identify the effect of the availability of foreign domestic workers from effects arising from changes in the wage distribution, real state prices, etc. To do so, we exploit the variation in program adoption in Hong Kong and Taiwan and differences in the demand for household services by households with relatively younger or older children to form difference-in-difference estimates of the impact of the foreign domestic helper policy on female employment rates. We argue, based on trends in economic and demographic outcomes and on similarities in the childcare markets of both countries, that Taiwan is a reasonable control. Using this approach we find that, on the aggregate, the foreign worker program in Hong Kong is associated with a 9 to 12 percentage point increase in employment of females with a young child, compared to females with a relatively older child over the period from 1976-2006. Consistent with the view that natives with a higher opportunity cost of time are more likely to purchase such domestic services and supply more labor, we find that this increase is almost entirely driven by the increase in employment rates of middle and highly skilled females.

The micro approach utilizes pooled cross-sectional data from the 2001-2006 Hong Kong population census to estimate the determinants of individual demand for FDWs and the impact of hiring a FDW on the likelihood of female employment and other labor market outcomes. By adopting a latent variable setup, we are able to identify the key factors that determine the individual consumer surplus from hiring a FDW. Confirming the predictions of a simple time-allocation problem we develop, we find that women with high education, high unearned income, and very young children are the main beneficiaries of the program. To account for the endogeneity of foreign domestic helper hire in our labor supply models, we propose instrumenting foreign domestic helper hire with the number of rooms in a household, controlling for proxies of household wealth. This instrument is motivated by the fact that most Hong Kong households are relatively space constrained and the intuition behind this instrument is that conditional on household wealth, the number of rooms is likely to have an impact on the propensity of maid hire, but should be uncorrelated to a woman's unobserved propensity of work. Thus, if we are able to control adequately for determinants of housing choice, this may serve as a valid instrument. We find the largest treatment effects for low educated mothers, large and statistically significant effects for mothers with a middle level of education, and smaller effects for mothers with a college degree or higher. We interpret these results as suggesting that most highly skilled mothers would have participated in the market regardless of the existence of the program; that is, the program did not change their participation decision, only their mode of childcare. On the other hand, the program enabled some middle class women and a few uneducated mothers to afford market provided childcare and to start working outside their homes. Nevertheless, when these treatment effects are aggregated, the smaller treatment effect

for highly educated mothers are offset by a much larger share of these women hiring FDWs. The resulting estimates suggest that the program had the largest effect on the medium skilled, followed by the highly skilled. The micro estimates also suggest that the time-series approach significantly underestimates the effect of the foreign domestic helper policy on female labor force participation by focusing on the relative increase in employment rates for mothers of young children compared to mothers with older children. Treatment effects for the sample of mothers of older children are generally large and statistically significant. Finally, the implied relative aggregate effects from our micro estimates are of the same order of magnitude as our time-series estimates but are generally smaller. This difference between our macro and micro level estimates could be due to positive social interactions in female labor force participation decisions. By enabling more women with young children to enter the workforce, this policy may have reduced both the economic and cultural barriers for later cohorts of women to enter the workforce, leading to an even larger increase in the demand for female employment over time.

Using the cross-section IV strategy, we also explore if hiring a foreign domestic helper allows women to enter higher paying jobs. Using the average male salary in the industry-occupation cell in which the woman works as a proxy for job quality, and controlling for occupation dummies, we find that having a domestic worker allows a woman to work in an industry that pays males close to 9 percent more. We also find weak evidence that women with FDWs enter industries with larger share of males. Consistent with the analysis of LFP rates, treatment effects are larger for mothers with low and medium education levels.

Despite the prevalence of these programs in many countries, there are few empirical studies of the labor market implications of the influx of temporary low-skilled domestic migrant workers to developed countries. A recent paper by Cortes and Tessada (2009) documents that the decrease in prices of domestic services, as a result of the growth in low-skilled immigrants, has a relatively large impact on the time-use of high-skilled American women. To our knowledge, only two papers have studied similar questions in the Hong Kong context. Suen (1993) and Chan (2006) both provide some evidence that hiring a live-in domestic worker is associated with a higher likelihood of female labor force participation, but neither addresses causality concerns.

The paper is organized as follows. The next section describes in detail the foreign domestic program in Hong Kong and describes the data. Section 3 presents the theoretical background, which will guide our empirical approach. Results from the time-series analysis are discussed in Section 4. Section 5 presents the cross-sectional instrumental variables approach and Section 6 concludes.

2 Background and Data Description

2.1 Foreign domestic helper policy in Hong Kong

The foreign domestic helper program was first introduced in Hong Kong in the early 1980s. Compared to other receiving countries, Hong Kong has a relatively liberal policy toward these foreign workers. The government does not impose a quota on the number of foreign domestic helpers in Hong Kong and employers are free to hire these workers so long as they fulfil the requisite conditions set out in the standard contract. The main restrictions are that the FDW has to work and reside in the employer's residence and that households have to meet an income criteria in order to hire a foreign maid. In 2008, this was set at the median household income (HKD$15,000) or the equivalent in assets. These workers are entitled to a minimum wage and are protected under the Employment Ordinance and the Standard Contract for the Employment of a Foreign Domestic Helper. Figure 1 shows the evolution of the minimum wage for FDW (there is no minimum wage for natives) and of the median wage for full time employees. As observed, the relative price of FDW decreased monotonically until 2001; since then it has stayed relatively stable, with a very slight increase from 2000 to 2005.

To provide a sense of how rapidly this program has expanded, Figure 2 presents the number FDWs in Hong Kong from 1981-2006 as a proportion of domestic households, by the education level of the female household head or spouse of household head and by the presence of children of different ages.[3] We consider three types of women: those with youngest child aged 0 to 5, 6 to 17 and those with no children. Several observations are worth mentioning. First, although women at the top education level consume the highest levels of FDWs, since the mid 1990s, the share hiring has stayed constant; it has been women with a medium level education who have shown the most continuous growth. For unskilled women the share hiring FDWs have increased, but continue to be significatively smaller than that of the other two groups. Second, the demand for domestic help comes almost exclusively from households with children. This is true even among highly skilled women. This might be explained by a number of factors such as the cost in terms of privacy loss of having a non-family member living in the house and the high cost of space in Hong Kong.

A couple of statistics show the amount substitution of household work that takes place in households that decide to hire a FDW. In the time-use supplement of the 2001 General Household Survey, 35 percent of FDWs report doing 100 percent of the household work, and at least 70 percent report doing more than 70 percent. By law, FDWs are only allowed to one free day a week which explains why 80 percent of FDWs report working more than 50 hours a week.

[3] We define low education as having at most primary education, medium level education as having more than a primary education but less than a college degree, and high education as having a college degree or a graduate degree. This classification applies to both Hong Kong and Taiwan.

Most of the foreign workers are drawn from the Philippines, Indonesia, and Thailand. Table 1 shows the evolution of the share of households with a domestic worker, by the domestic worker's nationality. In the 1970s almost all of the domestic workers were Chinese from the Mainland who worked for upper class families. Their advanced average age suggests that there was practically no replacement for them within the native labor supply. By 1981, some Filipinas entered the market, lowering the average age and increasing the education levels of domestic helpers. By the early 1990s, the FDW market was dominated by Filipinas, but their market share started eroding toward the end of the 1990s as lower-cost Indonesian maids entered into the domestic helper market. By 2006, there were roughly equal numbers of Filipinas and Indonesians working in Hong Kong as domestic helpers. As observed, FDWs tend not to be drawn from the lower tail of the education distribution of their home countries. Filipinas, in particular, are very educated: 20% of them have completed a college degree, compared to 12% of Hong Kong-ers and a mere 3% of Indonesians. Most Filipinas also speak English. Indonesians, in contrast, compensate for their lack of English speaking abilities by learning the local language, with close to 90% of Indonesians report speaking Cantonese.

In sum, the FDW program in Hong Kong has provided native women with a relatively inexpensive and reliable source of housekeeping and childcare services. In the next section, we explore theoretically how the availability of FDWs has affected the welfare and labor supply of native women in Hong Kong.

2.2 Data Description

We use the 5% sample data from the 1996-2006 Hong Kong Population census and by-census and the 1% sample data from 1976-1991. We will also make use of the General Household Survey (GHS) from 1985-2007. The Hong Kong population census and by-census are conducted every five years while the GHS is conducted quarterly. Both data sets provide a range of demographic information on all members of an enumerated household. The presence of live-in foreign domestic maids in a household is inferred from a variable that indicates whether the relation of the respondent to the household head is that of a live-in foreign domestic helper, chauffeur or gardener and the nationality of the respondent. While it is very likely that almost all workers in this category are foreign domestic helpers, to ensure that this is the case, we only include the female workers in this category. The Taiwan Manpower Utilization Survey (MUS) is a household survey conducted yearly by Taiwan's Directorate-General of Budget, Accounting, and Statistics (DGBAS). It provides labor force information for a representative sample of about 60,000 individuals over the age of 15. The sample covers the civilian population in Taiwan and excludes foreign workers who do not have citizenship.

3 Theoretical Background

We develop a very simple model of time-allocation, where we take fertility as exogenously determined, and study how women's labor supply and demand for market provided household work changes with the woman's potential wage, her unearned income, and the cost and availability of outsourcing childcare.

3.1 Woman's time-allocation problem

Assume that every woman has one child, and the (only) cost of raising a child is given by a fixed number of hours a day, h, that are needed to care for the child.

The woman consumes a market good c, priced at one. The woman allocates her time (normalized to 1) between leisure (l), childcare, and market work (L). She receives a wage w per unit of time devoted to market work. She is endowed with unearned income I.

Utility is given by the simple Cobb-Douglas function:

$$\alpha_c \ln(c) + \alpha_l \ln(l), \tag{1}$$

We start by assuming unavailability of foreign domestic workers. The solution in this case is straightforward:

$$L = \frac{\alpha_c}{\alpha_c + \alpha_l}(1-h) - \frac{\alpha_l}{\alpha_c + \alpha_l}\frac{I}{w} \qquad \text{if} \qquad I < \frac{\alpha_c}{\alpha_l}(1-h)w = \overline{I}^{NP} \tag{2}$$

$$L = 0 \quad \text{if} \quad I \geq \overline{I}^{NP} \tag{3}$$

Conditional on unearned income, the higher the potential wage the more labor the woman supplies to the market. On the other hand, keeping potential wage constant, women with higher unearned income are less likely to work, and if they do, they work shorter hours.

Now assume that the woman has the option to hire a live-in foreign domestic worker to take care of the child for a fixed (not per hour) amount $w_{\min}$. The nanny can substitute for the mother's time up to n hours ($n < h$); given the fixed salary, all nannies will be hired for exactly n hours. Let w_n be the implied wage per hour paid to the foreign domestic worker and define $\overline{I}^{P} = \frac{\alpha_c}{\alpha_l}(1-(h-n))w + w_n n$ to be the threshold income for participating in the labor market if a FDW is hired.

Who hires a nanny and how their labor supply changes depend on w, w_n , I and n in the following way:

1. A woman with a low unearned income $(I \leq \overline{I}^{NP} \leq \overline{I}^{P})$ and low potential wage $w < w_n$ will not hire a FDW and will not change her labor supply decision.

2. A woman with a low unearned income $(I \leq \overline{I}^{NP} \leq \overline{I}^{P})$ but high potential wage $w > w_n$ will hire a FDW and increase her labor supply to:

$$L = \frac{\alpha_c}{\alpha_c + \alpha_l}(1 - (h - n)) - \frac{\alpha_l}{\alpha_c + \alpha_l}\frac{I}{w} + \frac{\alpha_l}{\alpha_c + \alpha_l}\frac{w_n}{w}n \tag{4}$$

3. A woman with very high unearned income $(I > \overline{I}^{P})$ will hire a FDW regardless of the relation between w and w_n and will never participate in the labor market.

4. A woman with unearned income higher than $\overline{I}^{NP}$ but lower than $\overline{I}^{P}$, and with potential wage $w \geqslant w_n$ will hire a FDW and will join the labor force. Her labor supply will be given by (4). Note that even if $w = w_n$ a woman is better off hiring a FDW and working in the market. The reason is that before the program, her marginal utility of of leisure was higher than the marginal utility of consumption; therefore, by hiring the FDW and working $L < n$ she is able to increase her leisure and her utility.

5. A woman with unearned income higher than $\overline{I}^{NP}$ but lower than $\overline{I}^{P}$, and with potential wage $w < w_n$ will generally not hire a FDW and will not participate in the labor market, unless the difference $w_n - w$ is very small. Note that while the woman with $w = w_n$ can decrease her consumption of c by as little as she wants to, a woman with $w < w_n$ has to decrease it by more than $(w_n - w) * n$, which in most cases is too high to be compensated by the increase in leisure. The higher α_c and n, the smaller the difference between the two wages must be to make hiring an FDW and participating in the labor market optimal.

In short, the individual demand curve for a nanny can be approximated by the simple form (See Figure 3):

$$Nanny = 1 \text{ if } w_n < \overline{w} = max(w, \frac{I}{n} - \frac{\alpha_c}{\alpha_l}\frac{(1 - (h - n))w}{n}) \tag{5}$$

$$Nanny = 0 \text{ if } w_n > \overline{w} \tag{6}$$

This demand function will be the basis of our micro approach of section 5. For our macro approach we need to characterize the aggregate demand and supply curves for nannies, which we do in the next section.

