

# The Globalization of Household Production<sup>1</sup>

Michael Kremer

Stanley Watt

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Restrictions on migration of low-skilled workers to richer countries are arguably the largest distortion in the world economy and the most costly to the world's poor. Yet rich countries seem unlikely to eliminate these restrictions due to concerns about the impact of migration on inequality among natives, public finances, and native culture. A rapidly growing new type of migration may not be subject to these concerns. Many "new rich" countries issue special visas for foreigners, women in particular, to work as private household workers. "Old rich" countries often choose low levels of enforcement against illegal immigrants working in this sector. We argue 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. Calibration suggests programs, such as Hong Kong's or Singapore's, under which roughly 7% of the labor force are foreign private household workers, may increase the ratio of wages of native low-skilled to wages of high-skilled workers by 2.9% and increase native welfare by 0.9% of income, roughly 60 times the level estimated by Borjas. Paradoxically, however, even if these programs are pareto improving, they may conflict with ethical norms requiring stronger social obligations to long-term residents than to other foreigners. Short-term programs may be more acceptable.

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## 1. Introduction

Restrictions on movement of low-skilled workers to richer countries are arguably the most important distortion in the world economy and the most harmful to the world's poor. Klein and Ventura (2004), for example, estimate that the removal of immigration restrictions in OECD countries could increase world output by up to 172%.<sup>2</sup> Yet despite calls for freer mobility (perhaps, most notably from Mexico's President Fox), the elimination of immigration restrictions is not under consideration in rich countries. Indeed, resistance to low-skill migration seems to be hardening in developed countries. Many developed countries are increasingly focusing on admitting highly skilled immigrants from developing countries (Kapur, 2004), arguably with negative brain drain effects on the sending country (Bhagwati and Hamada, 1974; Haque and Kim, 1995; Miyagiwa, 1991).

High-income countries limit migration, particularly of low-skilled workers, due to concerns that immigration of low-skilled workers would (1) exacerbate inequality among natives, (2) create a burden on the welfare state, and (3) change native culture and increase crime.

In standard models, in which low and high-skilled workers are complements, migration by low-skilled immigrants lowers wages for low-skilled natives, raises wages for high-skilled natives, and thus increases inequality among natives. The estimated welfare gains for the host country are typically small relative to distributional effects.

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<sup>2</sup> Klein and Ventura assume that capital is mobile and that immigrants can take advantage of OECD levels of total factor productivity. Even without these favorable assumptions, Walmsley and Winters (2003) estimate that an increase of 3% of labor supply in immigration in developed countries could raise world welfare by 0.6%, half of the gains associated with complete trade liberalization. Williamson (1996) argues that 19<sup>th</sup> Century mass migration led to income convergence across today's rich countries by directly raising the wages of the migrants and by reducing labor supply in the sending countries.

Borjas (1999) estimates welfare gains to natives on the order of .01 or.02% of GDP<sup>3</sup> and Borjas (1995) writes that “the relatively small size of the immigration surplus – particularly when compared to the very large wealth transfers caused by immigration – probably explains why the debate over immigration policy has usually focused on the potentially harmful labor market impacts rather than the overall increase in native income.”

We examine a new form of low-skilled immigration and argue it may have very different effects. Women are increasingly crossing international borders to work as private household workers. A substantial proportion of “new rich” countries have explicit programs granting temporary visas that allow foreigners to work as private household workers, such as nannies and maids but restrict them to this sector. Table 1 shows that in Bahrain, Kuwait, and Saudi Arabia around 10% of the labor force or more are foreign workers in private households. In Hong Kong and Singapore, 6.8% and 7.0% of the total labor force, respectively, are foreign domestic helpers. Foreign private household workers make up at least 0.8% of the labor force in Taiwan, and immigrant workers in private households are at least 0.8% of the labor force in Israel. Non-Greek, non-EU employees in private households constitute about 1% of the labor force in Greece.

Women are also traveling from new EU member states to those older EU member states that have not delayed opening their labor markets: the U.K., Ireland, and Sweden. 427,000 people from Eastern European countries that joined the EU just over 2 years ago have received rights to work in Britain; anecdotal evidence suggests that many of these

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<sup>3</sup> Borjas (1999) gives a range of values depending on different assumptions about factor price elasticities. These numbers come from assuming that the price of capital is fixed, and are for changes in income, rather than welfare.

are household workers. The other EU member states are required to open their labor markets by 2011, and are also likely to see an increase in this type of migration.

Anecdotal evidence suggests that substantial numbers of foreign women work illegally as household employees in other “old rich” countries of Europe and North America. In the US 35% of women illegal immigrants reported that their first job was working in a private household (Cortes 2004). Authorities are less likely to enforce laws against hiring illegal workers when private households, rather than firms, are doing the hiring. Italy and Spain, for example, are reported to have significant numbers of foreigners working illegally as private household workers. A limited number of foreigners are working legally as private household workers in rich countries under Au Pair programs.

Whereas much less skilled migration is blocked by fears that it will increase inequality among natives, create a fiscal burden, and change native culture. We argue that migration of foreign private household workers can potentially (1) equalize wages among natives, (2) provide a fiscal benefit, and (3) limit the perceived impact of immigration on culture and crime.

When foreign workers perform services previously done within households, such as cooking, cleaning, and care for children, the sick, and the elderly, they free up native labor, particularly women’s labor that had been spent on household production, for market production. (See Cortes and Tessada, 2007). Since high-skilled natives with a higher opportunity cost of time are more likely to purchase domestic services from immigrants, native high-skilled workers will spend more time working in the labor market.

To the extent that migration of foreign private household workers leads high-skilled natives to increase labor supply to the market, wage inequality among natives is reduced. The increase in labor supply of high-skilled workers leads to a decline in their relative wage and an increase in the relative wage of complementary low-skilled native labor. By allowing women to work more flexible hours, foreign private household workers may also reduce gender disparities among high-skilled natives and help eliminate the glass ceiling.

Moreover, when high-skilled women hire immigrant private household workers and transfer their labor from home production to market work, their output becomes taxable, providing a fiscal benefit for the population, even without considering the taxes paid by the migrants themselves.

The long-run impact of Hong Kong or Singapore-style foreign private household worker programs on native culture is limited, since immigrant private household workers are typically not allowed to bring families with them on their visas. These workers are typically female, and crime is, therefore, less likely to be perceived as a problem.

We construct and calibrate a simple model to examine the economic impact of foreign private household workers on natives. We assume that high-skilled native families would use daycare centers in the absence of foreign private household workers. However, daycare centers typically do not cook or clean or admit children during holidays or when they are ill. Thus, private household workers allow their employers to supply more time to expand labor market supply on the intensive margin.

We report fixed effects estimates in Argentine and Israeli data which suggest that each private household worker leads to a 15% increase in employer time to market

production. Using this estimate of 15%, immigration of 7% of the native labor force can increase relative wages of the native low-skilled by 2.9% and native welfare by 0.9%. The effect on welfare is about 60 times the amount found by Borjas (1999). We argue that even if some foreign private household workers leak into other occupations, native low-skilled are still likely to be better off.

While immigration by foreign private household workers avoids many of the political economy obstacles of other forms of migration, it raises a new set of ethical issues and paradoxes. Under ethical norms where obligations depend on location of residence, rather than being either universal or linked to citizenship, foreign private household worker programs may well be considered unacceptable even if they are Pareto improving. Programs with temporary non-renewable visas might make introducing foreign private household workers more palatable. For example, existing Au Pair programs could be expanded or the requirement that Au Pair workers be students could be dropped.

The rest of the paper is structured as follows: Section 2 lays out a simple model designed to illustrate the impact of foreign private household workers on wages and welfare in the host country. Section 3 calibrates the impact of a Hong Kong or Singapore-style program in the US. Section 4 discusses ethical and policy issues related to the adoption of such programs, and section 5 concludes.

## **2. Model**

We present a model designed to illustrate the impact of foreign private household worker migration. Subsection 2.1 sets up the model by describing households and producers. Subsection 2.2 solves the model's equilibrium conditions. We focus on parameter values

for which native households would use daycare centers in the absence of foreign private household workers, and we abstract from endogenous fertility decisions or labor/leisure tradeoffs. Our model is thus most appropriate for societies where many women are educated and can potentially work in the labor market, and where time freed up by these workers is likely to go into market work rather than leisure or increased fertility. A more complicated model might be needed in places where the fertility response is likely important, as discussed at the end of the section.

### **2.1. Setup**

We assume there are three types of agents: native high-skilled workers, native low-skilled workers, and foreign private household workers. We normalize the native population to one and assume that a fraction  $h$  are high-skilled, leaving  $1 - h$  the fraction of low-skilled natives. Let  $m$  denote the population of foreign private household workers, making the total population in the host country  $1 + m$ . Each agent is endowed with 1 unit of labor.

Agents consume two types of private consumption goods, a general good, denoted good  $A$ , and a domestic good like cooking, cleaning, or childcare, denoted good  $C$ . Consumers' utility is linear in good  $A$  and is  $U = A + v(g)$  where  $g$  is the government provision of a public good to be discussed later. All native consumers must consume a required  $R$  units of the domestic good. The domestic good can either be self-produced, purchased from daycare centers, or purchased from private household workers. Natives also consume a public good paid for by the government as discussed later.