Summarizing, the introduction of a FDW program increases the labor supply of women with high potential wages, both at the intensive and extensive margins, provided that their unearned income is not high enough to justify not working at all. Women with very high unearned incomes, regardless of their potential wage, will hire a FDW but will not join the labor force.

Once the program is in place, if the minimum wage for FDW goes down: (1) women that were already hiring a FDW will decrease their labor supply, both at the intensive and at the extensive margins; (2) women that were not hiring a FDW, but who after the price drop have a wage larger than w_n, will hire one and increase their participation and hours worked. If potential wage is strongly correlated with education, we should see highly educated women be the first to hire FDWs and increase their labor supply. However, as the wage for FDW decreases significantly, the largest effects on adoption and labor supply should be observed for women with medium education levels.

3.2 The market for nannies

3.2.1 Aggregate Demand and Supply

Figure 3 illustrates the structure of aggregate demand and supply for domestic help in the economy based on our simple model. Aggregate demand will depend on the wage and unearned income distribution for women in the economy. The aggregation of individual demand curves will generate a downward sloping aggregate demand curve. As the wage distribution of women shifts to the right and as families become richer, the demand for nannies will also shift to the right.

We assume that prior to the introduction of the FDW program the aggregate supply of nannies is upward sloping; native women will be willing to work as nannies if the pay is good enough.[4] The introduction of the FDW program in Hong Kong results in a perfectly elastic supply of nannies at the minimum wage determined by the government. The minimum wage is usually high enough compared to the wage opportunities in sending countries that we can assume an almost unlimited supply of foreign domestic workers at the prevailing minimum wage.

3.2.2 Equilibrium

The intersection of aggregate demand and supply curves leads to an equilibrium price, w_n^*, and quantity, Q_n^*. A lower bound for the share of women hiring a nanny will be given by the area of the wage distribution to the right of w_n^*. As observed in Figure 3b, the introduction of the program, ceteris paribus, should have increased the number of domestic workers. From the individual

[4] Note that when analyzing the individual decision we made a different assumption: there was no market provision of childcare before the program was introduced.

maximization problem we also know it should have increased the hours worked and labor force participation of women who hired a nanny as a result of the introduction of the program (with the exception those with very high unearned income), and decreased the labor supply of women who were already hiring a nanny ($\overline{w} > w_n^*$) , both at the intensive and extensive margins.

3.2.3 Estimating the effect of the FDW program on the market for nannies

Hong Kong experienced a rapid economic growth during the period in which the program was established. As the economy grows, women see their wages and unearned incomes go up. Therefore, changes in the observed quantities of nannies and in the labor force participation of women, cannot be fully attributed to the creation of the program; shifts in demand are likely to be very important too. Figure 4 presents the empirical challenge. Before the introduction of the program, the market was at equilibrium in point A. After the introduction of the program (and high rates of economic growth), the market is at equilibrium point C. Clearly, comparing points A and C would not allow us to discern whether the increase in the share of women hiring nannies was a result of the supply shift due to the FDW program or concurrent increases in the demand for nannies due to the rightward shift in the wage distribution of women over the same time period. Moreover, as the economy grows, this may affect the supply of nannies, even in the absence of the FDW program.

Ideally, we would like to estimate point B in the figure, which represents the equilibrium which would have resulted in the absence of the FDW program over the same time period. In Figure 4, we assumed that the supply curve of nannies in the absence of the program shifts slightly to the left due to increase in wealth and in wages in alternative occupations, although under a different set of assumptions, the supply curve could have shifted to the right. Our empirical strategy will use Taiwan, a country that experienced a remarkably similar growth path to Hong Kong to estimate the program effect, B-A.

4 Macro Approach: Hong Kong vs. Taiwan

To tackle the question in the paper, the ideal quasi-experiment would probably involve comparing female employment rates in regions that introduced a foreign domestic helper scheme to regions that did not, assuming that regions exogenously decide whether or not the implement such a scheme. Unfortunately, Hong Kong is a relatively small country and the policy was implemented at a national level, hence we cannot exploit geographical variation within Hong Kong. Looking outside Hong Kong, however, suggests that we can use Taiwan as a possible control group given the close proximity as well as economic and cultural similarity of the two countries.

As first evidence that Taiwan is a reasonable control group for Hong Kong we present results

from two exercises. First, we show that the two countries experienced very similar trends in the main observed determinants of the labor supply for women. Figure 5 depicts the predicted labor force participation of mothers in Taiwan and Hong Kong from a cross-sectional model using as explanatory variables age dummies, education dummies, husband's income percentile dummies, dummy for youngest child aged 0-5, and a dummy for Hong Kong. The model is estimated using all available years. As observed, the evolution of LFP due solely to compositional changes in the explanatory variables is remarkably similar between the two countries. Second, we test if changes in the core parameters determining LFP (the coefficients in the regression) are reasonably similar in Hong Kong and Taiwan. Figure 6 presents the predicted evolution of LFP in Taiwan and Hong Kong, fixing the observables at their 1989-1993 levels and allowing the coefficients to change each period. The figure shows that changes in the coefficients were similar in both countries for most of the studied period, with the exception of the change from 1976-1981 to 1985-1988. A possible explanation is that the number of observations used for the estimation of the LFP model in the first period is much smaller than for later years; also, the data for Hong Kong in the earliest period comes from the Census, whereas for all the remaining periods comes from the household surveys.

4.0.4 The childcare market in Taiwan and Hong Kong

In this section we provide a brief discussion of who the main providers of childcare services in each country are and make the argument that the demand and supply of childcare services has followed similar trends in the two countries.

Cultural Similarities and the Role of Grandparents

As Chinese societies, Hong Kong and Taiwan share very similar cultural heritage and family values. In both, most people aged 60 and above live with one of their offspring, usually their eldest son. The extended family systems traditionally have provided for many of the needs of family members, including childcare. Table 2 shows how the probability that a married woman lives with her mother or mother-in-law has evolved in the past decades in the two countries. Two observations are worth mentioning. First, although in both countries the share of married woman living with the extended family is very high by Western standards, it is consistently larger in Taiwan. A likely explanation for this difference are the space constraints in Hong Kong. Most apartments in the city-state are very small. Note, however, that it is still very common for the parents to live very close to their adult children and to be very much involved in their daily lives. Most important for our empirical exercise is the observation that for both countries, net of age dummies, the probability of living with a mother or mother-in-law has stayed high and relatively constant.

Market Provision of Childcare

Nurseries for children younger than three are very uncommon in both countries. In Taiwan, the lack of FDWs has not been compensated by a larger supply of nurseries or childcare centers. Table A1 in the Appendix shows that less than 0.5 percent of Taiwanese children age 0-3 went to day care; most of them were taken care by parents or grandparents (91 percent) or by nannies (7.5 percent in 2006). In Hong Kong, 50 percent of working mothers of young children (0 to 4 years of age) relied on foreign domestic helpers as the major care provider, while only 30.6 percent had a family member or relative to look after their children (Henshall, 1999).

Shifts in the demand for childcare

As in many other countries, higher returns to education and the increase in the price of women's skills have generated a substantial increase in the labor force participation of married women and mothers in Hong Kong and Taiwan. Figure 7 presents the evolution of the average wage and the 10th percentile wage (in constant units) for women in Hong Kong and Taiwan, and for Hong Kong, the minimum wage for FDWs. Its purpose is three-fold. First, to show that average female wage has followed remarkably similar paths in the two countries; second, that assuming that maids and nannies are drawn from the bottom of the wage distribution, so have the prices of outsourcing household production in the absence of FDWs. Third, that the presence of FDWs has significantly reduced the relative price of outsourcing household production in Hong Kong compared to Taiwan.

It is worth pointing out that while Taiwan does have a foreign domestic helper program, the magnitude and scope of the program is far smaller than that of Hong Kong's. In 2001, FDWs comprised approximately 1.1% of the labor force in Taiwan compared to 5.3% in Hong Kong (and as observed in Table A1, less than 0.4 percent of children age 0-3 were taken care of by FDWs). There are two main programs through which foreign nationals can work as domestic helpers in Taiwanese households - the foreign domestic helper scheme and the foreign caretaker scheme. The official foreign domestic helper scheme began in 1992, and at it's peak in 1996, accounted for approximately 13,000 foreign workers. This program has since been scaled down and only permits special applications for foreign investors and families requiring special child or elderly care. The bulk of foreign domestic workers to Taiwan have since entered under the foreign caretaker scheme. This scheme, however, requires applicants to demonstrate that the person under their care has a medical condition that requires 24 hours care[5]. This is in sharp contrast to the program in Hong Kong, where household income is the only eligibility requirement.

[5] `http://dhsc.evta.gov.tw/eng/applicant.html`. Note that it is common for households to forge medical documents in order to hire a foreign caretaker to perform domestic or childcare duties at home. For our purposes, we will not draw a distinction between foreign caretakers and foreign domestic helpers in Taiwan. It is likely that the total stock of foreign caretakers and foreign domestic helpers is an upper bound for the number of foreigners performing domestic childcare duties in households in Taiwan.

4.1 Difference-in-Difference Estimator

We will exploit differences in the ease of engaging a foreign domestic helper between Hong Kong and Taiwan as well as differences in the probability of domestic maid hire by child age structure to examine the impact of foreign domestic helper policies on female labor force participation rates. The cross-country comparison allows us to use Taiwan as a control group to difference out group-specific trends in employment, while the comparison of females with older (youngest child aged 6 to 17) versus females with younger children (youngest child aged 0 to 5) allows us to difference out country-specific trends in female labor force participation over the time-period that affect women in both groups. As one might expect the female labor force participation rates of females with an older child and a younger child to change differentially across time, even within a country, we will compare differences in the growth rates of employment across the groups. We interpret the difference in the growth of female LFP of these two groups, adjusting for composition changes, as providing a measure of the impact of the foreign worker policy on LFP rates in Hong Kong.

Our sample consists of women aged 25-44 who have at least one child aged 0-17. Basic descriptive statistics of demographic and economic variables that will be used in the empirical analysis are presented in appendix (Table A2). Generally speaking, the levels of most variables are remarkably similar between Taiwan and Hong Kong, considering that the two are different countries. The last column in Table A2 suggests that Taiwan and Hong Kong experienced similar pre-trends (between 1976 and 1988) for most of the variables we consider; only for the share of married women, the share of women with no children, and the share of women with youngest child aged 6-17 are the pre-trends are statistically different at a 5 percent level.

Figure 8 provides graphical evidence that the trends in labor force participation of females with a younger child aged 0 to 5 and females with a relatively older child aged between 6 to 17 has evolved quite differently across the two countries starting in the late 1980s. In particular, while the change in employment of females with younger and older children was relatively similar prior to 1981 in both countries, labor force participation rates of women with younger children in Hong Kong accelerated starting in the late 1980s, such that by 2006, it actually exceeded that of women with older children. This is in stark contrast to Taiwan, where the growth in employment rates across the two groups of women remained virtually parallel over the entire sample time period from 1976-2006.

In Figure 9, we separately graph the trends in LFP rates of women in the two countries by education level. All of the catching-up in LFP of younger women in Hong Kong can be attributed to trends in the LFP of higher and middle educated women. Highly educated mothers, whose youngest child is less than five, started participating in the labor market almost at the same rate as mothers of older children early on, before 1986; since then, they have been mostly above the participation levels

for mother of older children. Highly educated mothers of young children in Taiwan, on the other hand, show very high levels of labor participation, and although the distance between their rate and that of mothers with older children is small, it has stayed permanently below. The catch-up in labor force participation of medium skilled mothers with young children in Hong Kong started in the late eighties, when the relative wages of FDW had already decreased significantly. They reach participation levels comparable to those of mothers with older children by the late 1990s, but diverge again at the end of our period of analysis, coinciding with the slight increase in the relative wage of FDWs. The employment trends of lower-educated females across the two groups of women appear to be mostly stable across our sample time period. This evidence is consistent with the view that higher educated women are more likely to respond to changes in the price of domestic services due to their higher opportunity cost of household production.

Nonetheless, these graphs do not control for changes in the composition of both groups of women over time - to the extent that there may be differential changes in the composition of mothers with older or younger children across time, these effects may confound the aggregate trends that we observe in the graph. In the next section, we will provide formal econometric evidence that adjusts for such composition effects.

4.1.1 Formal econometric evidence

We estimate the regression analogue of Figures 8 and 9, adjusting for relevant individual covariates such as age and education:

$$Y_{ijgt} = \gamma_{jt} + \lambda_{tg} + \tau_{jg} + \beta_t D_{jgt} + \delta X_{jgt} + \epsilon_{ijgt} \tag{7}$$

where i is the individual, j is the country, g is the group (whether female has older or younger child), t is the time period. The time period, t, can take the values of a dummy for 1976-1984, 1985-1987, 1989-1993, 1994-1998, 1999-2002 and 2003-2006. Vector X_{jgt} are individual-level controls for age and education. D represents the relevant indicator variables; $D_{jgt} = 1[HK = 1, Youngchild = 1, period = t]$. Some specifications also include education group×period fixed effects and education×period×HK fixed effects. Standard errors are clustered at the country-period level.[6]

[6] It is likely that the error terms are not only correlated within country×period groups (which we address by clustering by country×period) but also across time generating serial correlation issues. A common approach is to cluster at a higher level. In our case it will imply clustering at the country level, but that will leave us with two clusters only. We increase the number of clusters by assuming independence across education groups within countries and clustering at the country×education group. Standard errors clustered at this level are presented in square parenthesis in Table 3 Panel A.