The production function for good  $A$  is  $A = H^\beta L^{1-\beta}$  where  $H$  is high-skilled native labor,  $L$  is low-skilled native labor, and  $0 < \beta < 1$ . We assume immigrating foreign private household workers are legally excluded from entering this sector under the terms of their visa, as in Hong Kong and Singapore.<sup>4</sup> We will consider the case where some foreign private household workers leak into the general economy and substitute for low-skilled workers in production of good  $A$  in section 3.

We assume there are three technologies for domestic good production: Home production, daycare centers, and private household workers. People can home produce one unit of domestic good with one unit of labor.

Daycare centers produce good  $C$  with production function  $C_{dc} = kH^\beta L^{1-\beta}$ . We assume daycare centers have the same factor intensity as good  $A$ . If anything this is a conservative assumption, as Kisker et al. (1991) find that 47% of teachers in US day care centers have completed college. This is considerably more than the 24.1% of workers with college degrees in the general economy (Kominski and Adams, 1994).

Daycare centers only produce certain types of the domestic good. We therefore assume there is an upper limit denoted by  $\bar{c} < R$  as to how much of the domestic good consumers can purchase from daycare centers. Most daycare centers are open only during limited hours, are closed on holidays, and send home sick children. Consumers

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<sup>4</sup> The assumption that low-skilled immigrants and low-skilled natives are not perfect substitutes and that these types of immigrants have a comparative advantage at producing the domestic good is necessary for our results. Imperfect substitutability of immigrants and native low-skilled workers may arise due to differences in skills between these workers, or to government policies that restrict immigrants' ability to work outside the domestic sector, as in the Hong Kong foreign domestic helpers program or the US and UK Au Pair programs, or to differential enforcement of immigration restrictions across workers in different sectors. Some evidence that immigrants have a comparative advantage in domestic work is provided by the fact that in 1998 in the US, non-citizens were almost five times more likely to work in personal service – private household category as citizens. 3.6% of non-citizens were employed in those occupations as opposed to 0.7% of US citizens.<sup>4</sup> 2.7% of foreign-born US residents (including naturalized citizens) work in personal service occupations. Cortes (2006) finds specifically that 25.8% of low-skilled female immigrants are employed in private households, a number much larger than for the native population.

employing daycare centers must still drop off and pick up their children, find alternative childcare on holidays, and care for sick children themselves. Daycare centers also do not perform other domestic tasks like cooking and cleaning.

We also assume a third type of technology for good C production, private household workers. In most of the developed world, we observe very few natives working as private household workers. In the UK in 1990, only 0.05% of the working population were employed as domestic housekeepers. In the US, only around 1% of entire employed population (including natives and non-natives) are employed in the personal services – private household industries. To account for this, we also assume that working conditions and social stigma associated with private household work cause people to dislike working in the private household sector and/or that households prefer or are more efficient at producing their own domestic good, because they know their own tastes in food, enjoy taking care of their own children, etc. This will mean that there will be a wedge between the after-tax wage of potential employers and the wage in alternative jobs open to potential employees. We model this by assuming that workers suffer disutility  $\delta$  from doing private household work.

Although foreign household workers experience a utility penalty when working as private household workers, we assume that their other options are even less attractive. Thus, we assume a potentially inelastic supply of foreign private household workers. We assume that the supply of foreign private household workers is only limited by the number of visas that the host government will provide.

Foreign private household programs usually restrict immigrants to working for only one native household worker, so we assume that foreign private household workers

cannot divide their labor supply among several native households. (Relaxing this assumption would magnify the impact of foreign private household worker migration.)

We assume that one private household worker can provide the full  $R$  units of domestic good production for exactly one household (and this worker is restricted to work for only one employer, for example because it is important to be on call all the time for when a child gets sick, a parent needs to work late, etc. Formal programs often restrict foreign private household workers to a single employer.)<sup>5</sup>

The government taxes the labor income of all natives at tax rate  $\tau$  and spends all tax revenue on a public good that is only enjoyed by natives. Taxes are paid in units of good  $A$ . In order to abstract from debates about whether immigrants pay more in taxes than they receive from the government in social services, we assume that foreign private household workers are neither taxed nor enjoy the benefits of the government good. (In fact, foreign private household workers are most likely to be net contributors to the welfare system. In Hong Kong and Singapore, employers of private household workers are levied a tax, and the workers themselves enjoy very little of government provided goods and transfers.)

Natives inelastically supply one unit of labor and face the following budget constraint:

$$W_i(1-\tau)(1-L_C) = P_A A + P_{hw} C_{hw} + P_{dc} C_{dc}, \text{ where } W_i \text{ is the wage of consumer } i (i \in \{H, L\})$$

where subscript  $H$  denotes high-skilled workers, and  $L$  corresponds to low-skilled

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<sup>5</sup> We assume that native private household worker provides  $1-R+\bar{c}$  units of their own labor to produce  $R$  units of domestic good for the employing household. This implies that the production function of native private household workers is  $C = \frac{R}{1-R+\bar{c}} \cdot Labor$ . We, therefore, assume that native private household workers to employ daycare centers to care for their own children. This assumption is not crucial to our results, and it is made for simplicity.

**Comment [M1]:** (I could not add comments to footnote). Maybe the assumption about production function of native private household workers is worth mentioning in the body of paper; if you have some justification for this (other than this assumption is not crucial for your results) it would be nice to add it here. I think this assumption (about production fn) is better for native PHW than assuming that they (natives) are restricted somehow to work within the same household; in such specification, there is no redundant labor.

workers),  $L_C$  is the amount of domestic good production households self-produce,  $P_A$  is the price of good A,  $P_{hw}$  is the price of good C produced by household workers,  $C_{hw}$  is the amount of good C purchased from household workers,  $P_{dc}$  is the price of daycare, and  $C_{dc}$  is the amount of good C purchased from daycare providers. Good A will be the numeraire, and thus  $P_A = 1$ . In addition, the household faces the constraint that  $C_{dc} \leq \bar{c}$  and that  $C_{hw} + C_{dc} + L_C = R$ .

How the household chooses its consumption bundle of domestic services depends on the price of daycare services,  $P_{dc}$ , the price of private household worker services,  $P_{hw}$ , and the opportunity cost of home production of the domestic good  $(1 - \tau)W_i$ . Households will choose the combination of daycare services, household worker services, and own production that maximizes their consumption of good A (recall that their utility function is equal to consumption of good A). If households have sufficiently low wages that  $W_i(1 - \tau) < P_{dc}$  and  $W_i(1 - \tau) < P_{hw}$ , they will self-produce  $R$ , their entire domestic good consumption. If the opportunity cost of working is greater than the price of daycare services,  $W_i(1 - \tau) > P_{dc}$ , but private household workers are too expensive, relative to a mix of using daycare and home production,  $P_{hw}R > P_{dc}\bar{c} + W_i(1 - \tau)(R - \bar{c})$ , then households will fully utilize daycare centers and self-produce the balance of their domestic good needs. Finally, if  $P_{hw} < W_i(1 - \tau)$  and  $P_{hw}R < P_{dc}\bar{c} + W_i(1 - \tau)(R - \bar{c})$ , then the household will hire a private household worker.<sup>6</sup>

The model implies that high-skilled natives with a higher opportunity cost of time will be more likely to utilize private household workers. This is consistent with empirical

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<sup>6</sup> We have covered all possible cases except where the price of daycare centers is greater than the cost of hiring a private household worker which we believe is extremely unlikely.

data. In 1990, almost 18% of university educated mothers in Singapore hired domestic workers while only 15% of polytechnic educated mothers, 2% of secondary educated mothers and less than 0.2% of primary school educated mothers hired domestic workers (Singapore Census of Population 1990).

## 2.2. Equilibrium

We first consider the closed economy case where no foreign private household workers are permitted in the host country. With perfect labor mobility, for someone of a given skill, wages  $W_i$  must be the same in both the good  $A$  and daycare labor markets. Furthermore, natives working as private household workers must be paid a higher wage in order to make them indifferent between working as a private household worker and working in the daycare or good  $A$  industries. This wage is determined by

$W_{hw}(1-\tau)(1-L_{chw})-\delta=W_i(1-\tau)(1-L_{Ci})$  to make agents with potential wage  $W_i$  indifferent between private household work and working in sector  $A$  (or daycare provision). Here  $W_i(1-\tau)(1-L_{Ci})$  is the utility of an agent working in sector  $A$ , as we earlier assumed that it is equal to consumption of good  $A$ , and  $P_A = 1$ .  $1-L_{chw}$  is labor supply of natives working as private household workers. Therefore, the price of the service provided by native private household workers will be  $P_{hw}R = W_i(1-L_{Ci}) + \frac{\delta}{(1-\tau)}$

where  $W_i$  is the wage of workers of type  $i$  being hired as private household workers, and  $L_{Ci}$  is amount of labor which a worker of type  $i$  spends on home production of domestic good.  $P_{hw}R$  should be equal to the wage of a private household worker since the worker is restricted to work only for one employer, and  $P_{hw}R$  is the maximum amount of money this worker can earn working for this employer.

**Proposition 1:** *If*

**Assumption A1:**  $h < \beta$

**Assumption A2:**  $h > \frac{\left(\frac{1}{k}\right)^{\frac{1}{\beta}}}{\left[1 - \tau(1 - \beta)\right]^{\frac{1}{\beta}} + \left(\frac{1}{k}\right)^{\frac{1}{\beta}}}$  and

**Assumption A3:**

$$(1 - \beta) \left(\frac{h}{1 - h}\right)^{\beta} - (1 - \tau) \beta \left(\frac{h}{1 - h}\right)^{\beta - 1} (R - \bar{c}) > \frac{\bar{c}}{k} - \frac{\delta}{(1 - \tau)(1 - R + \bar{c})},$$

then  $W_H > W_L$ ,  $W_i(1 - \tau) > P_{dc}$ , and  $P_{hw}R > P_{dc}\bar{c} + W_i(1 - \tau)(R - \bar{c})$  for

$i \in \{H, L\}$ , and in the absence of immigration, all natives employ daycare centers and do not hire native private household workers. (Proof is in Appendix A).

In the subset of the parameter space defined by Assumptions A1 – A3<sup>7</sup>, for each native the opportunity cost of not working is strictly greater than the cost of daycare centers. With the required wage premium, no native private household workers are hired. Thus, every native fully utilizes daycare services to procure  $\bar{c}$  of the domestic good, and self-produces the remaining  $R - \bar{c}$ . For each native type, the amount of market labor supplied is  $1 - R + \bar{c}$ . Note that with both low-skilled and high-skilled making the same domestic good production decisions, the ratio of high-skilled to low-skilled labor in the economy is equal to the ratio of high-skilled to low-skilled workers in the population,

$\frac{h}{1 - h}$ . Furthermore, given the identical factor intensities in the production functions for

<sup>7</sup> Assumption A1 ensures that high-skilled natives earn higher wages than low-skilled natives. Assumption A2 ensures that low-skilled natives (and by implication high-skilled natives) can afford the use of daycare service. Assumption A3 ensures that  $\delta$ , social stigma (disutility) of natives working as private household workers, is sufficiently high such that no natives can afford a native private household worker.

good  $A$  and daycare services, the ratio of high-skilled to low-skilled labor supplied in each industry will equal this worker population ratio.

We, now, consider the effects of  $m < h$  foreign immigrants who are given visas to enter the country and who are restricted to working only as private household workers.<sup>8</sup> In order to be as conservative as possible about the benefits to the receiving economy, we assume foreign private household workers have full property rights in their visas and thus extract all of the surplus in bargaining with employers, making their employers indifferent between hiring them and their next best option.

Since  $m < h$ , only high-skilled workers will hire foreign private household workers as the reservation price of high-skilled workers for purchasing private household worker services is higher than that of low-skilled workers.

The key change induced by the entry of foreign private household workers is the ratio of high-skilled to low-skilled market labor provided. Since  $m$  high-skilled workers now hire foreign private household workers to produce the requisite  $R$  units of the domestic good, they now supply a full 1 unit of market labor, whereas the rest of the native workers continue to supply  $1 - R + \bar{c}$  units of market labor. The ratio of high-skill to low-skilled labor provided in both the good  $A$  market and the daycare market is now

$$\frac{(h-m)(1-R+\bar{c})+m \cdot 1}{(1-h)(1-R+\bar{c})} = \frac{h}{1-h} + \frac{m(R-\bar{c})}{(1-h)(1+R-\bar{c})}$$

. It is now greater than the population ratio of high-skilled to low-skilled workers, and consequently high-skilled wages decrease and low-skilled wages increase relative to the case without immigration.

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<sup>8</sup> Recall that each foreign private household worker is restricted to work for exactly one employer. As a result, if  $m$  immigrants enter economy to work as private household workers, exactly  $m < h$  high-skilled workers hire these immigrants to produce their domestic good.

This change in labor prices induced by the release of high-skilled native labor from home production into the market could result in a change in behavior of those households that do not hire a foreign private household worker. However, under Assumptions A1-A3 it was optimal for all households to hire daycare and not to hire native private household workers. With  $m$  foreign private household workers working for high-skilled households, low-skilled wages have increased and high-skilled wages have decreased. As long as low-skilled and high-skilled wages continue to bear the same ordinal relation,  $W_H > W_L$ , with the boost in wages low-skilled workers will still employ childcare centers and will refuse to work as native private household workers. In order to ensure  $W_H > W_L$  with  $m$  immigrants, we amend Assumption A1. The appropriately modified Assumption A1' is contained in Proposition 2.

**Proposition 2:** *If*

$$\textbf{Assumption A1': } h < \beta - \frac{(1-\beta)m(R-\bar{c})}{1-R+\bar{c}},$$

$$\textbf{Assumption A2: } h > \frac{\left(\frac{1}{k}\right)^{\frac{1}{\beta}}}{\left[1-\tau\right](1-\beta)^{\frac{1}{\beta}} + \left(\frac{1}{k}\right)^{\frac{1}{\beta}}} \textit{ and}$$

**Assumption A3:**

$$(1-\beta)\left(\frac{h}{1-h}\right)^{\beta} - (1-\tau)\beta\left(\frac{h}{1-h}\right)^{\beta-1} (R-\bar{c}) > \frac{\bar{c}}{k} - \frac{\delta}{(1-\tau)(1-R+\bar{c})},$$

*then  $W_H > W_L$ ,  $W_i(1-\tau) > P_{dc}$ , and  $P_{hw}R > P_{dc}\bar{c} + W_i(1-\tau)(R-\bar{c})$  for  $i \in \{H, L\}$ , and with  $m < h$  immigrants working as private household workers,  $m$  high-skilled households will hire foreign private household workers, and all other natives employ daycare centers*

and do not hire native private household workers. Furthermore, high-skilled wages are decreasing in  $m$  and low-skilled wages are increasing in  $m$ :

$$W_L = (1-\beta) \left[ \frac{h}{1-h} + \frac{m(R-\bar{c})}{(1-h)(1-R+\bar{c})} \right]^\beta,$$

$$W_H = \beta \left[ \frac{(1-h)(1-R+\bar{c})}{h(1-R+\bar{c})+m(R-\bar{c})} \right]^{1-\beta},$$

$$\frac{\partial W_L}{\partial m} = (1-\beta)\beta \left[ \frac{R-\bar{c}}{(1-h)(1-R+\bar{c})} \right] \left[ \frac{h}{1-h} + \frac{m(R-\bar{c})}{(1-h)(1-R+\bar{c})} \right]^{\beta-1} > 0; \text{ and}$$

$$\frac{\partial W_H}{\partial m} = -(1-\beta)\beta \left[ \frac{(1-h)(1-R+\bar{c})(R-\bar{c})}{h(1-R+\bar{c})+m(R-\bar{c})} \right] \left[ \frac{(1-h)(1-R+\bar{c})}{h(1-R+\bar{c})+m(R-\bar{c})} \right]^{-\beta} < 0.$$

(Proof is in Appendix A).

In equilibrium a fraction of high-skilled natives employ foreign private household workers while the rest rely on daycare. Therefore, the price of foreign private household workers,  $P_{fhw}$ , is set such that the high-skilled are indifferent between hiring daycare services and a foreign private household worker. Mathematically, this condition is given as:  $W_H(1-\tau)(1-R+\bar{c}) - P_{dc}\bar{c} = W_H(1-\tau) - P_{fhw}R$ , where the left-hand side is the utility of a high-skilled worker using daycare centers and the right-hand side is the utility from hiring a foreign private household worker. This suggests that the price of foreign private household worker service is

$$P_{fhw} = \frac{1}{R} \left[ W_H(1-\tau)(R-\bar{c}) + \frac{\bar{c}}{k} \right] = \frac{1}{R} \left[ \beta(1-\tau)(R-\bar{c}) \left[ \frac{(1-h)(1-R+\bar{c})}{h(1-R+\bar{c})+m(R-\bar{c})} \right]^{1-\beta} + \frac{\bar{c}}{k} \right]$$

Proposition 2 states that the immigration of  $m < h$  foreign private household workers reduces wage inequality among natives. The release of high-skilled workers

increases the wage of the low-skilled and decreases the wage of the high-skilled. Income inequality, however, may not be reduced since the gross income of the high-skilled before payments to foreign private household workers may increase with their greater market labor supply.

Once the population of foreign private household workers reaches the population of high-skilled natives,  $h$ , then all high-skilled natives will employ foreign private household workers. Any further increases in  $m$  will cause the price of private household workers to fall as to persuade low-skilled natives to begin hiring them. This will lead to an increase in native low-skilled labor supply and a decline in their wages. Once the number of immigrants equals the number of natives, one, then all high-skilled and all low-skilled workers will employ private household workers and the ratio between the wages of high and low-skilled natives will be the same as without any immigration. Note that because tax revenue will be higher, as discussed below, all natives will be strictly better off than they were before, so this would be a Pareto improving level of immigration.