The main results are presented in panel A of Table 3. The first column of each time period is the raw, unadjusted, difference. The second column adjusts for an individual's age and education and the third and fourth columns include education fixed effects interacted with year and country×year. The first row suggests that, relative to mothers of older children, mothers of younger children participated less in HK than in Taiwan. The results for the most flexible specification indicate that relative to 1976-1984 (the base period), the gap between HK and Taiwan started closing in 1985-1987; by 1989-1993 there was no difference between the two countries, and by the mid 1990s-early 2000s the relative participation of mothers of young children vs. older children in HK was 4-6 percent higher than the relative participation of mothers of young children in Taiwan. In 2003-2006 the difference decreased slightly to 3 percentage points. Summarizing, between 1976 and 2006 the gap in LFP rates between mothers of younger and older children decreased by between 8.7 to 12 percentage points more in HK than in Taiwan. In section 5.1, we will compare these estimates to the estimates obtained from the micro approach.

Panel B of Table 3 analyzes whether the evolution of female labor force participation rates varies by the educational attainment of the women; interesting patterns emerge. Highly educated mothers of young children were the first to significantly increase their labor force participation. By the mid 1980s (few years after the first FDWs came to HK), their relative labor supply had achieved its maximum. As our simple model and Figure 2 suggest, they were the first to hire the FDWs, and once the price started to decrease, they were slightly less likely to participate than in previous years. On the other hand, medium educated mothers of young children only started to signficantly increase their relative LFP in the early 1990s, when the relative price of FDWs started to decline systematically. As predicted by our model, as the relative wage of the FDWs went down, more and more women started hiring them and participating in the labor force. Finally, we observe very small effects on mothers with the lowest education levels, at least until the last period. This is not surprising as the potential wage of most mothers in this group is way below what it needs to be to justify hiring an FDW; hence, changes in the prices of domestic help has little effect on their labor force participation.

5 Cross-sectional instrumental variables approach

We now turn to our cross-sectional approach. We start by deriving a simple empirical model from our theory section.

Equation (5) of section 3 suggest that we can interpret the binary decision of hiring a nanny as derived from the latent variable *Consumer Surplus*. We observe the household-level hiring decision, but we do not observe their benefits and costs of hiring a nanny.

Assume that we can model *Consumer Surplus* using the following equation:

$$Consumer\ Surplus_i = Benefits_i - Costs_i = \beta Z_i + \varsigma_i \tag{8}$$

where Z include variables that determine the benefits and costs from hiring a FDW. From the model we learned that the potential wage of a woman (w) and her unearned income (I) are two of the main determinants of the benefits, whereas the minimum wage of the FDW is one of the main costs. Benefits and costs might also depend on other variables not included in our theoretical model such as the number of members of the household, their age composition, space constraints and loss of privacy.

The decision to hire a FDW can be expressed as:

$$FDW = 1 \text{ if } \beta Z_i + \varsigma_i > 0 \tag{9}$$

$$FDW = 0 \text{ if } \beta Z_i + \varsigma_i \leq 0 \tag{10}$$

where ς is an unobserved random variable, which we assume is independent of Z , symmetric around zero and with cdf function G. Therefore,

$$P(FDW = 1|z) = P(\varsigma_i > \beta Z_i|z) = G(\beta Z_i) \tag{11}$$

Equation (11) can be estimated using Probit or Logit models.

The advantage of modeling our empirical approach as a latent variable model is that we can use our estimates of β and equation (8) to understand how the surplus from hiring a FDW depends on the characteristics of the household.

What variables do we include in the vector Z? As a proxy for unearned income we use the husband's income, age, and education; we include the age, age squared and education of the woman as the determinants of potential wage; the presence of young children and seniors are considered factors that affect potential benefits, and the number of rooms in the household (conditional on number of members) is included as a proxy for space restrictions. We also add a set of fixed effects for the housing district and the type of residential quarters and a dummy variable that indicates whether the individual was sampled in 2001 or 2006. Our sample comprises of married mothers aged 25-44. Descriptive statistics of our sample are presented in the appendix (Table A3).

The estimated coefficients, presented in Table 4, are vey much in line with the predictions of the

model.[7] As suggested by equation (5), consumer surplus increases with potential wage, unearned income, and a higher number of hours required to care for a child (h). Our coefficients imply that compared to having a high education level, having a low or medium education reduces the surplus of hiring a FDW significantly, by a whole standard deviation and a third of a standard deviation respectively.[8] Conditional on the number of children, having a young child (higher h) increases surplus by more than half a standard deviation, and having an extra child younger than 18 increases it by a third of a standard deviation (keeping household size constant). Higher unearned income, as proxied by the log of the husband's wage, also increases the surplus from hiring a FDW. When we split the sample by education levels, coefficients are relatively similar across the different groups, with the exception of number of children and husband's income. As the model predicts, we find that husband's income increases the surplus more for women with low potential wages, and having more children (h) increases the surplus disproportionally for more educated women. Using the number of rooms as a proxy for space restrictions and a measure of a non-monetary cost of hiring an FDW we find that lower costs of hiring an FDW, as reflected by having an extra room (going from 3 to 4 rooms), increases the surplus of hiring an FDW by a third of a standard deviation. This is true even when we control for measures of household wealth and fixed effects for housing district and type of residential quarters.

5.1 Labor Supply

One of the implications of the theoretical model of Section 3 is that the introduction of the FDWs should have important effects on the labor supply of women, both at the intensive and extensive margins. In this section, we empirically explore the effect of hiring an FDW on a female's decision to participate in the labor market. This outcome is interesting for at least two reasons. First, there has been a large empirical literature that looks at the effects of childcare provision on maternal labor supply and one can think of hiring an FDW as an extremely effective form of childcare, both on the cost side and on the degree of flexibility that it affords mothers. This suggests that we might see much larger effects on labor force participation than other childcare innovations. Second, from a public policy perspective, the FDW program was instituted in Hong Kong with the explicit intention of encouraging women to enter the labor market - our estimates will also provide a sense of the effectiveness of this policy and its applicability to other countries.

[7] For the cross-section exercise we change the definition of low education to include not only those with at most primary but also those having less than form 5. The reason is that by 2001-2006 very few women had at most primary school.

[8] Note that because we have estimated the model using a probit, we have assumed a standard deviation of one for the latent variable.

5.1.1 Labor Force Participation

We follow the latent variable model representation and assume that a linear latent index generates labor force participation decisions:

$$LFP_i = 1(X_i^{'}\gamma_0 + \gamma_1 FDW_i \geq \epsilon_i) \tag{12}$$

Where X includes all variables in Z, except the number of rooms. In our results we present estimations of (12) assuming it takes a linear probability form (OLS and 2SLS) and also assuming that ϵ and ς are both normally distributed (Probit and Bivariate Probit).

A potential problem in estimating (12) is that ς might be correlated with ϵ, in other words, there might be unobserved characteristics of the woman that drive both her decision to hire a FDW and her decision to work. For example, our model suggests that potential wage affects both decisions, and unearned income and amount of household work will too. To the extent that women in households that hire maids have higher potential wages, simple OLS or Probit estimates will be upward biased. Unobserved household wealth will have the effect of biasing the OLS/Probit estimates downward since a household's permanent income is positively correlated to foreign maid hire[9], but tends to reduce the likelihood of female employment. At the same time, it is also plausible that households that decide to hire maids may have an unobserved need for more housework. While some of these household differences can be taken into account through the introduction of controls such as the education of the woman, her age, her husband's income and the age structure of children, the OLS/Probit is still likely to suffer from omitted variables bias. To address this issue, we propose using the number of rooms in the household as an instrument for hiring an FDW and argue that it belongs to Z but not to X (affects the cost-benefit analysis of hiring a FDW but not directly the decision to work), and that is uncorrelated with ϵ_i. In the next section we discuss the instrument more thoroughly and the potential threats to its validity.

5.1.2 Proposed instrument

The main instrument that we use is the number of rooms in the household. The motivation behind this instrument is the fact that space limitations in Hong Kong coupled with restrictions on lodging for domestic workers (for example, it is stated in the employment contract that they cannot sleep in the kitchen or share a room with an adult of the opposite sex) imply that all else equal, a household

[9] Having a FDW is correlated with unearned income, not only because of the mechanisms suggested by the model, but also because households have to meet an income criteria to hire a FDW and the FDW cannot be hired by the hour.

living in a house with more rooms is more likely to hire a domestic worker. Hence, assuming we are able to control adequately for household wealth, we would not expect the number of rooms in the house to be correlated to an individual's unobserved work propensity. At the same time, the number of rooms in a household is likely to increase the likelihood of hiring a foreign domestic helper due to reduced space constraints. There are a number of concerns in using the number of rooms as an instrument. We discuss each of these concerns in detail.

Issue 1: Moving concerns

The first concern is that exogeneity of this instrument implicitly requires that individuals either face prohibitively high moving costs or that some frictions in the housing market limit the ease of moving. Since we only have cross-sectional data, it is not clear whether the observed first stage relationship between the number of rooms and the probability of maid hire reflect space constraints or households moving to a larger place when they decide to hire a maid. Such actions by the household may lead to endogeneity in the choice of the number of rooms in the household.

We follow two strategies to address this concern. First, for all specifications, we present models with the sample restricted to women living in subsidized sale flats. Due to limited space and the high costs of housing, almost half of the population in Hong Kong reside in some form of government housing while the remainder live in private housing. In 2005, 29.1% of households were tenants in government provided housing while another 15.8% owned subsidized flats[10] through the Home Ownership Scheme (HOS) (Census and Statistics Dept, 2006). For individuals residing in government subsidized housing, mobility is rather limited due to various restrictions imposed on the resale of flats. For example, under the Home Owndership Scheme (HOS), eligible households can apply to purchase subsized flats at a discount of 30% of market value. After the third year of occupancy, HOS flat owners may sell their flats in the open market, but only after paying a premium to the Housing Authority, which is equal to the value of the subsidy at prevailing market prices. With these restrictions in place, the secondary market for HOS flats is quite inactive (Lui and Suen, 2006).

Second, using the entire sample, we can explicitly test whether households that have moved in the last five years are more likely to hire domestic helpers. In results presented in the appendix (Table A4) we find that having moved in the past 5 years is uncorrelated with a higher probability of having a domestic worker. We also perform this test on a subset of households whose only child is five or younger. Given that the probability of maid hire increases substantially when a household has young children, this group of households are likely to be first-time employers of foreign maids. Hence, looking at their moving behavior in the previous five years provides a test of whether households move in anticipation of hiring a foreign maid. The results for this subsample

[10] In our sample, the share living in subsidized sale flats is higher, 24 percent.

of households with small children are also not statistically significant and very small.

We interpret these results as suggesting that families are not moving in large numbers to accommodate a foreign domestic worker. To complement the evidence in Table A4, we will also present estimates of our labor supply models using a subsample of households that did not move in the last five years. We will compare the estimates obtained from the full sample to the sample of non-movers to see if this is indeed a large concern.

Issue 2: Omitted household wealth

Our instrumentation strategy is only valid if we are able to control adequately for determinants of household wealth that are correlated with the number of rooms. Since richer households tend to have a larger number of rooms and are also more likely to hire a foreign domestic helper, omitting household wealth would tend to lead to upward biased estimates of the first-stage. On the other hand, failing to include household wealth would tend to lead to a downward bias in the reduced form relationship since the probability of female employment is decreasing in permanent income. Hence, failing to account for differences in household wealth would tend to lead to a downward bias in our IV results.

To circumvent this problem, we restrict our sample to households that have 3 or 4 rooms[11], and define our instrument as a dummy for having 4 rooms. We do this for two reasons. First, given that we are looking at families with at least one child and assuming one room is the couple's bedroom, the second is the child's and the third is the living/dining room, going from 3 to 4 rooms will surely relax the space constraint. Second, even after controlling for husband's wage, owning very large houses (5 , 6, or more rooms) or very small ones (1 and 2 rooms) are likely to be a good proxy for unearned income, especially given how unusual they are.

As additional evidence that our instrument is not merely proxying for an individual's unobserved propensity to work or unobserved household wealth, we also run "placebo" tests of the reduced form of having 4 rooms on labor force participation for subsets of households that have a very low probability of maid hire, such as married households without children and low income households who are not eligible to hire a foreign maid. In particular, we will estimate the following linear regression:.

$$LFP_{it} = \alpha + \delta I(Number \text{ of rooms} = 4)_{it} + \gamma X_{it} + \eta_t + \theta_k + \epsilon_{ijt} \tag{13}$$

and its probit counterpart. We run the above specification for three groups of women: (1) married women with children (our main sample), (2) married women with no children, (3) low-educated mothers whose husband earn less than 10,000 HK dollars per month (the bottom quartile of the

[11] For tabulations of number of rooms by education level of the woman see Table A3 of the Appendix.

wage distribution). The share of households with an FDW for the three groups are, 14 percent, 2.6 percent, and 1.5 percent, respectively. If our instrument merely proxies for an individual's unobserved propensity to work, we would expect to find a significant positive relationship between the number of rooms and the employment status of females in these households, regardless of their low demand for domestic services. However, if δ is only significant in the sample of households that have a relatively high demand for domestic help, then this suggests that the number of rooms affects the employment decisions of females through its impact on maid hire, as opposed to merely proxying for some unobserved variables that might be correlated with the individual's propensity to work.