The increase in welfare associated with foreign private household worker migration will be equal to the extra tax revenue collected from employers, In this framework, social welfare is equal to the total amount of good  $A$  production minus payments to foreign private household workers minus any disutility penalty incurred by natives working as private household workers, and provides a convenient measure of native welfare if one values a dollar in the hands of all natives equally or assumes costless redistribution. (To the extent that one places a higher value on the marginal

dollar of consumption for low-skill natives, or that it is costly to raise revenue, welfare gains will be larger.) We can show the following proposition:

Proposition 3. If  $m < h$  (the level of immigration is relatively small), then social welfare (including tax revenues) is given by:

$$Welfare = W_H [(1 - R + \bar{c}) + m(R - \bar{c})] + W_L [(1 - h)(1 - R + \bar{c}) - p_{dc}\bar{c} - m(1 - \tau)W_H(R - \bar{c})]$$

The change in welfare caused by a marginal change in immigration in this case is

$$\frac{\partial Welfare}{\partial m} > 0. \text{ (See Appendix B for proof).}$$

Thus, for small inflows of migrants, the increase in native welfare caused by the inflow of foreign private household workers is given by the increase in tax revenues from the additional market work done by the high-skilled. To understand the intuition, note that when market work is taxed and home production is not, taxation introduces a distortion as households will purchase domestic services only if the *private benefit* exceeds the private cost. However, the *social benefit* of working more hours in the market and purchasing domestic services includes the taxes paid on market labor earnings. When immigrants reduce the price of the outsourced good, this distortion can be countered, and welfare gains can be achieved. The extra taxes paid when someone switches from home production to purchasing domestic services is a pure externality and welfare gain.

Although we think the most relevant case is the one discussed above, we briefly describe the case where some natives are employed as private household workers (see discussion in Appendix C). In the absence of immigrants, low-skilled natives will be the only native private household workers. If parameters are such that daycare centers and native private household workers both exist in equilibrium, high-skilled natives will be

indifferent between utilizing daycare and hiring low-skilled natives as private household workers.

When the numbers of foreign private household workers are close to zero, high-skilled natives will utilize daycare, hire native private household workers, and hire immigrant private household workers. For this to occur, high-skilled natives will be indifferent between hiring a private household worker and a combination of daycare and home production.

Foreign private household workers will both displace native low-skilled private household work into good  $A$  production and increase the market labor supply of the high-skilled by allowing some high-skilled natives to switch from utilizing daycare centers to hiring immigrant private household workers. In equilibrium, the increases in both types of native labor will be exactly such that native high and low-skilled relative wages do not change. The amount of high-skilled labor freed by natives must be exactly offset by the displacement of low-skilled native private household workers. Otherwise either all natives will leave private household work, or high-skill workers will cease using daycare centers. Increases in foreign private household workers will not affect relative wages until all native private household workers have been displaced. Once all native private household workers have been displaced, the analysis of section 2.2 will apply.<sup>9</sup>

To the extent that private household workers contribute to increase fertility or consumption of leisure, our calibration will overestimate the high-skilled labor response

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<sup>9</sup> The finding that this type of immigration has zero effect on wages when the high-skilled are using three types of domestic good production is an artifact of the two-type nature of the model, and of the assumption of no diminishing returns in home production. More generally, however, the existence of a domestic sector will stabilize wages in this range. Low-skilled wages will initially decline with an increase in foreign private household workers, until all native private household workers are displaced, and then will rise as more and more high-skilled labor is released. In a more realistic model, in which workers differed in more than just a single dimension, we conjecture that this type of immigration would lower wages of native private household workers and daycare center employees but raises wages of other low-skilled workers.

and will overestimate changes in wages and welfare. If foreign private household workers lead to higher fertility among high-skilled natives, long-run income distribution among natives' may be equalized for two reasons. First, higher fertility could increase the long-run supply of high-skill labor, at least to the extent that high-skilled parents can transmit education to their children. Second, to the extent that greater fertility among high-skill workers leads them to split their bequests and attention among more children the distribution of wealth will be equalized. (Related to the idea that private household workers may not actually increase market work is the idea that in some societies a large amount of housework is done by grandparents. To the extent that foreign private household workers would displace grandparent labor and increase grandparent leisure, our calibrations would overestimate the effect.)

The closed economy is subject to two different distortions. One is a public finance distortion from taxing market but not household labor. The other is a trade distortion due to cutting off trade in domestic services. In theory, an omniscient government could correct the pure public finance distortions without bringing in foreign private household workers. Doing so would involve subsidizing people to hire native private household workers and then implementing other taxes and transfers to achieve the desired income distribution among natives. For example, in our model, the government could make all expenditure on domestic services, including daycare centers, tax deductible, or equivalently subsidize daycare centers and private household workers. One could imagine a government doing this for daycare centers, but doing it for private household workers seems unlikely since it would make the tax code look very regressive, even though it might not actually be regressive given general equilibrium effects. Moreover,

for some parameter values (i.e., a large enough disutility of doing private household work), even completely fixing the tax distortion will not induce natives to work as private household workers.

### **3. Calibration**

In this section, we estimate the empirical magnitudes of the effects on wages and welfare described in the model. Subsection 3.1 discusses assumptions about key quantities.

Subsection 3.2 discusses the results, and Subsection 3.3 considers how the effects of foreign private household workers could change under alternative assumptions and if some of these workers were to “leak” into the general workforce.

#### **3.1. Assumptions**

To estimate the impact of foreign private household workers programs on relations of wages and on welfare of natives, we will first need an estimate of the amount of high-skilled labor freed up by hiring a private household worker. We will also need the native proportion of high-skilled workers, the estimated wage of high-skilled workers, and the marginal tax rate.

We present four different sources of information from which to infer reasonable estimates of the labor supply response of the high-skilled to foreign private household workers: one from aggregate Israeli labor force participation data, one from Cortes and Tessada (2007), one from Ellwood, Wilde, and Batchelder (2004), and one using Argentine and Israeli panel microdata. We also present some country-level time series evidence consistent with the hypothesis that foreign private household workers are associated with high rates of female labor force participation.

Information on how the extensive margin of labor force participation varies with whether mothers have household helpers/care givers is provided by Israeli data. Table 2 shows Israeli female labor force participation rates in 2001.<sup>10</sup> Overall, women with youngest children aged 2 to 4 who employ household helpers for more than 16 hours per week have approximately 21.6 percentage points or 29% higher labor force participation than those who do not hire care givers. Mothers with children aged 0 to 1 are almost 50% (30 percentage points) more likely to participate in the workforce if they hire a private household worker. On the other hand, women without children who hire a private household worker for more than 16 hours per week have 24% (10 percentage point) lower labor force participation.

These figures could be either larger or smaller than the causal effect of hiring private household workers on labor supply. To the extent that some women hiring private household workers have an unobserved taste for work and would have chosen to work regardless, the causal effect is smaller. On the other hand, to the extent that there is variation in the amount of domestic work across households, depending on the number and ages of children, the number of elderly in the household, and the ability of other adults to participate in household production, these figures are likely to underestimate the impact of private household workers on employers' labor supply. Households with more need for domestic work are more likely to hire private household workers. The effects of this bias can be seen comparing the higher gap when disaggregating women with the gap when women are not disaggregated, for example, by age of youngest child. These effects may also be understated if private household workers free up fathers, not necessarily to enter the workforce, but to put in longer hours.

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<sup>10</sup> Table 5 includes both foreign household workers and native household workers.

Cortes and Tessada (2007) find effects of immigration on female labor supply using time use data from America. In order to control for endogeneity in immigrants' choice of location, they instrument for the share of the labor force with less than high-school education using immigration patterns from 1970, arguing that social networks are important determinants of future patterns of immigration. They preliminarily estimate that doubling the percentage of workers with less than a high school education will increase the labor supply of high-skilled women from 1 hour (for those with a college degree) to almost 8 hours a week (for those with professional degrees) .<sup>11</sup> This point estimate implies that each immigrant in an occupation that arguably largely substitutes for domestic production increases native labor supply to the market by the equivalent of 0.15 workers.<sup>12</sup>

Even looking at time use data may lead to an underestimating in the increase in effective market labor supply associated with hiring a private household worker. High-skilled natives using childcare centers may be unable to accept certain projects or certain

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<sup>11</sup> Khananusapkul (2004) also attempts to estimate the labor supply effect of low-skilled immigrants, but, since she lacks time-use data on the intensive margin of labor supply, she is unable to find strong results.

<sup>12</sup> Weighting the labor supply response by labor force participation and population share, we find that the Cortes and Tessada (2007) estimates imply that a 10% increase in low-skilled labor increases high-skilled female labor supply by about 0.4%.

Only 12.9% of the US labor force had less than a high school education. A 10% increase in the number of people without high school education due to immigration corresponds to a 1.29% increase in the overall labor force. In the US 20.7% of all immigrants with less than a high school education find employment in industries we classify as likely to displace substantially native household production (private household services, landscaping services, childcare services, restaurant services, drinking establishments, car washes, barber shops, beauty salons, nail salons, dry cleaning and laundry, and taxi and limousine services, according to the Public Use Microdata Samples 2000).. This implies that a 10% increase in the population of workers without high school education due to immigration would correspond to a  $.207 \times .0129 = 0.27\%$  increase in immigrants in private household worker sectors.. Cortes and Tessada (2006) assume that low-skilled immigrants and low-skilled natives are not perfect substitutes and are aggregated with a CES aggregator. For simplicity, we assume that they are perfect substitutes as their assumption will not change the figures by much).

Using Cortes and Tessada's (2007) estimates means that this increase in immigration would lead to about a 0.4% increase in native, high-skilled, female labor supply, equivalent to about a 0.04% increase in total native labor supply, which suggests that each immigrant in occupations that affect native labor supply increases native labor supply by  $0.04/0.27 = 15.0\%$  of a native worker.

occupations. It is hard to be a 40 hours a week investment banker or partner in a high-end law firm. Foreign private household workers may allow some highly educated natives to function as very highly skilled workers. Evidence consistent with the hypothesis that taking care of children leads to lower wages is provided by Ellwood, Wilde, and Batchelder (2004), who use a panel data set to estimate that high ability women suffer net hourly wage losses of 30% ten years after the birth of a child relative to counterparts who did not give birth.