Table 5 present the results: the coefficient for the sample of married women with children is positive and very statistically significant, the coefficient is negative and not significant for married women with no children, and positive, but half the size and not statistically significant, for low educated mothers with low unearned income. The lack of a significant reduced form relationship between our instrument and the employment probability of females in these households that have a relatively low demand for maid services is reassuring and further reinforces the validity of our instrument.

5.1.3 First-stage estimates

Before turning to the main labor force participation models, we first present and discuss the first-stage, which we estimate using OLS and Probit. We have already estimated the Probit regressions to construct Table 4, here we report the marginal effects, estimate specifications that limit the sample to non-movers and to women living in subsidized housing, and add the OLS estimates. As shown in Table 6, having 4 rooms increases significantly the probability of hiring a domestic helper: the extra room increases the chances of hiring a domestic helper between 4 and 7 percentage points, and the coefficient has a t statistic larger than 10. When we restrict the sample to those households that have not moved in the past 5 years or that live in subsidized housing the coefficient goes down somewhat, but is it still highly significant. An increasing pattern emerge when we run the first-stage by the education level of the mother: a very small effect of having an extra room if the mother is low educated (1.5 to 3 percentage points), much larger if mother is has a medium level education (9 percentage points) and even larger (13 percentage points) if the mother has a college or graduate degree. The pattern is consistent with our simple model. Most women with low education will have low enough potential wages that they will be far from considering whether to hire an FDW or not, and thus the share of compliers (for which the first-stage coefficient is a close proxy) should be small.

5.1.4 Effects on labor force participation

As mentioned before, we use two methodologies to estimate the causal effect of hiring an FDW on the labor force participation: the first is 2SLS, which uses OLS to estimate the first-stage and assumes a linear specification for the second stage; the second a bivariate probit. Both approaches give us an estimate of the local average treatment effect (LATE): the average effect that hiring an FDW has on the labor force participation of women whose decision to hire an FDW depend on having four versus three rooms.

Panel A of Table 7 presents the labor force participation models for the sample of all mothers, for those that have not moved in the past 5 years, and for those who live in subsidized housing. The OLS coefficient is significantly smaller than either the 2SLS or the bivariate probit suggesting that a having an FDW is highly correlated with unobserved wealth. An alternative explanation is that there is no bias but treatment effects for non-compliers are much smaller than for compliers. However, this is highly unlikely, as Table A5 of the appendix shows, the demographic characteristics of the compliers and non-compliers are very similar. The magnitude of the IV coefficients suggest that hiring an FDW increases the labor force participation of mothers by between 50 and 58 percentage points; when we restrict the sample to the non-movers, the results are very similar. Note that we cannot estimate the distribution of the effects that generate the average (Angrist and Pischke, 2009); in other words, we cannot know if our estimate is not one because some women will have worked anyway, because some women will have never worked, or because some women quit the labor force as a result of lower wages for FDW (a possibility derived from our model).

The estimation of the model by the education level of the mother shows significant variation in the magnitude of the effects (Panel B). The largest effects are found for the low education group, where hiring an FDW almost guarantees that the woman will start working. Large effects, but smaller than one, are found for medium educated women. Estimates for women with a college or graduate degree are much smaller. The observed pattern is very much in line with the implications of our model. Women with very high potential wages are likely to work in the market, even if the FDW program never existed. Also, given the high correlation of unearned income and education, it is likely that a fraction of them will be so rich to ever work in the market. What the program did was to allow them to purchase childcare services at much lower prices than before (they have the largest share of compliers and the largest share hiring FDWs), but this did not necessarily change their participation decision. On the other hand, for women with lower potential wages, the program allowed a fraction of them to afford childcare for the first time and therefore to start working. This logic also applies for the larger coefficient for the living in subsidized housing sample, given that they are likely to be less educated and have a smaller unearned income. Note that the aggregate effect on the labor force participation for each of the education groups will not only depend on the estimated treatment effect, but also on the fraction treated (which is very small for the least educated group).

As observed in Table 7 the negative bias of the OLS coefficient is very large for low educated mothers, smaller but still negative for women with a medium level education, and even smaller for highly educated women. Given that having an FDW is likely to be a stronger signal of unearned income for the least educated, and that unearned income is a more important determinant of FDW hire for this group, this pattern supports the hypothesis that the source of the OLS bias is the correlation between having an FDW and unobserved wealth.

5.1.5 Effects of FDWs on other Labor Market Outcomes

Until now we have only studied how FDWs affect the labor supply of Hong Kong women on the extensive margin. Our simple model also implies changes at the intensive margin. Unfortunately, the census data does not include data on number of hours worked, and we cannot use the household surveys because they do not have the number of rooms as a variable. However, there are other potential effects on the labor supply of women that were not explored in the theoretical section but are nonetheless interesting and potentially important. For example, the model abstract from the dynamic effects of FDW on women's careers. But it is possible that the benefits of hiring an FDW accrue over time because they allow women to pursue "career" jobs that require stable participation with few short or long-term absences.

In this section we explore how the availability of domestic work might allow women to work in industries that pay higher wages, arguably by being able to compete more successfully with men. Using a very similar IV strategy to section 5.2, we test if women that have a domestic worker, keeping occupation constant, are more likely to work in industries with higher salaries for males. For example, does having a domestic worker allow a female corporate manager to work in the male dominated insurance industry where average salaries are much higher than in other industries? Although we acknowledge that women might change occupations, given the broad occupation categorization used in the Census, it is unlikely; examples of occupation categories are "Physical, mathematical and engineering science professionals", "Life science and health professionals", and "Office clerks".

We use two dependent variables: the share of female workers and the log of the average salary for male workers in the industry-occupation cell in which the woman works (we use the 1991 Census to construct characteristics of industry-occupation cells). Table 8 reports the estimates for various samples.[12] Consistent with our LFP results, we find that OLS estimates are biased downwards and that the bias is particular strong for the low-education sample. For the sample of all mothers, estimated coefficients go all in the expected direction and are statistically significant for the variables

[12] Note that we only have occupation and industry information for working mothers; therefore, our estimates might suffer from sample selection bias and should be interpreted with caution.

related to average salary of male workers. Magnitudes suggest that having a domestic worker allows a woman to work in an industry that pays males close to 9 percent more than in the industry she would have worked if she didn't have an FDW at home. Weaker evidence is found for a positive effect of having a domestic worker on the share of males in the industry.

The pattern of the coefficients by education level is generally consistent with what we observed for the LFP models: treatment effects are largest for mothers with a low or medium education levels. Hiring an FDW does not change the labor market outcomes for mothers with a college or graduate education.

5.1.6 Comparing macro and micro estimates

To compare our micro and macro estimates we need to estimate the LATE by the age of the youngest child. In results presented in the appendix, we find that the treatment effects are generally larger for mothers of young children and that the effect follows the same decreasing pattern observed before as education increases (see Table A6). We also need to assign treatment effects to non-compliers and out-of-sample observations. Based on the observed characteristics of compliers vs. non-compliers and out of sample (Table A5) we work with two sets of assumption. First, we assume that treatment effects are constant within education levels and age of youngest child. We also assign treatment effects based on our model's predictions and sample characteristics. For example, households with 5 or more rooms tend to be significantly richer than those with 3 and 4, and treatment effects are likely smaller for this group. Combining the estimated coefficients using 2SLS and Bivariate Probit with these two sets of assumptions, we calculate that the aggregate relative effects implied by our micro estimates are between 6 and 8 percent (see Table A7). How do these compare with our time-series diff-in-diffs estimates? The micro numbers are of the same order of magnitude, but systematically smaller than the macro estimates (8.7 to 12 percent versus 6 to 8 percent). This is contrast to what we would expect if general equilibrium effects generate lower wages for women, suggesting perhaps the presence of positive social interactions. By enabling more women with young children to enter the workforce, this policy may have reduced both the economic and cultural barriers for later cohorts of women to enter the workforce, leading to an even larger increase in the demand for female employment over time.

Although we acknowledge that the difference in the macro and micro estimates might come from potential flaws in our estimation strategies (Taiwan not being a perfect control group, or the average treatment effect on the treated being much larger than LATE) our results are very much in line with recent developments in the literature of labor force participation of women. For example, Fogli and Veldkam (2009) develop and test a model in which women learn about the uncertain effects of maternal employment on children by observing nearby employed women. An exogenous increase

in labor force participation of mothers (for example as a result of an FDW program) generates more information, which reduces uncertainty about the effect of maternal employment and makes participation of other women more likely, accelerating the growth in LFP of women. Maurin and Moschion (2009) identify a significant elasticity of own labor market participation of women to neighbors' participation, using an instrumental variable approach that uses sex composition of neighbor's chidlren as an exogenous source of variation. Neumark and Postlewaite (1998) suggest that women's decision to participate in the labor market is influenced by the decision of their sisters and by the social status of their sisters-in-law.

6 Conclusion

The outsourcing of household production to temporary foreign domestic helpers is a distinctive feature of many newly industrialized nations. Moreover, this form of migration is also becoming increasingly prevalent in some western countries as a result of demographic changes and increasing demand as women seek to enter the labor market.

In this paper, we find that temporary domestic helper policies have had a sizeable impact on increasing female labor force participation rates in Hong Kong and on allowing mothers to enter higher paying jobs. The effect has been particularly large for middle class mothers of young children, who can now afford childcare. The estimated treatment effect is much smaller for highly educated women, even if they are the primary consumers of FDWs, given that even in the absence of the program they would have been able to afford more expensive childcare. Back of the envelope calculations suggest that the program increased the labor force participation of mothers in Hong Kong by around 8 percentage points.

The influx of domestic migrant workers is likely to have different economic implications on the host country labor market as compared to conventional low-skilled migrants. Since these workers substitute for household production, they free up native women to take up employment in the labor market and potentially allow them to enter more demanding occupations. This can have important policy ramifications for encouraging women to enter the labor market and to bridge the gender gap. Given that domestic workers provide relatively inexpensive childcare, they might also have an effect on the fertility decisions of natives. This point is particularly relevant for Hong Kong, which has one of the lowest fertility rates in the world. We hope to address this interesting question in future research.

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Figure 1. Trends in FDW Min wage and Native Avg. Wage

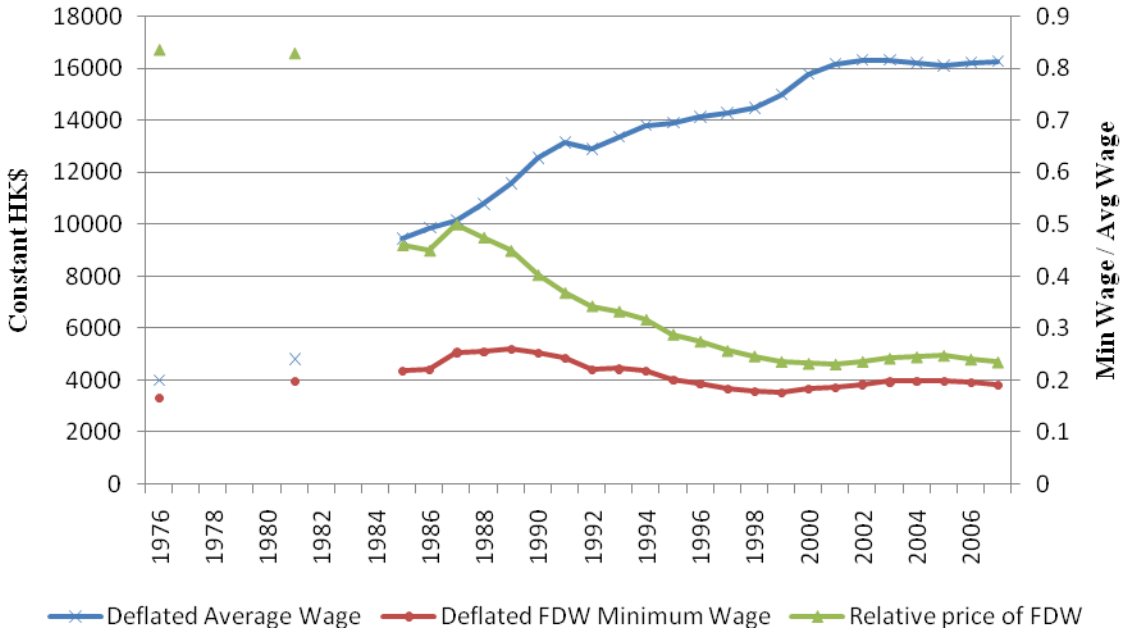


Figure 2. Share of women with a FDW, by education level and age of youngest child

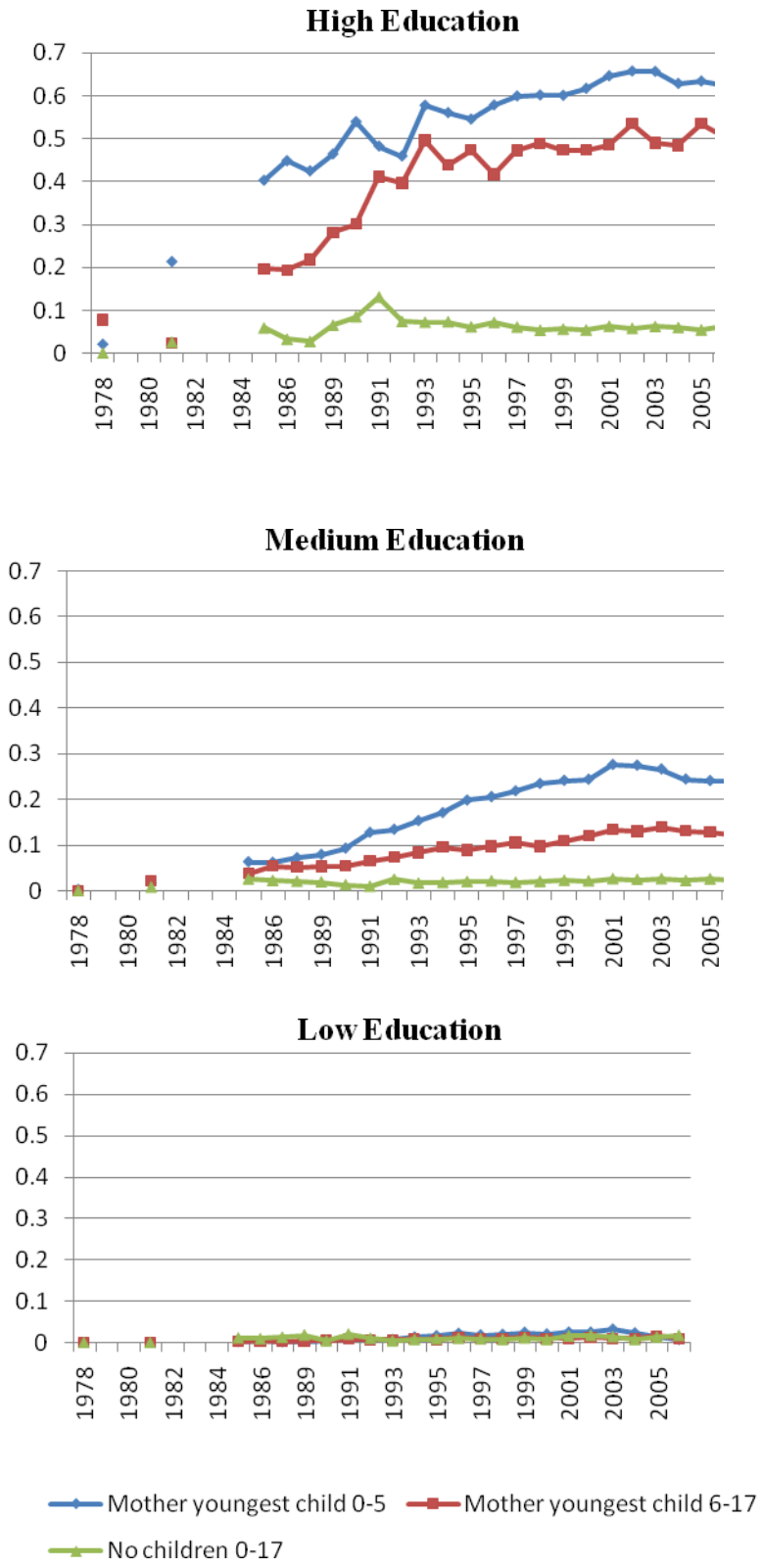


Figure 3a. The Market for Nannies

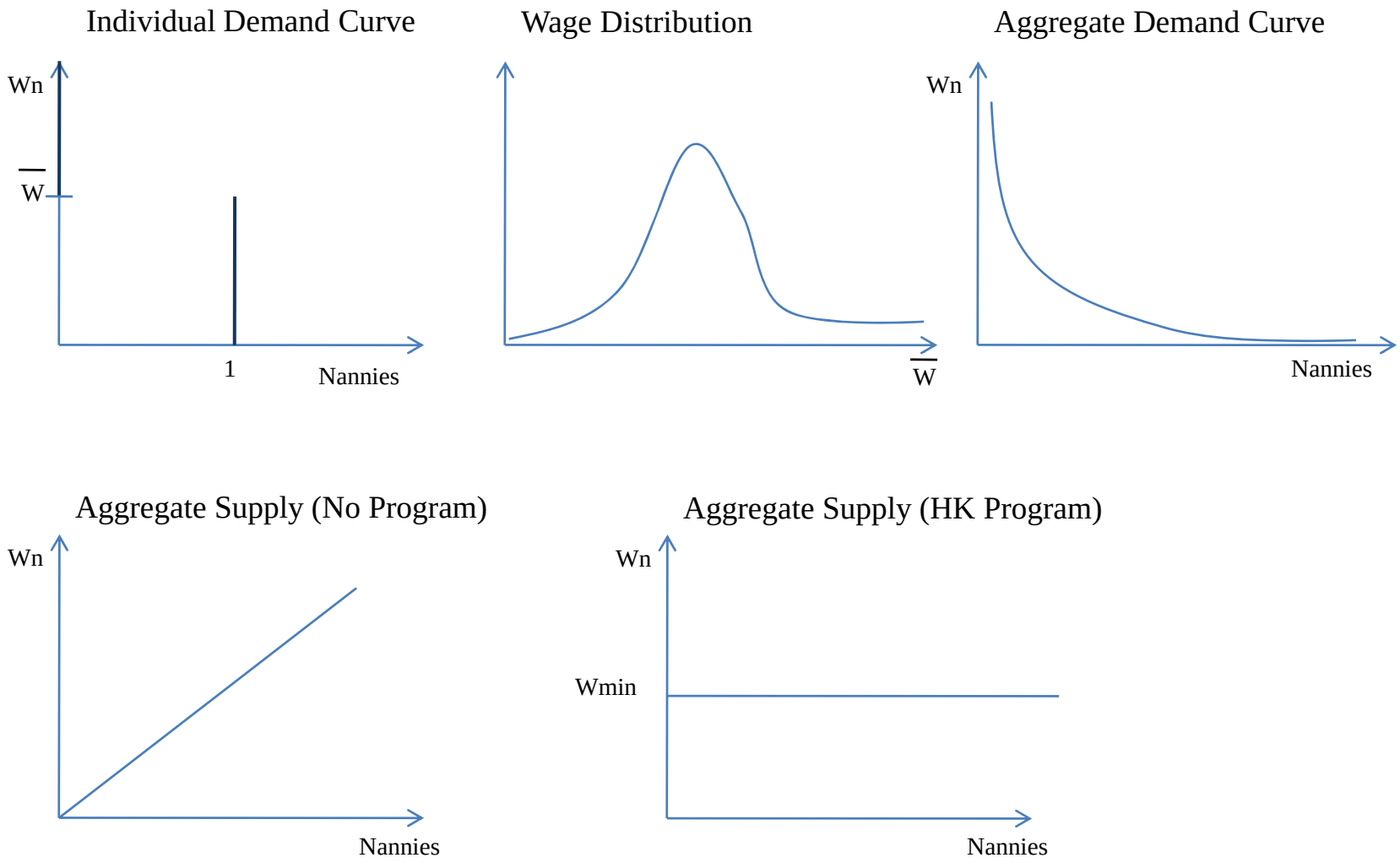


Figure 3b. The Market for Nannies

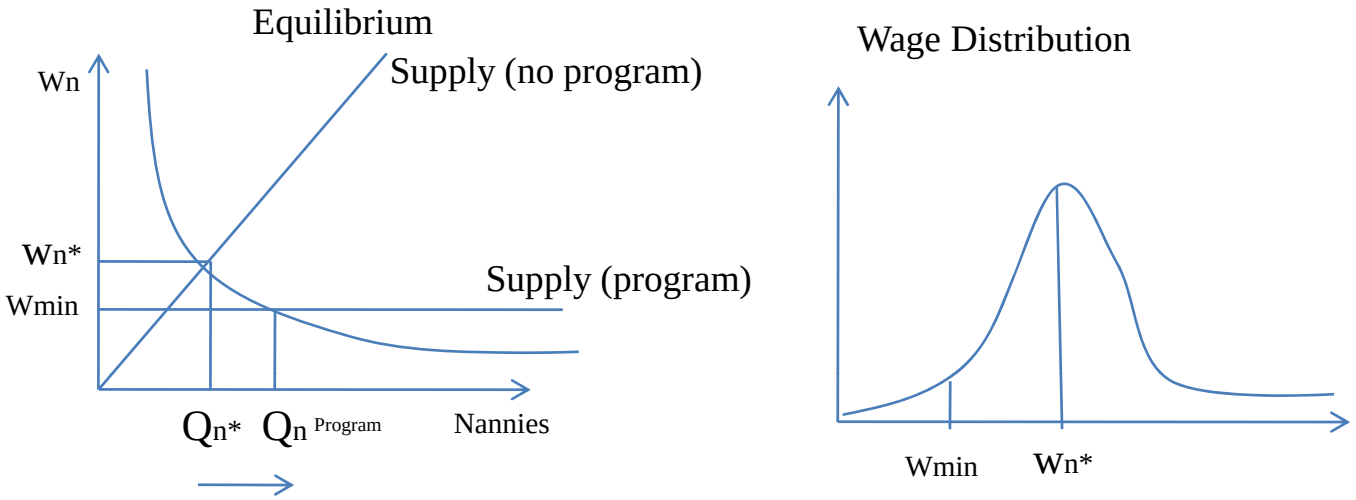


Figure 4. Equilibrium in the Market for Nannies

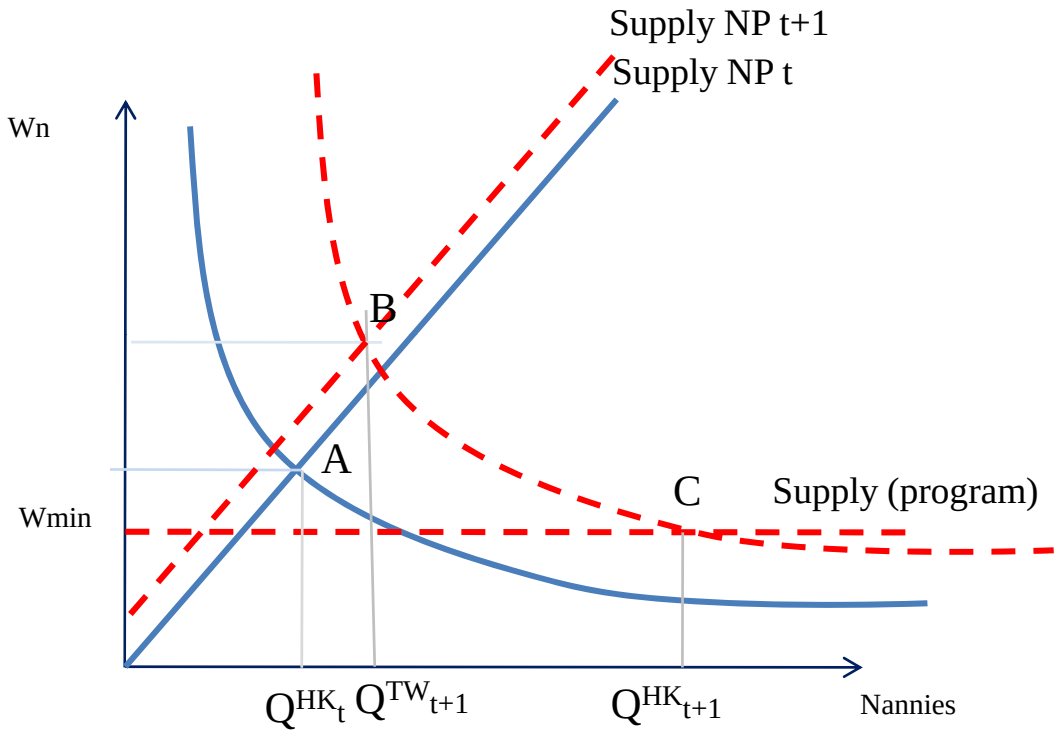


Figure 5. Evolution in the LFP of mothers due to changes in the distribution of observables