This may be an underestimate of the impact of having a child on earnings, since even working mothers reduce the number of hours worked and some mothers drop out of the labor force. On the other hand, even mothers who employ private household workers will probably experience some loss of wages and earnings, and the 30% figure above may in part reflect selection.

A fourth source of evidence comes from Israeli and urban Argentine panel microdata.<sup>13</sup> We regress maternal labor supply on an indicator for whether the household has a domestic worker, while in some specifications including individual fixed effects and time-variant controls. Descriptive statistics from these data show that the average Argentine mother works 15-16 hours per week, and half of Argentine mothers work (Table 3). Israeli female labor supply is slightly greater, at 18-20 hours and 62-65 percent labor force participation. The Argentine data record only whether a domestic worker lives in the household, and half a percent of households have a domestic worker. The Israeli data report whether a household receives over 40 hours per week of domestic help, and one percent of Israeli households do. Essentially all domestic Argentine workers are

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<sup>13</sup> The Data Appendix provides details of extracting samples from the 1998-2001 Argentine household surveys and the 2001-2004 Israeli labor force surveys.

female and their mean age is 30 years. In both countries domestic servants work 50 hours per week. The sample of nannies is small—the Argentine balanced panel data contains only 164 household-waves where a nanny is present and the Israeli balanced panel has only 481—but the regression estimates are fairly robust.

Fixed effects estimates show that hiring a nanny increases a mother’s supply of labor by 5.4 to 5.6 hours. This is 25-33 percent relative to the Israeli and Argentine sample means for all women of 15-20 hours (Table 4) or 15% relative to the sample means for employed women of US Census data.<sup>14</sup> OLS estimates are large, perhaps since the mothers who hire a nanny are also the mothers more likely to work, anyway. Fixed effects parameter estimates are invariant to including a detailed array of time-variant controls, including measures of household composition, dwelling characteristics, and spousal wages. If anything the parameter slightly increases, suggesting that a survey with more extensive controls could produce even larger estimates. Since the average domestic worker in both countries works 50 hours (Table 3), this implies that ten hours of domestic help free up one hour of a mother’s market work.

Hiring a nanny increases an Argentine’s probability of being employed by 25.0% (12 percentage points), whereas in Israel the impact is about 3.4% (2 percentage points), and is statistically insignificant. This difference may arise since having a worker live in-home (as in Argentina) gives a mother more flexibility to seek employment, while having daily or hourly contracts with domestic workers (as in Israel) makes it less feasible to enter the labor force, though it is perhaps more likely that the effects of nannies on the extensive margin is simply larger in Argentina than in Israel.

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<sup>14</sup> US census data is taken from Cortes and Tessada (2007). This extrapolation conservatively assumes that the only impact of hiring a nanny is on the intensive margin.

The small number of domestic workers makes subsamples imprecise, but we present some variety of estimates (Table 6). Table 6, Panel B uses only the observations where the presence of a domestic worker change during the panel – the observations that drive fixed effects estimates – which gives the same parameter values. Panel B suggests that an Israeli domestic worker increases maternal labor supply by 4.9 hours. These regressions are identified from 172 household-waves in Argentine and 670 in Israel. Panels C and D show that the effect of a nanny grows with education in Israel but decreases in Argentine, though the estimates have large confidence regions. We see no obvious explanation for the divergence. Reassuringly, Panels E and F show that the effect of domestic workers appears only for households with children, which suggests that these workers are largely supplying child care. Using only observations where a domestic worker is present for one or more waves but then vanishes—perhaps due to a firing, or due to no longer needing the nanny—obtains moderate-sized positive estimates in both countries.

Fixed effects regressions represent an improvement over use of cross-sectional or aggregate time-series variation. One could worry that unobserved shocks like local economic conditions drive both maternal and nanny employment, though it is reassuring that controlling for available household characteristics hardly changes and slightly increases parameter estimates.

Additional evidence that market labor supply is sensitive to the price of childcare services is provided by Blau and Robins (1988), Connelly (1992), Ribar (1995) and Kimmel (1998) who find that decreases in childcare prices increase the likelihood of

mothers entering the workforce and estimate child-care price elasticities of employment from -0.74 to -0.2.

Time series evidence on labor force participation rates across countries is consistent with the hypothesis of large impacts of foreign private household worker programs on female labor force participation, at least in countries with significant numbers of educated women and social norms allowing interaction between men and women in the work place. Table 7 shows labor force participation and fertility rates for a number of countries, some of which have large populations of foreign private household workers.<sup>15</sup> Consistent with the idea that these programs can increase female labor force participation, Hong Kong and Singapore both have high rates of female labor force participation. These rates are higher than in Korea although similar to the US and UK. Female labor force participation was not high in these countries in the 1970's, before large numbers of domestic workers from abroad began to enter the labor force, casting doubt on purely cultural explanations. Fertility rates for Hong Kong and Singapore are much lower and have fallen more quickly than in comparable countries, consistent with the view that women freed up from household work to participate in the labor market have fewer children.<sup>16</sup>

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<sup>15</sup> One problem is that labor force participation statistics for most countries (except for Bahrain) include foreign private household workers. We estimate the female labor force participation rate without foreign private household workers for those countries by assuming the age distribution from a survey of foreign private household workers in Hong Kong in 1996 applies to the population of foreign private household workers in Hong Kong in 2000, Singapore in 2003, and Kuwait in 1995. The relevant age distribution is multiplied by the number of foreign private household workers in Hong Kong in 2000, Singapore in 2003, and Kuwait in 1995. This number is subtracted from the number of women working in each country and the total number of women in each country when calculating the female labor force participation rate. (Hong Kong Census and Statistics Department 1996)

<sup>16</sup>Note, however, that in the Gulf States, fertility is high and female labor force participation is low. If social norms limit female labor force participation or if households are wealthy due in large part to non-wage income, rather than high wages, then time freed up by foreign private household workers may go into leisure or increased fertility rather than into more market labor. If foreign private household workers free up time that natives devote to leisure or simply lead to more household work being done than would be

We consider the case in which hiring a private household worker allows one high-skilled parent to increase labor supply by 15%. This is roughly equivalent, for example, to assuming that a parent (typically a mother) can go from a 40 hour a week job with children in daycare to a 46 hour a week job with a private household worker. This estimate is close to the estimates obtained from the four sources described above.

To estimate the welfare gains and wage effects of foreign private household workers, we also need information on the share of high-skilled workers, their wages, and the deadweight loss of taxation. If one treats workers having completed a college education as high-skilled, then  $h = 0.24$  for the US. Hong Kong data imply that high-skilled workers employing private household workers earn twice the average wage in the economy.<sup>17</sup> The Argentine microdata (Table 3) show that mothers employing a nanny earn 2.3 (=8.8/3.9) times the mean wage of all mothers or all fathers. Since these data contain only large cities this may be a low estimate, though since very young and old workers could have lower wages it may be a high estimate.<sup>18</sup> If foreign private household workers were less than 7% of the labor force, employer wages would presumably be even greater relative to the average wage as, the highest earning natives are likely the most eager to hire domestic help.

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done otherwise, relative wages between different classes of native workers will be unaffected by foreign private household workers.

<sup>17</sup> According to the Hong Kong Census and Statistics Department, in January of 1996 median monthly household income of households hiring domestic helpers in Hong Kong was 40,000 HK dollars. In the 4th quarter of 1995, median monthly household income of all HK households was 15,700 HK dollars

<sup>18</sup> Alternative estimates of this magnitude using national accounts and EPH microdata provide values in the range of 2.36 to 2.57. In EPH, the 397 mothers who have a strictly positive wage and a domestic worker present report a mean hourly wage of 8.30 pesos (standard deviation 7.22), and the 243,476 individuals reporting a strictly positive wage have a mean hourly wage of 3.51 pesos (standard deviation 3.80). The implied ratio is 2.36 (=8.30/3.51). Using total monthly individual income from all sources rather than wages, this ratio is 2.57 (=1312.40/510.86). The 1999-2003 average of per capita GDP from INDEC data is 6411, so using 534 (=6411/12) as the denominator implies a ratio of 2.46 (=1312.4/534). All values deflated to 1999 pesos. Note that the microdata represent only individuals in large cities, while the GDP data are national.

We assume high-skilled workers face a 50% marginal tax rate. In 2003, the top tax rate in the United States was 35%. After including the population-weighted highest average marginal tax rate of the 50 states (5.2%) and payroll taxes, natives who would be most likely to hire personal household workers face a marginal rate of around 51.6% (including the 7.65% of payroll taxes paid by the employer) if they are not above the social security cap and around 40% if they are.

We assume that the marginal welfare cost of a dollar collected in taxes is 1.4.<sup>19</sup> We consider the impact of foreign private household worker migration equivalent to 7% of the native workforce, roughly the level in Hong Kong and Singapore. To convert welfare benefits from a share of wages to a share of GDP, we assume wages are 60% of GDP.

### 3.2. Results

The extra tax revenue from the increased labor supply of the employers of private household workers creates an externality benefit equal to the amount of high-skilled labor entering the labor market times the wage of high-skill workers times the tax rate times the marginal cost of funds.

In this case, if each private household worker frees up 15% of a high-skilled worker and these high-skilled workers earn twice the average wage in the economy as suggested by the Hong Kong and Argentine data, and households face a marginal tax rate of 51.6%, and the marginal cost of raising one dollar in tax revenue is 1.4 dollars, then each private household worker creates an externality benefit equal to  $0.15 * 0.5 * 1.4 * 2 = 0.21$  times the average wage in the economy. This implies that it is possible to raise

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<sup>19</sup> Our model does not include a labor-leisure tradeoff or tax compliance and evasion costs, so this is a bit ad hoc, but will be addressed in future versions.

welfare by about 1.47% of wages by admitting 7% of the labor force as foreign private household workers, taking into account only the benefits associated with the fiscal externality. This figure is given in the first column of Table 8. If we assume that wages make up 60% of GDP, welfare increases by just under 0.9% of total GDP. Our estimated welfare effects are thus 60 times larger than those found by Borjas (1999), who estimates that immigration of 10% of the workforce, raises national income by at most 0.01% to 0.02% when the supply of capital is perfectly elastic.

This estimate ignores the extra taxes that are levied in many private household worker programs. In Hong Kong employers of foreign domestic helpers are required to pay a levy of about 400 Hong Kong dollars a month 2.5% of the average monthly wage which goes to the training of local workers. In Singapore employers pay a levy of about 345 Singaporean dollars a month.<sup>20</sup> Including the marginal cost of funds, this means that the host country should expect an extra welfare benefit of  $1.4 \cdot 0.025 = .036$  average wages for each private household worker. With 7% immigration, this is an extra 0.25% of average wage increase in welfare, bringing the total welfare change to 1.7% of the average wage or 1.0 % of GDP (Column 2, Table 8).

The welfare estimates have assumed that high-skilled natives receive no surplus from employing a private household worker. This is a very extreme assumption. If high-skilled natives receive a surplus of 10% over the wage they pay foreign private household workers, the total surplus to high-skilled natives employing foreign private household

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<sup>20</sup> In the United States certain categories of diplomats and international civil servants are allowed to obtain G-5 visas for private household workers. The G-5 visa holders are subject to social security taxes and to payroll taxes for unemployment insurance. However, workers on G-5 status are not eligible to collect either social security or unemployment insurance. (For comparison, the minimum wage of a domestic helper in Hong Kong is 3,270 Hong Kong dollars a month and the average basic wage in Singapore in 2002 was 1,065 Singaporean dollars a month. (*Asia Pulse*, 2004; *Singapore Yearbook of Manpower Statistics 2002*).

workers is 0.3% of the total wage bill in Hong Kong.<sup>21</sup> Adding this to the original welfare gains gives a new total of 1.8% change in welfare relative to the total wage bill or 1.1% of GDP. (See Table 8, column 3).

We can do a similar calculation for wages. Under a CES production function, the effect of foreign private household workers on relative wages of native low-skilled and native high-skilled depends on the proportionate increase in each type of labor supply. Suppose again that each private household worker frees up 20% of a high-skilled worker.

If 7% of the labor force consists of foreign household workers, high skilled labor increases by  $.15 \times 7\% = 1.05$  percentage points. Given that high-skilled natives make up about 24% of the native labor force, high-skilled labor increases by about  $1.05 / 24 = 4.4\%$ . Although private household workers will displace native workers in daycare centers, because we assume that the skill intensity of daycare centers is the same as that of the general economy, the proportion of low-skilled natives displaced in daycare centers will be exactly offset by the proportion of high-skilled natives displaced in daycare centers. Under a Cobb-Douglas production function the elasticity of substitution is one and  $\frac{W_L}{W_H} \approx \frac{h}{(1-h)}$ . This implies that the ratio of low-skilled to high-skilled wages increases by about 4.4 %.

The Cobb-Douglas production function assumed in our model implies that the elasticity of substitution between high-skilled and low-skilled labor is one. Although this assumption may not be unreasonable, it is probably low. Katz and Murphy (1992) estimate this elasticity to be 1.41 using US data from 1963 to 1987. Krusell et al. (1997)

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<sup>21</sup> If total compensation (including room and board) of a foreign private household worker is \$6,540 which is 41.7% of the average wage in Hong Kong, high-skilled natives value the service at 46.3% of average wages and receive a surplus of 4.6% of average wages.

estimate the elasticity to be 1.3 using a US dataset expanded to 1991 and an estimate of 1.67 from a model with capital-skill complementarity. Heckman, et al.(1998) estimate the elasticity to be 1.44 using a model incorporating job training. The Cobb-Douglas case provides analytical simplicity, but if the true elasticity is on the order of 1.5, we conjecture that the impact of immigration on wage differentials will be roughly two-thirds as large as those calculated in the paper. Our calibrations on the impact of foreign private household workers on tax collection should be roughly unaffected. If we assume an elasticity of substitution of 1.5, this ratio decreases by about 2/3 to 2.9%.

### **3.3. Robustness**

In this subsection we consider robustness to the parameters above, to the assumption that workers in daycare centers have the same skill mix as the general economy, and to the possibility that foreign private household workers will leak into the general economy.

It is straightforward to conduct sensitivity analyses for the parameters above. For example, if one wanted to assume that the labor supply response of high-skilled natives was 7.5% rather than 15%, one would simply divide all our welfare and wage estimates by two. These effects would still be large.

Even under the extreme assumption that daycare centers are wholly staffed by low-skilled natives, wages of low-skill natives will rise. For daycare centers, we assume that each immigrant replaces a native daycare worker at a ratio of 5:1. (The usual staff to child ratios in daycare facilities is 1:9 (Blau 2003), but some private household workers may care for more than one child.) We also assume that 75.1% of natives who hire foreign private household workers would utilize daycare centers in the absence of

migration; this is the labor force participation rate of Israeli women who do not hire household workers (see Table 7.) – We thus assume that for every 100 foreign private household workers hired, 75.1 will replace native daycare center workers, but only at a rate of 5 to 1. In this case, the increase in low-skilled labor would be  $7 * 0.751 * 0.2 = 1.05$  percentage points which is about 1.42% of the low-skilled native labor force (76%). This would increase the ratio of low- to high-skilled wages by  $4.4\% - 1.4\% = 2.0\%$  under a Cobb-Douglas assumption. With an elasticity of substitution of 1.5, the ratio would increase by 1.3%.

Our estimate for wage effects will be reduced to the extent that foreign private household workers leak from their programs and enter the broader workforce, and if leakage were great enough, could be overturned. Countries like Hong Kong, Singapore, and the Gulf States have adopted very strong rules to minimize leakage, but many other developed countries may be unwilling to adopt similar strict standards.<sup>22</sup> Leakage would likely be greater in larger, more ethnically mixed societies, with liberal attitudes on civil liberties and without a national ID system.

It is straightforward to calculate the largest fraction of immigrants who can leave the foreign private household program for the general economy without reducing the relative wages or welfare of the native low-skilled. Define the variable  $F$  as the amount of high-skilled labor freed up by each private household worker. Note that if the number of low-skill immigrants leaking into the general economy for each one who remains in the

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<sup>22</sup>In Singapore foreign domestic helpers are required to sign an agreement stipulating that they will not marry a Singaporean citizen or resident without permission from the Controller of Work Permits, that they will not become pregnant or deliver children during the validity of their work permit, and that they will not “engage in any relationship with a citizen or resident that will result in the birth of any child” (Singaporean Ministry of Manpower, 2004) Singapore conducts inspections for foreign private household workers to ensure that they have not become pregnant.

foreign private household sector is  $\frac{(1-h)F}{h}$ , then the proportional increase in high-skilled labor from foreign private household workers is exactly equal to the increase in low-skilled labor from immigrants “leaking” into the general economy. If  $F$  is 0.15 as we have assumed before, and  $h = 0.24$ , then as long as fewer than 0.48 immigrants leak into the general economy for each foreign private household worker, the relative wages of the native low-skilled would increase. Even at a leakage rate of 0.48, however, low-skilled natives would experience welfare gains due to the extra tax revenue received by the government.

To calculate the level at which leakage offsets the fiscal gains to low-skill natives, we can assume that all extra taxes are distributed to natives proportional to the amount of taxes that they pay. If we assume that native high-skilled wages are about twice the average wage of the economy and that tax rates are roughly 50%, the extra taxation collected will be  $2*F*0.5 = F$ . If we assume a marginal cost of funds of 1.4, this amounts to a fiscal benefit of  $1.4F$ . The share of taxes that low-skilled natives pay is  $(1-h)/(2*h + (1-h)) = 0.61$ . Thus, the tax rebate distributed to the native low-skilled will be  $0.61*F$ . From the Cobb-Douglas production function, the change in low-skilled relative wages for each foreign private household worker will be the percent change in high-skilled labor,  $F/h$ , minus the percent change in native low-skilled labor,  $leakage/(1-h)$  where  $F$  is again the amount of high-skilled labor freed up by each private household worker and leakage is the fraction of foreign private household workers who leak into the general economy.. Setting this equal to the low-skilled tax rebate implies that the maximum leakage rate will be  $3.8F$  or  $0.57$  if  $F = 0.15$ .