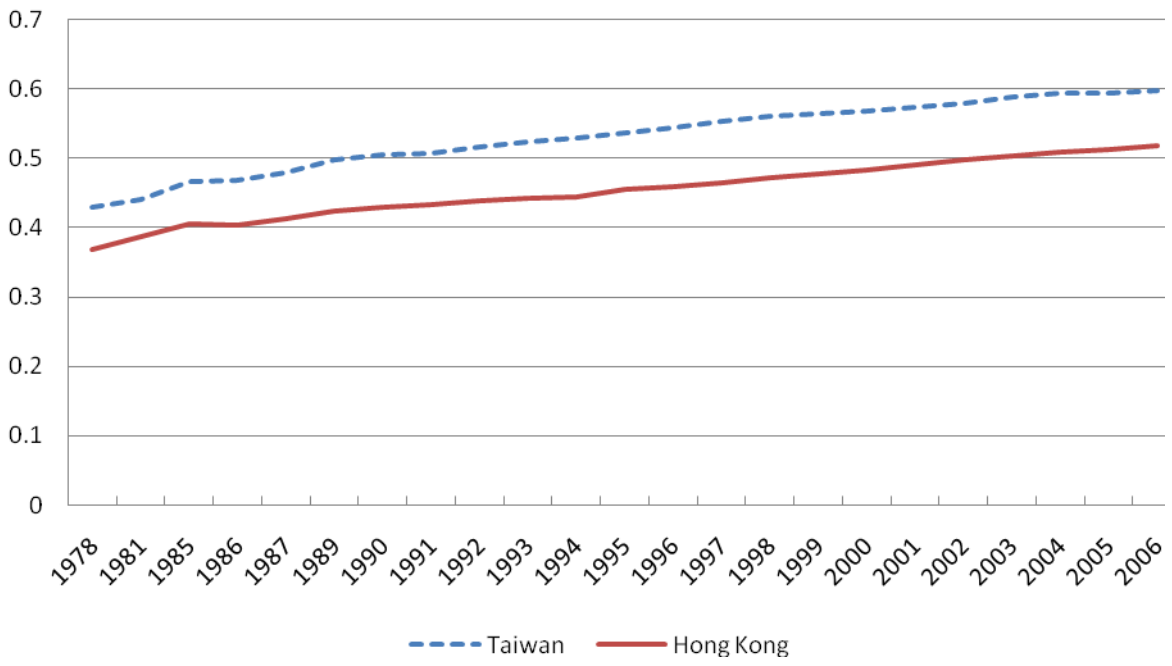


Figure 6. Trends in LFP of mothers, keeping distribution of observables fixed and allowing coefficients to vary by year and country

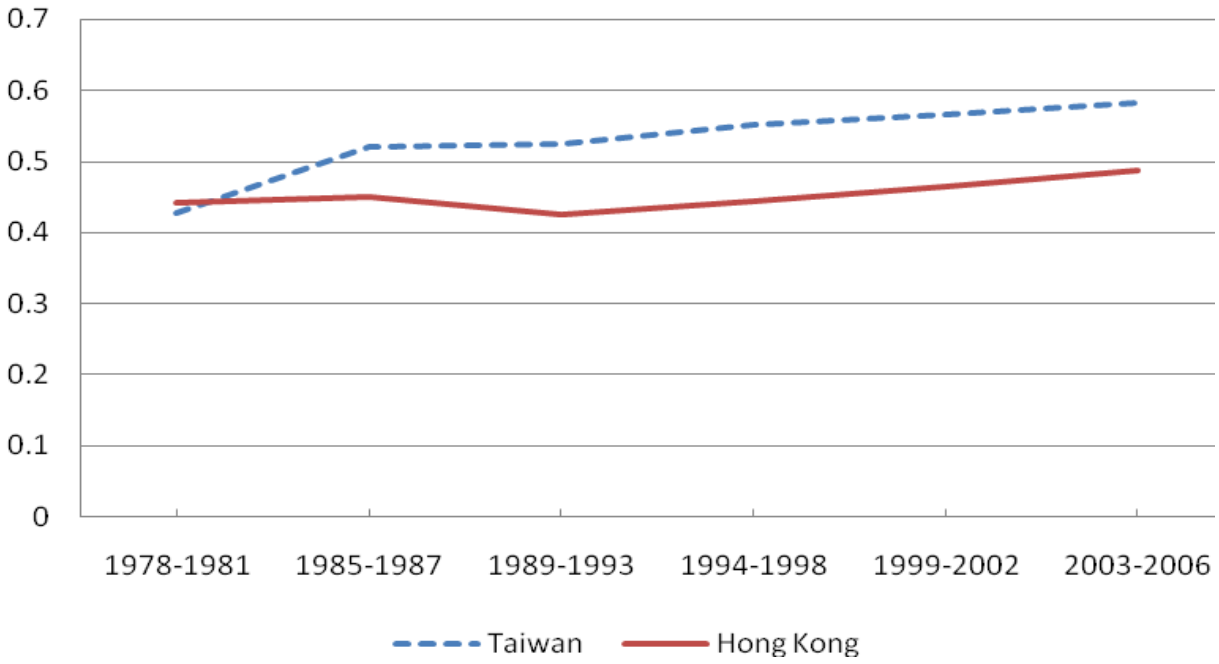
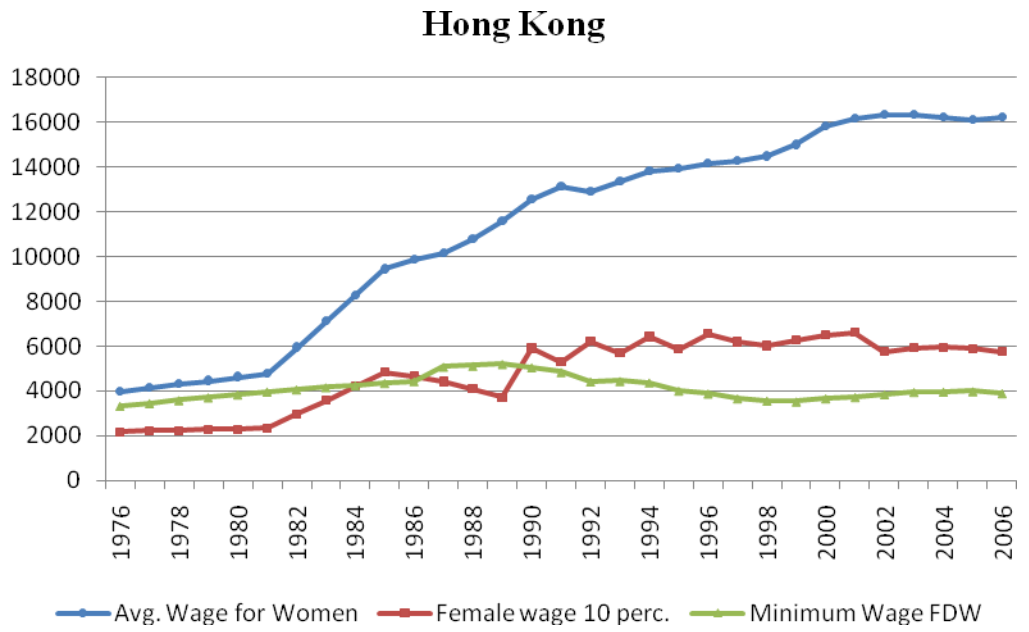


Figure 7. The Evolution of Female Wages in Hong Kong and Taiwan



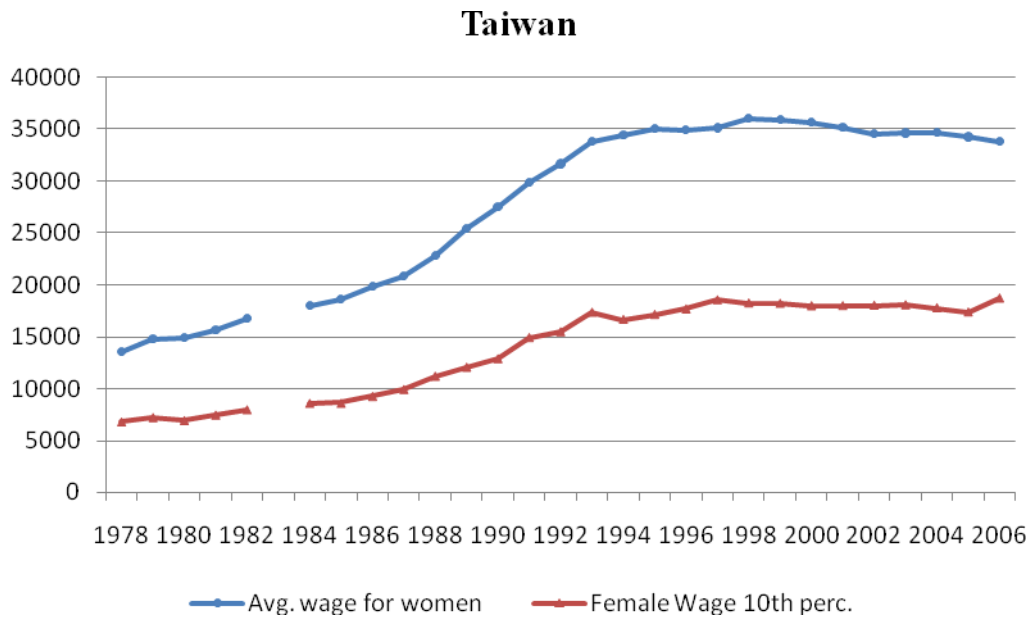
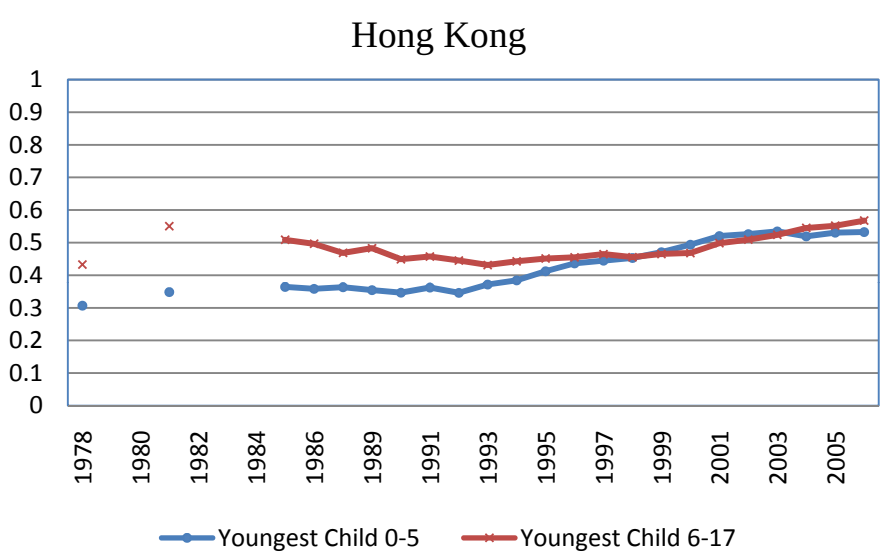