[Leakage could presumably be reduced by paying part of the workers' salary into an account which the worker could not access until he or she returned home. Having workers, employers, or employment agencies post a bond which they would forfeit if the workers overstayed their visas would be another possibility. Pritchett (2006) suggests making countries responsible for the return of temporary workers. A variant of this approach under which employment agencies rather than countries are responsible seems more flexible and creates incentives for multiple firms to explore ways to reduce leakage. Visas could be limited to people hired through a licensed, bonded intermediary agency. In Singapore and Hong Kong, most contracts are arranged by employment agencies, and these would presumably develop recruiting strategies and other practices, such as hiring through networks and finding immigrants new jobs in other countries, in order to induce foreign private household workers to leave their host countries after their visa expired.

The wage consequences of leakage could be further reduced by requiring higher skill levels from foreign private household workers. 50% of Filipinas working overseas as private household workers have some college education or more compared to 34.9% in the general population. These numbers are restricted to women aged 25-44.]

The model does not allow for capital. To the extent that capital is mobile or otherwise adjusts over time, the estimates may be reasonable in the long run, but in the short run, overall increases in output will not be as sharp. The pattern in changes and returns to factors will depend on the patterns of complementarity and substitutability among skilled labor, unskilled labor, and capital.

#### 4. Paradox of Place Specific Norms

While "new rich" countries such as Kuwait, Hong Kong, and Singapore have established formal domestic helper programs, "old rich" countries generally have not done so, although many implicitly tolerate foreign private household workers working illegally. One reason for this may be that formal long-term domestic helper programs that restrict long-term residents who want to stay in the country to domestic service with no chance of citizenship may conflict with social norms in societies which require higher social obligations to long-term residents than to foreigners living abroad. This conflict is somewhat paradoxical, however, since if migration is voluntary, standard economic reasoning suggests migrants are better off. The calibration exercises suggest that immigration can create sizeable welfare gains for the host economy. It is thus difficult to frame ethical objections to programs allowing immigration of foreign domestic helpers on consequentialist grounds. It is nonetheless clear that many would feel it would conflict with ethical norms to have a class of people living in their society for twenty or thirty years, permanently restricted to working only as private household workers and unable to bring their families to live with them.

Note that this conflict would not arise if ethical obligations were universalistic, independent of residence within national boundaries, or particularistic, but based on citizenship or on relatively immutable characteristics like race, ethnicity, or religion.<sup>23</sup>

To see the paradox created by norms that require different obligations to people depending on whether they have resided in the country for some time, suppose Americans believe that it is unfair to restrict somebody from the Philippines, who has

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<sup>23</sup> Such norms may be common in countries with a long history of immigration from a diverse set of countries and a conception of identity, independent of culture, ethnicity, or religion.

lived in America for twenty or thirty years, to work only in the domestic sector. Suppose also that Americans will not admit more immigrants if this hurts the low-skilled natives. In this case, America would not admit low-skilled people from the Philippines, since this would either hurt low-income Americans or involve unfairly restricting the immigrants to the domestic sector. If, on the other hand, in Kuwait or Hong Kong people feel that their obligations to long-term foreign private household workers are only those specified contractually then they would then be willing to establish a foreign domestic helper program. Paradoxically, people in the Philippines will be better off if other countries follow these hypothetical Kuwaiti/Hong Kong norms than the posited American norms.

One view is that the Americans are merely hypocritical: they prefer more severe suffering out of sight in the Philippines, to less severe, suffering that is more visible to Americans. One might thus argue that the ethical objections to foreign private household workers are misplaced, but rather than second-guess this, we will model it by assuming that residents pay a utility penalty if long term residents have low welfare and consider the implications for policy.<sup>24</sup> If the utility penalty is greater than the externality benefit per foreign private household workers, natives will prefer not to have a long-term foreign private household workers program than to have one. An alternative would be to design programs that would not trigger the utility loss among the native population, by providing only temporary, non-renewable visas for periods less than that needed to trigger the utility penalty - for example, 3-year non-renewable visas. These programs would be

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<sup>24</sup> Note that this is not an issue of time consistency because many people in multicultural rich societies would presumably not want to have a foreign private household worker program even if they could commit in advance to not admit foreign private household workers as citizens.

similar to existing Au Pair programs, but would not be limited to students.<sup>25</sup> Canada's Live-in Caregiver Program provides another model. The program admits foreign immigrants as caregivers for children and the elderly for at least two years. Caregivers are required to live-in with the family. After two years, immigrant caregivers can apply for permanent residence status. In 2001 2,624 immigrants entered Canada through this program making up about 1% of the total number of immigrants. The fact that programs already exist eases the political, legislative and administrative burden of movement in this area.

Restricting visas for foreign private household workers to be temporary and non-renewable would carry some efficiency costs in lost learning by doing and disrupted relationships between children and foreign private household workers. However, it would also provide some equity benefits relative to a policy under which foreign domestic helpers could stay indefinitely, because it would allow more people in the source country to earn money abroad for a period, save, and return home with enough capital to start a small business or buy a house. Moreover, if visas were temporary and non-renewable, workers might be more likely to assess their well being using their status in the source country as a reference point, rather than typical consumption levels in the host country. Rather than seeing themselves as worse off than those in the country where they work temporarily, they may see themselves as better off than those in their country of origin. They would be more likely to save a high proportion of their earnings and bring them

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<sup>25</sup> The US Au Pair program, administered by the Department of State, admits students between the ages of 18 to 26 into the US for one year under a J1 visa. The IRS estimates that there are around 12,000 Au Pairs in the US in any given year. In 2000 the UK admitted 12,900 people on Au Pair visas. Around 5,000 Au Pair work illegally (Anderson, 2001).

back with them to their country.<sup>26</sup> The source country is likely better off if instead of a small percentage of citizens leaving on a semi-permanent basis and earning much more than they would have at home, a much larger number of citizens leave for 2 or 3 years, make some money, and come home.

Attila Ambrus has suggested a policy that would legally allow foreign private household workers to stay in the host country and enter the general economy conditional on their first acquiring certain educational qualifications. This program would allow low-skilled immigrants to become high-skilled labor in the host country. It is also worth noting that if more than a fraction  $h$  of workers who move into the general economy become high-skilled, native low-skilled workers gain. One could imagine a modified Au Pair program, in which participants would not be required to be students in the country of origin, but were required to take classes and show satisfactory academic progress in the host country.

To the extent that ethical concerns relate to the well-being of the private household worker herself while in the host country, a key question is how the surplus from the relationship is divided between the foreign domestic helper, the employer, and the host country. In the model we assume that a certain number of foreign domestic helpers are admitted to the country and that once they are in the country they are free to choose their employer. In this case, wages are bid up to the reservation level for employers. However, in a number of cases, the terms of the migrants' visas require them to work for a specific employer and, in this sense, part of the property right over the visa is given to the employer. Currently, foreign domestic helper programs in Hong Kong and

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<sup>26</sup> Ahlburg and Brown (1998) find that Samoans who migrate but intend to return home generally remit higher sums of money controlling for income and other variables.

Singapore and the Live-in-Caregiver program in Canada, for example, require immigrants to sign a work contract before immigrating and make their legal status contingent on being employed by that specific employer. This shifts the bargaining power towards the employer and reduces the welfare of the private household worker.

Objections to foreign private worker programs may also be related to the high consumption of employers rather than the low consumption of workers. Restricting participation to employers with compelling needs (i.e. those caring for children with special needs or for the elderly or disabled) may make these programs more politically palatable.<sup>27</sup>

## 5. Conclusion

Migration of women to work as private household workers is likely to grow due to demographic, technological, and cultural trends. Improvements in transportation and remittance technologies increase the supply of foreign domestic workers, and the expanding role of women in the workplace creates more demand as does the growing burden of caring for the elderly.<sup>28</sup> As more countries join the ranks of the “new rich”, formal programs may expand. After 2011, Western Europe will be required to open its labor markets to workers from new eastern members..

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<sup>27</sup> Hiring a foreign private household worker through Canada’s foreign private household worker program requires having a child or an elderly person in the household. Hiring a foreign private household worker through Taiwan’s foreign private household worker program requires having an elderly person in the household over 70 or children under 6. Taiwan is considering enacting a law making it possible for a person to get a foreign private household worker if she has one of the 32 illnesses listed by the government.

<sup>28</sup> In the US, 21% of the population provides unpaid care to friends and family age 18 and older and nearly 80% of these care recipients are over fifty years old (Pandya 2004).

As we have argued, private household worker migration addresses the key political economy issues limiting immigration in rich countries: widening native wage inequality among natives, fear of a fiscal drain, and the perceived impact on native culture and on crime.

Our calibration exercise suggests that the admission of 7% of the labor force as foreign private household workers could potentially increase welfare among natives by as much as a 1.1% increase in GDP. This effect is 60 times larger than the effects estimated by Borjas. Moreover, this type of immigration could increase the ratio of low-skilled to high-skilled native wages by 2.9% .

Such programs could arguably do more good for the world's poor than existing aid programs. Remittances from migrant workers amounted to 6.4% and 17.6% of GDP in Bangladesh and El Salvador, respectively (Ahmed, 2006 and Hausmann, Rodrik, and Velasco, 2005). If the U.S. had a foreign private household worker program the size of Hong Kong or Singapore's and if each worker saved or remitted \$5,000 annually, which seems conservative if the program were explicitly temporary, total savings and remittances to developing countries would be approximately \$40 billion, four times as large as annual US official development assistance.