Figure 8. Labor Force Participation of Mothers by Age of Youngest Child



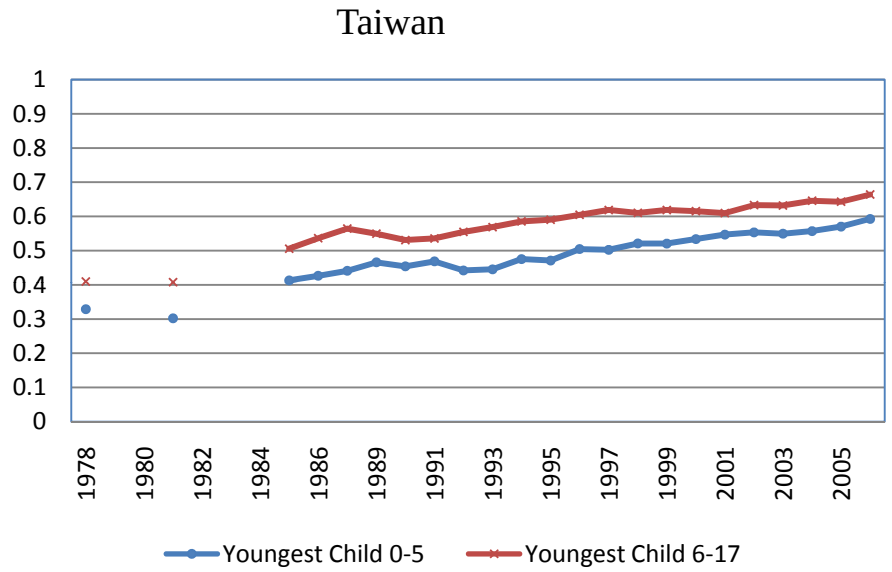


Figure 9. LFP of Mothers by Age of Youngest Child and Education Level

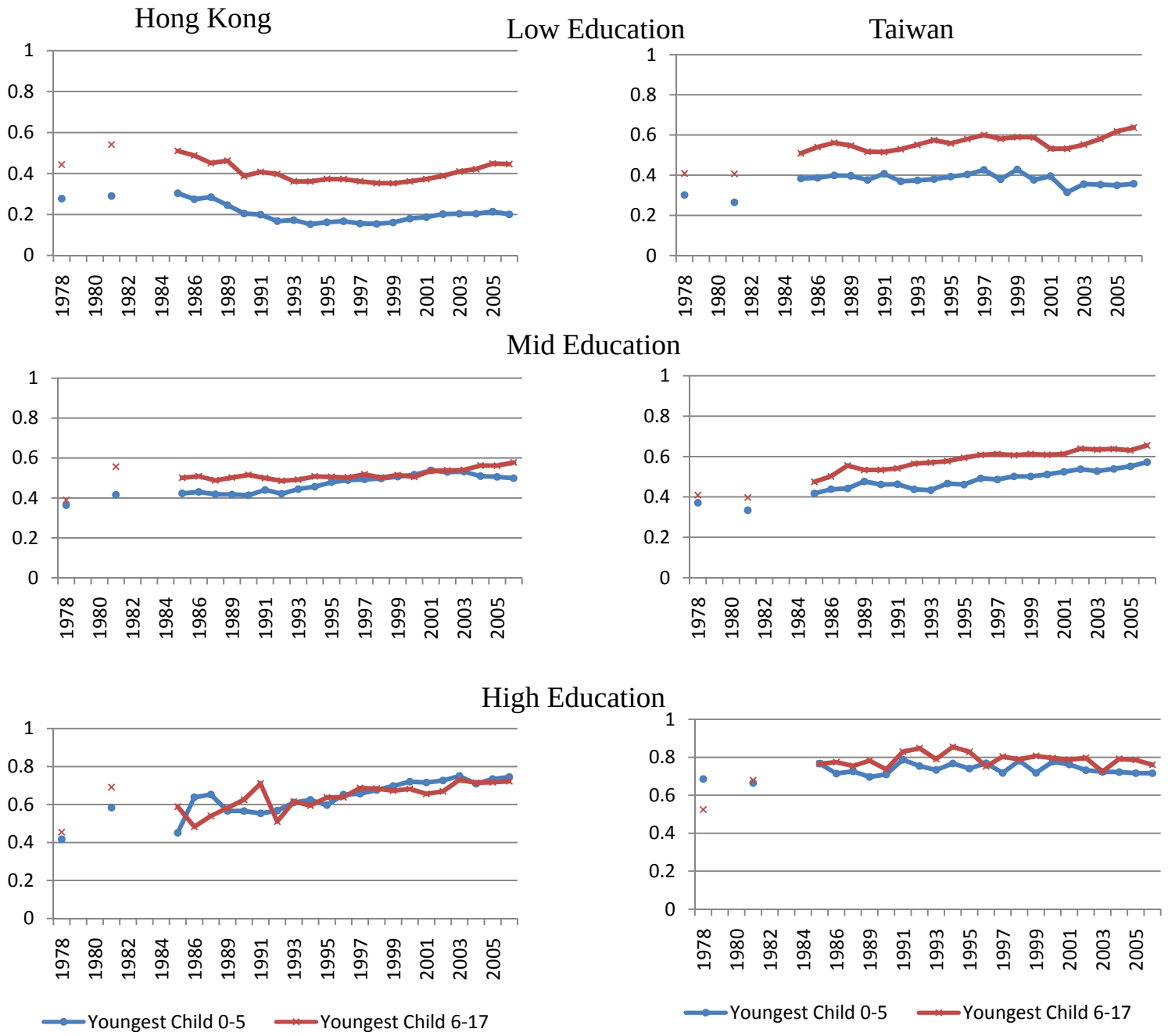


Table 1. Characteristics of Live-in Domestic Workers in Hong Kong

	1976	1981	1986	1991	1996	2001	2006
Share of Hhlds with a DW	0.015	0.013	0.020	0.033	0.059	0.074	0.075
Native	0.975	0.665	0.237	0.043	0.024	0.004	0.007
From Mainland	0.914	0.636	0.210	0.038	0.016	0.003	0.005
Foreigner	0.02	0.34	0.76	0.96	0.98	1.00	0.99
From Philippines	-	0.32	-	0.88	0.84	0.69	0.52
From Indonesia	-	-	-	-	0.09	0.26	0.45
Age	56.6	50.9	38.8	34.2	32.9	32.4	32.9
Ever Married	0.61	0.49	0.42	0.45	0.46	0.49	0.50
Less than Form 5	0.98	0.73	0.33	0.22	0.26	0.31	0.40
Form 5	0.01	0.23	0.34	0.40	0.36	0.17	0.20
Post secondary	0.01	0.01	0.20	0.18	0.15	0.37	0.29
College +	0.00	0.03	0.13	0.20	0.22	0.15	0.12
Speaks English	-	-	-	0.90	0.85	0.77	0.65
Speaks Cantonese	-	-	-	0.17	0.24	0.43	0.52

Source: HK Census and By-Census

Table 2. Prob. of married women 24-44 with mother-in-law or mother at home by country, education level, and year
(Net of age dummies; from Census Data)

	Taipei				
	All	Primary	Secondary	Post-Sec	College+
1980	0.304	0.267	0.317	0.310	0.343
	(0.002)	(0.004)	(0.004)	(0.004)	(0.012)
1990	0.296	0.236	0.314	0.321	0.339
	(0.002)	(0.004)	(0.004)	(0.004)	(0.012)
2000	0.323	0.242	0.346	0.342	0.330
	(0.002)	(0.004)	(0.004)	(0.004)	(0.012)
No. obs:	TW =1286647				
	Hong Kong				
	All	Primary	Secondary	Post-Sec	College+
1980	0.269	0.221	0.300	0.191	0.178
	(0.014)	(0.029)	(0.020)	(0.043)	(0.053)
1990	0.267	0.213	0.286	0.272	0.228
	(0.015)	(0.030)	(0.019)	(0.042)	(0.052)
2000	0.257	0.190	0.292	0.228	0.180
	(0.014)	(0.030)	(0.019)	(0.040)	(0.049)
No. obs:	HK=55081				

Table 3. Triple Difference Estimation of the Effect of FDW in the LFP of Mothers of Young Children
Mothers of Young Children vs. Mothers of Older Children, Taiwan vs. Hong Kong : 1976-2006

	Dependent Variable: Labor Force Participation						
	A. All Women				B. By Education Level		
	(1)	(2)	(3)	(4)	Low	Mid	High
HK*Child05 (Base period 78-84)	-0.065	-0.073	-0.059	-0.059	-0.072	-0.032	-0.159
	(0.030)	(0.030)	(0.029)	(0.031)	(0.034)	(0.040)	(0.063)
	[0.050]	[0.049]	[0.036]	[0.037]			
HK*Child05*period 85-87	0.036	0.039	0.040	0.032	0.009	0.029	0.236
	(0.033)	(0.032)	(0.032)	(0.033)	(0.036)	(0.043)	(0.090)
	[0.007]	[0.009]	[0.012]	[0.013]			
HK*Child05*period 89-93	0.063	0.063	0.072	0.046	0.003	0.055	0.187
	(0.035)	(0.035)	(0.035)	(0.034)	(0.036)	(0.044)	(0.067)
	[0.022]	[0.022]	[0.011]	[0.016]			
HK*Child05*period 94-98	0.138	0.138	0.138	0.101	0.033	0.115	0.199
	(0.032)	(0.031)	(0.031)	(0.032)	(0.035)	(0.041)	(0.067)
	[0.038]	[0.037]	[0.023]	[0.022]			
HK*Child05*period 99-02	0.154	0.155	0.137	0.121	0.067	0.119	0.257
	(0.031)	(0.031)	(0.031)	(0.032)	(0.037)	(0.041)	(0.065)
	[0.064]	[0.059]	[0.010]	[0.013]			
HK*Child05*period 03-06	0.120	0.124	0.095	0.087	0.090	0.071	0.217
	(0.032)	(0.032)	(0.031)	(0.033)	(0.041)	(0.043)	(0.065)
	[0.073]	[0.067]	[0.019]	[0.020]			
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year*HK FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child05*Period FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Education*Period FE	No	No	Yes	Yes	-	-	-
Education*Period FE*HK	No	No	No	Yes	-	-	-
Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs.	564575	564575	564575	564575	166908	363054	34613

Notes: The sample is restricted to women aged 25-44 who have at least one child aged 0 to 17. HK is a dummy variable if the respondent is from Hong Kong. Child05 is a dummy variable if the youngest child is aged 0 to 5. p85-87, p89-93, p94-98, p99-02, p03-06 are dummy variables that denote the time-period considered. Controls include age dummies and three dummies for the education level of the women. Standard errors in parenthesis are clustered at the country-year-level and in square brackets at the country-education level .

Table 4. Determinants of Consumer Surplus of Hiring a FDW - Probit Estimations

	Dep. Var: Dummy for Domestic Worker at Home					
				Education of the Mother		
	All	Non-movers	Subsid. Hous.	Low	Medium	High
Child 0-5	0.527	0.549	0.646	0.488	0.555	0.480
	(0.025)	(0.033)	(0.051)	(0.057)	(0.030)	(0.073)
Number of Children	0.319	0.349	0.317	0.055	0.405	0.656
	(0.033)	(0.048)	(0.075)	(0.058)	(0.042)	(0.099)
Person older than 65 in hhld.	0.407	0.474	0.469	0.346	0.410	0.609
	(0.050)	(0.067)	(0.101)	(0.085)	(0.064)	(0.146)
No. of People in Hhld	-0.290	-0.358	-0.356	-0.221	-0.302	-0.505
	(0.029)	(0.043)	(0.066)	(0.049)	(0.037)	(0.083)
Age	0.290	0.318	0.314	0.167	0.332	0.352
	(0.033)	(0.053)	(0.071)	(0.068)	(0.041)	(0.098)
Age Squared	-0.004	-0.004	-0.004	-0.003	-0.005	-0.005
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Low Education	-0.975	-0.961	-1.066			
	(0.042)	(0.059)	(0.097)			
Medium Education	-0.259	-0.252	-0.317			
	(0.034)	(0.050)	(0.085)			
Log(Husb. Income)	0.218	0.214	0.207	0.347	0.196	0.172
	(0.019)	(0.026)	(0.046)	(0.047)	(0.024)	(0.043)
Low Education Husb.	-0.178	-0.243	-0.176	-0.250	-0.250	0.046
	(0.038)	(0.053)	(0.086)	(0.125)	(0.046)	(0.128)
Medium Education Husb.	-0.016	-0.079	0.004	-0.150	-0.070	0.087
	(0.032)	(0.045)	(0.078)	(0.125)	(0.039)	(0.066)
Dummy for 4 rooms	0.359	0.343	0.291	0.384	0.353	0.359
	(0.021)	(0.029)	(0.044)	(0.048)	(0.026)	(0.058)
Quarter Type FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	32661	18676	7928	15759	14493	2365

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17 and living in homes with 3 or 4 rooms. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

Table 5. Placebo Tests: Reduced form

	Dependent Variable: Labor Force Participation					
	Married with Kids		Married No Kids		Low Edu, Wage husb <10000	
	OLS	Probit - ME*	OLS	Probit - ME	OLS	Probit - ME
Dummy for 4 rooms	0.042	0.045	-0.006	-0.005	0.021	0.022
	(0.006)	(0.006)	(0.008)	(0.008)	(0.017)	(0.018)
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Type FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
N. of Observations	32663		9934		5343	

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

* ME refers to Marginal Effects

Table 6. First Stage: Number of Rooms and the Likelihood of hiring a FDW

	Probit - Marginal Effects Reported						OLS					
				Education of the Mother						Education of the Mother		
	All	Non-movers	Subs. Hous.	Low	Medium	High	All	Non-movers	Subs. Hous.	Low	Medium	High
Dummy for 4 rooms	0.054	0.047	0.040	0.018	0.094	0.140	0.074	0.068	0.049	0.030	0.098	0.130
	(0.003)	(0.004)	(0.006)	(0.003)	(0.007)	(0.022)	(0.004)	(0.005)	(0.008)	(0.004)	(0.007)	(0.021)
Demograp. Cont.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	32663	7940	18677	15794	14493	2376	32663	7940	18677	15794	14493	2376

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17 and living in homes with 3 or 4 rooms. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

Table 7. Cross-section Evidence of the Effect of FDW on Labor Supply

	Dependent Variable: Labor Force Participation																	
	A. All Women									B. By Education Level								
	All			Non-movers			Subsidized Housing			Low			Medium			High		
	OLS	2SLS	Biprobit	OLS	2SLS	Biprobit	OLS	2SLS	Biprobit	OLS	2SLS	Biprobit	OLS	2SLS	Biprobit	OLS	2SLS	Biprobit
Having a FDW	0.349	0.579	0.510	0.353	0.536	0.498	0.374	0.909	0.527	0.383	0.884	0.547	0.348	0.546	0.425	0.233	0.203	0.315
	(0.007)	(0.080)	(0.010)	(0.009)	(0.117)	(0.014)	(0.013)	(0.261)	(0.010)	(0.020)	(0.305)	(0.021)	(0.008)	(0.084)	(0.034)	(0.017)	(0.139)	(0.105)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
N. Obs.	32663			18677			7940			15794			14493			2376		

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17 and living in homes with 3 or 4 rooms. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

Table 8. Cross-section Evidence of the Effect of FDW on Other Labor Outcomes

	A. All Women						B. By Education Level					
	All		Subsidized Housing		Non-movers		Low		Medium		High	
	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS	OLS	2SLS
	Dep. Var.: Share of Males in Occupation x Industry cell											
Having a FDW	0.000	0.038	0.001	0.106	0.000	0.066	-0.003	0.165	0.001	0.018	0.001	-0.027
	(0.002)	(0.021)	(0.004)	(0.082)	(0.002)	(0.034)	(0.006)	(0.090)	(0.002)	(0.020)	(0.004)	(0.029)
	Dep. Var.: Log of male wages in Occupation x Industry cell											
Having a FDW	0.007	0.092	0.011	0.157	0.002	0.122	-0.024	0.001	0.012	0.140	0.009	0.017
	(0.003)	(0.033)	(0.008)	(0.121)	(0.005)	(0.051)	(0.010)	(0.103)	(0.004)	(0.040)	(0.008)	(0.063)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Obs.	16575		4098		9498		6267		8692		1616	

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17 and living in homes with 3 or 4 rooms. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

APPENDIX

Table A1. Type of care for children age 0-3, Taiwan

Year	Parents	Grandparents or Relatives	Nannies	Guest Worker	Daycare
1980	84.71	12.92	2.18	-	0.19
1990	72.93	21.88	5.01	-	0.17
2000	72.33	20.65	6.53	0.16	0.33
2003	69.65	22.35	7.41	0.13	0.46
2006	65.79	26.05	7.48	0.34	0.33

Source: Directorate-General Budget, Accounting and Statistics, Executive Yuan (Taiwan)

Table A2. Descriptive Statistics for the Sample used for the Diff-in-Diff Estimator: Women age 25-44

	Hong Kong						Taiwan						Ho: $X^{HK}_{85\text{-}87}-X^{HK}_{78\text{-}81}=X^{TW}_{85\text{-}87}-X^{TW}_{78\text{-}81}$
Period	78-81	85-87	89-93	94-98	99-02	03-06	78-81	85-87	89-93	94-98	99-02	03-06	p-value
Age 25-29	0.36	0.34	0.27	0.22	0.21	0.19	0.36	0.33	0.29	0.25	0.24	0.26	0.61
Age 30-34	0.24	0.29	0.29	0.27	0.24	0.24	0.24	0.30	0.28	0.26	0.25	0.24	0.711
Age 35-39	0.18	0.23	0.25	0.28	0.29	0.27	0.20	0.21	0.25	0.25	0.26	0.25	0.06
Age 40-44	0.21	0.14	0.19	0.23	0.27	0.30	0.19	0.16	0.18	0.23	0.25	0.25	0.386
Married	0.85	0.78	0.75	0.73	0.70	0.66	0.89	0.85	0.82	0.78	0.76	0.69	0.05
Youngest Kid age 0-5	0.42	0.37	0.29	0.26	0.22	0.19	0.45	0.40	0.34	0.31	0.29	0.24	0.817
Youngest Kid 6-17	0.25	0.31	0.34	0.33	0.32	0.32	0.38	0.39	0.40	0.38	0.37	0.35	0
No Kid 0-17	0.33	0.32	0.37	0.41	0.46	0.50	0.17	0.21	0.26	0.31	0.34	0.41	0.018
Low Education	0.59	0.44	0.33	0.23	0.16	0.10	0.71	0.53	0.36	0.22	0.11	0.06	0.425
Mid Education	0.38	0.52	0.62	0.67	0.69	0.69	0.26	0.42	0.57	0.69	0.77	0.77	0.51
High Education	0.03	0.04	0.05	0.09	0.15	0.21	0.04	0.05	0.06	0.09	0.12	0.17	0.087
LFP	0.51	0.57	0.59	0.63	0.67	0.72	0.41	0.53	0.57	0.62	0.65	0.70	0.164

Table A3. Descriptive statistics of samples used in micro approach

	Sample											
	All		Subsidized H.		Non-movers		Low Edu		Mid Edu		High Edu	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
1-2 Rooms in Hhld.	0.12	0.33	0.04	0.20	0.12	0.32	0.18	0.39	0.08	0.28	0.03	0.16
5-6+ Rooms in Hhld.	0.20	0.40	0.17	0.37	0.17	0.37	0.10	0.30	0.25	0.43	0.49	0.50
3-4 Rooms- Our sample	0.67		0.79		0.71		0.72		0.67		0.49	
Characteristics of Women 3-4 Rooms												
FDW	0.14	0.35	0.12	0.32	0.13	0.33	0.03	0.17	0.21	0.41	0.45	0.50
LFP	0.55	0.50	0.56	0.50	0.56	0.50	0.44	0.50	0.65	0.48	0.75	0.43
Wage | working	12998	11169	11338	7870	12397	10278	7233	5243	14346	9538	27686	17784
Age	37.44	4.70	37.81	4.57	38.61	4.20	38.04	4.68	36.99	4.70	36.20	4.31
Low-Education	0.48	0.50	0.52	0.50	0.51	0.50						
Med-Education	0.44	0.50	0.44	0.50	0.44	0.50						
High-Education	0.07		0.04		0.06							
HHLd. Size	4.02	0.99	4.00	0.92	4.08	0.98	4.27	1.02	3.81	0.91	3.61	0.82
Dummy Child 0-5	0.37	0.48	0.34	0.47	0.28	0.45	0.27	0.44	0.44	0.50	0.69	0.46
Number of Kids	1.73	0.75	1.71	0.71	1.80	0.76	1.97	0.80	1.54	0.63	1.40	0.58
Dummy for member 65+	0.12	0.33	0.13	0.34	0.13	0.33	0.12	0.33	0.12	0.33	0.09	0.29
Husband's wage	17581	15009	15730	10436	16763	13610	13108	8657	19769	15494	33968	26529
Husb. Low-Edu	0.51	0.50	0.56	0.50	0.54	0.50	0.76	0.43	0.32	0.47	0.07	0.25
Husb. Med-Edu	0.38	0.48	0.38	0.49	0.37	0.48	0.23	0.42	0.55	0.50	0.28	0.45
Number of Obs.	32663		7940		18677		15794		14493		2376	

Source: Census 2001 and 2006.

Note: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17. Low Education refers to women with less than Form 5, Mid Edu to women with Form 5, matriculation or vocational training, and High educ to women with a college degree or more.

Table A4. Having Moved and the Likelihood of hiring a FDW

	Dep. Var: Dummy for FDW at Home			
	All		Youngest child 0-5	
	OLS	Probit	OLS	Probit
Moved in past 5 year	0.004	0.003	0.008	0.009
	(0.005)	(0.004)	(0.015)	(0.015)
Demographic controls	Yes	Yes	Yes	Yes
Quarter Type FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
No. of Observations	32663		5945	

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17. Moved in past 5 year is a dummy variable that indicates if the household reported moving at least once in the past five years. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

Table A5. Characteristics of Compliers, non-compliers and out of sample

	Low Education				Medium Education				High Education			
	Compliers	Non-Comp.	5+ Rooms	1-2 Rooms	Compliers	Non-Comp.	5+ Rooms	1-2 Rooms	Compliers	Non-Comp.	5+ Rooms	1-2 Rooms
Age	35.9	38.1	38.1	36.9	38.2	36.9	37.1	34.9	36.9	36.1	36.9	33.4
Household Size	2.86	4.32	4.52	3.61	3.50	3.84	3.87	2.97	3.77	3.58	3.50	2.46
Child under 5	0.36	0.26	0.25	0.27	0.50	0.44	0.37	0.27	0.67	0.69	0.46	0.19
Number of Kids	0.95	2.01	1.87	1.43	1.43	1.55	1.40	0.81	1.52	1.38	1.22	0.35
Dummy for Old > 65	0.11	0.12	0.19	0.09	0.07	0.13	0.16	0.07	0.12	0.09	0.11	0.04
Woman's Education:												
Primary School	0.27	0.30	0.26	0.32	-	-	-	-	-	-	-	-
Form 5	-	-	-	-	0.71	0.75	0.62	0.74	-	-	-	-
College	-	-	-	-	-	-	-	-	0.87	0.85	0.78	0.86
Husband's Wage	18268	12901	20475	11031	26383	19146	35659	14665	32557	34201	56866	25840
Husbands Education:												
Primary School	0.33	0.24	0.18	0.29	0.03	0.05	0.02	0.07	0.02	0.01	0.00	0.01
Less form 5	0.39	0.52	0.43	0.51	0.10	0.29	0.14	0.33	0.10	0.05	0.02	0.09
Form 5	0.18	0.17	0.23	0.14	0.40	0.37	0.31	0.38	0.15	0.13	0.06	0.13
Matriculation	0.02	0.04	0.05	0.03	0.14	0.08	0.11	0.09	0.06	0.05	0.04	0.08
Post Secondary	0.02	0.02	0.04	0.01	0.14	0.09	0.14	0.07	0.03	0.10	0.07	0.09
College	0.06	0.01	0.04	0.01	0.15	0.09	0.21	0.06	0.37	0.47	0.51	0.46
Graduate	0.01	0.00	0.01	0.00	0.04	0.02	0.07	0.01	0.28	0.19	0.29	0.14

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17. Compliers are defined as those who hire an FDW if they have 4 rooms and do not hire an FDW if they have 3 rooms. Non-compliers are defined as those who hire an FDW when they have 3 rooms or who do not hire an FDW when they have 4 rooms.

Table A6. Cross-section Evidence of the Effect of FDW on Labor Supply: Mother of Young vs. Older Children

	Dependent Variable: Labor Force Participation											
	Low Education				Medium Education				High Education			
	Child 0-5		Child 6-17		Child 0-5		Child 6-17		Child 0-5		Child 6-17	
	2SLS	Biprobit	2SLS	Biprobit	2SLS	Biprobit	2SLS	Biprobit	2SLS	Biprobit	2SLS	Biprobit
Having a FDW	1.317	0.642	0.724	0.294	0.539	0.378	0.696	0.413	0.313	0.319	0.262	0.204
	(0.312)	(0.086)	(0.405)	(0.183)	(0.089)	(0.068)	(0.107)	(0.033)	(0.142)	(0.173)	(0.247)	(0.229)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Obs.	4215		11579		6392		8101		1636		740	

Notes: The sample is restricted to women aged 25 to 44 with at least one child aged 0 to 17 and living in homes with 3 or 4 rooms. Demographic controls include age, age-squared, three dummies for educational attainment and spouse educational attainment, household size and indicators for the presence of children aged 0 to 5 and 6 to 17, the presence of a live-in parent aged above 65 years and log spouse income. Robust standard errors reported.

Table A7. Aggregate Effects implied by the Micro-level Estimations

	Child 0-5				Child 6-17			
	Rooms 3-4		Rooms 1-2	Rooms 5-6	Rooms 3-4		Rooms 1-2	Rooms 5-6
	Compliers	Non-comp.			Compliers	Non-comp.		
	Low-Education (34% of Child 0-5, 57% of Child 6-17)							
Share of Edu. Group	0.026	0.663	0.211	0.099	0.016	0.712	0.172	0.099
Share with FDW	0.060	0.060	0.009	0.254	0.021	0.021	0.003	0.128
*Treatment Effect**								
Assuming const. TE	0.642	0.642	0.642	0.642	0.294	0.294	0.294	0.294
Heterogeneous TE **	0.642	0.578	0.770	0.514	0.294	0.264	0.352	0.235
Est. Aggregate Effect								
Assuming const. TE	0.044				0.008			
Heterogeneous TE	0.038				0.007			
	Medium-Education (52% of Child 0-5, 40% of Child 6-17)							
Share of Edu. Group	0.069	0.591	0.092	0.248	0.051	0.624	0.079	0.246
Share with FDW	0.301	0.301	0.062	0.559	0.151	0.151	0.026	0.397
Treatment Effect								
Assuming const. TE	0.378	0.378	0.378	0.378	0.413	0.413	0.413	0.413
Heterogeneous TE	0.378	0.340	0.453	0.302	0.413	0.372	0.496	0.330
Est. Aggregate Effect								
Assuming const. TE	0.129				0.083			
Heterogeneous TE	0.113				0.072			
	High-Education (14% of Child 0-5, 3% of Child 6-17)							
Share of Edu. Group	0.070	0.440	0.027	0.462	0.054	0.382	0.025	0.536
Share with FDW	0.506	0.506	0.195	0.717	0.328	0.328	0.119	0.640
Treatment Effect								
Assuming const. TE	0.319	0.319	0.319	0.319	0.204	0.204	0.204	0.204
Heterogeneous TE	0.319	0.287	0.383	0.255	0.204	0.184	0.245	0.163
Est. Aggregate Effect								
Assuming const. TE	0.190				0.100			
Heterogeneous TE	0.162				0.083			

Est. Aggregate Effect for Child 0-5:		Est. Aggregate Effect for Child 6-17:	
Assuming const. TE	0.109	Assuming const. TE	0.041
Assuming Heter. TE	0.095	Assuming Heter. TE	0.035

Aggregate Micro Approach Effect: Effect for mothers of younger child - Effect for mothers of older child

Assuming const. TE	0.068
Assuming Heter. TE	0.060

*The reported TE are estimated using Bivariate Probit Models (See Table 7). Results using the 2SLS estimates are similar: Aggregate micro effect of 8.1 percent for Const. TE, and of 7.1 percent for Heter. TE.

* *The Heterogeneous TE assume that the TE for non-compliers is 1.1*LATE, for Rooms 1-2 1.2*LATE and for Rooms 5-6 0.8*LATE.

Notes: Compliers are defined as those who hire an FDW if they have 4 rooms and do not hire an FDW if they have 3 rooms. Non-compliers are defined as those who hire an FDW when they have 3 rooms or who do not hire an FDW when they have 4 rooms. The estimated aggregate effect is computed by taking the weighted sum of the treatment effects, weighted by the share of education group*share with FDW in each group.