Foreign private household worker programs are likely to have a number of other impacts on the sending countries. They are likely to raise the status of women in these societies by providing them with more control over resources. In general, private household workers are somewhat more educated than the typical woman in their home societies. For example, in the Philippines, eighty percent of migrating women aged 25 – 44 have a high school education compared with only sixty percent of the general

population in this demographic group.<sup>29</sup> So while on the one hand it is possible that there would be some exacerbation in inequality in the sending countries due to the removal of higher skilled workers, on the other hand, this could also provide an incentive to invest in female education.

Discomfort with foreign private household worker programs in the developed world often comes with fears of abuse. However, in many countries foreign private household workers exist in large numbers illegally. This unfortunately subjects them to abuse as the lack of legal status disqualifies them from legal protection. A formal program which allowed household workers to switch employers rather than assigning them to specific employers as is common in most existing programs could greatly alleviate this problem. A formal program that enhanced the property rights over the visa held by the immigrant would make it easier for these workers to change employers and avoid abuse.

Poor workers in developing countries would be better off in the absence of immigration restrictions in the rich world. However, they are better off under private household worker programs than they would be either under the draconian immigration restrictions that characterized the rich world for much of the 20<sup>th</sup> century or under the current trend toward selectively encouraging migration by highly-skilled workers. Foreign private household workers programs would not end the system of international apartheid that keeps the world's poor walled off from the rich. But they would open a crack in the wall.

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<sup>29</sup> We thank Dean Yang for this information.

## Appendix A

### Proof of Proposition 1

The first order conditions and zero-profit condition in the Good A market are:

$$W_H = \beta H^{\beta-1} L^{1-\beta} \quad [1]$$

$$W_L = (1-\beta) H^\beta L^{-\beta} \quad [2]$$

$$H^\beta L^{1-\beta} = W_H H + W_L L. \quad [3]$$

The first order conditions and zero-profit condition for the daycare market are:

$$W_H = \beta P_{dc} k \hat{H}^{\beta-1} \hat{L}^{1-\beta} \quad [4]$$

$$W_L = (1-\beta) P_{dc} k \hat{H}^\beta \hat{L}^{-\beta} \quad [5]$$

$$P_{dc} k \hat{H}^\beta \hat{L}^{1-\beta} = W_H \hat{H} + W_L \hat{L}. \quad [6]$$

If all natives hire daycare services (we later will derive the assumptions for this to be true), the total high-skilled and low-skilled market labor provided are given by:

$$\hat{H} + H = h(1-R+\bar{c}) \quad [7]$$

$$\hat{L} + L = (1-h)(1-R+\bar{c}). \quad [8]$$

Dividing the FOCs in each of the markets ([2] by [1] and [5] by [4]) and equating the resulting expressions yields:

$$\frac{\hat{H}}{\hat{L}} = \frac{H}{L} = \frac{h}{1-h} \quad [9]$$

where the last equation holds by the market clearing conditions [7] and [8]<sup>30</sup>.

To find the condition that guarantees  $W_H > W_L$ , substitute for the wages using the FOCs [1] and [2], which yields:

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<sup>30</sup> Recall that taxes are paid in the good A.

$$h < \beta \quad [10]$$

which is Assumption A1.

Low-skilled workers will prefer hiring daycare services to home producing the entire  $R$  amount of the domestic good if  $W_L(1-\tau) > P_{dc}$ . Using the zero-profit condition [6] and the FOCs [1], [2], [4], and [5], we get the price of daycare as  $P_{dc} = 1/k$ . Subbing this into our condition and using [5] and [9] yield:

$$h > \frac{\left(\frac{1}{k}\right)^{1/\beta}}{(1-\tau)(1-\beta)^{-1/\beta} + \left(\frac{1}{k}\right)^{1/\beta}} \quad [11]$$

which is Assumption A2. Given  $W_H > W_L$ , if low-skilled workers prefer hiring daycare services to home producing the entire  $R$  amount of the domestic good, then high-skilled workers will as well.<sup>31</sup>

Finally, high-skilled workers will prefer using daycare to hiring a low-skill native as a private household worker only if  $P_{hw}R > P_{dc}\bar{c} + W_H(1-\tau)(R-\bar{c})$ . With the wage premium on household work,  $P_{hw}R = \frac{\delta}{(1-\tau)} + W_L(1-R+\bar{c})$ . Substituting this into the expression, along with  $P_{dc} = 1/k$  and using [1], [2], and [9] yields the condition:

$$(1-\beta)\left(\frac{h}{1-h}\right)^\beta - (1-\tau)\beta\left(\frac{h}{1-h}\right)^{\beta-1}(R-\bar{c}) > \frac{\bar{c}}{k} - \frac{\delta}{(1-\tau)(1-R+\bar{c})} \quad [12]$$

which is Assumption A3. Given  $W_H > W_L$ , if high-skilled workers prefer hiring daycare services to hiring a native private household worker, then low-skilled workers will as

<sup>31</sup> Equation [11] by assuming that all natives utilize daycare ensure that the labor supply equations given by [7] and [8] hold.

well. □.

## Proof of Proposition 2

The proof of Proposition 1 showed that, in the absence of immigration, Assumptions A2 and A3 and  $W_H > W_L$  imply that  $W_i(1-\tau) > P_{dc}$  and  $P_{hw}R > P_{dc}\bar{c} + W_i(1-\tau)(R-\bar{c})$  for  $i \in \{H, L\}$  which ensures that all natives utilize daycare and no native hire native private household workers. With  $m < h$  immigrants working as private household workers in high-skilled households, the expressions for wages are now

$$W_L = (1-\beta) \left[ \frac{h}{1-h} + \frac{m(R-\bar{c})}{(1-h)(1-R+\bar{c})} \right]^\beta = (1-\beta)\phi^\beta \quad [13]$$

$$W_H = \beta \left[ \frac{(1-h)(1-R+\bar{c})}{h(1-R+\bar{c}) + m(R-\bar{c})} \right]^{1-\beta} = \beta\phi^{\beta-1}. \quad [14]$$

Taking the derivative of each with respect to  $m$  yields:

$$\frac{\partial W_L}{\partial m} = (1-\beta)\beta \left[ \frac{R-\bar{c}}{(1-h)(1-R+\bar{c})} \right] \left[ \frac{h}{1-h} + \frac{m(R-\bar{c})}{(1-h)(1-R+\bar{c})} \right]^{\beta-1} = \beta(1-\beta)\phi^{\beta-1} \frac{\delta\phi}{\delta m} > 0 \quad [15]$$

$$\frac{\partial W_H}{\partial m} = -(1-\beta)\beta \left[ \frac{(1-h)(1-R+\bar{c})(R-\bar{c})}{h(1-R+\bar{c}) + m(R-\bar{c})} \right] \left[ \frac{(1-h)(1-R+\bar{c})}{h(1-R+\bar{c}) + m(R-\bar{c})} \right]^{-\beta} = \beta(\beta-1)\phi^{\beta-2} \frac{\delta\phi}{\delta m} < 0 \quad [16]$$

Using [13] and [14], the new condition that guarantees  $W_H > W_L$  is

$$h < \beta - \frac{(1-\beta)m(R-\bar{c})}{1-R+\bar{c}} \quad [17]$$

which is Assumption A1'. Since high-skilled wages are now *lower* and low-skilled wages are now *higher*, than they were without immigration, Assumption A3 remains a sufficient condition such that no low-skilled native works as a private household worker

(i.e.  $P_{hw}R > P_{dc}\bar{c} + W_H(1-\tau)(R-\bar{c})$ , and with  $W_H > W_L$ ,  $P_{hw}R > P_{dc}\bar{c} + W_L(1-\tau)(R-\bar{c})$ ).

Similarly, Assumption A2 remains a sufficient condition for daycare centers being

affordable for all natives (i.e.  $W_i(1-\tau) > P_{dc}$  for  $i \in \{H, L\}$ ).  $\square$ .

## Appendix B

Total welfare in the economy is given by the total amount of good  $A$  produced minus any payments to foreign private household workers. With  $m < h$  immigrants, the market clearing conditions in the labor markets are now:

$$\hat{H} + H = h(1 - R + \bar{c}) + m(R - \bar{c}) \quad [18]$$

$$\hat{L} + L = (1 - h)(1 - R + \bar{c}). \quad [19]$$

Adding the two zero-profit conditions, [3] and [6], and rearranging gives:

$$P_{dc} k \hat{H}^\beta \hat{L}^{1-\beta} + H^\beta L^{1-\beta} = W_H (\hat{H} + H) + W_L (\hat{L} + L). \quad [20]$$

Market clearing in the daycare market implies:

$$k \hat{H}^\beta \hat{L}^{1-\beta} = (1 - m)\bar{c}. \quad [21]$$

Substituting [18], [19], and [21] into [20] yields:

$$H^\beta L^{1-\beta} = W_H (h(1 - R + \bar{c}) + m(R - \bar{c})) + W_L ((1 - h)(1 - R + \bar{c})) - P_{dc}(1 - m)\bar{c} \quad [22]$$

The total welfare in the economy (the sum of all native utilities) is given by [22] the total amount of good  $A$  minus payments daycare centers and to foreign private household workers ( $mRP_{fphw}$ ), who are paid the reservation price of high-skilled employers. It is thus:

$$W_H [h(1 - R + \bar{c}) + m(R - \bar{c})] + W_L [(1 - h)(1 - R + \bar{c})] - P_{dc}(1 - m)\bar{c} - m [P_{dc}\bar{c} + (1 - \tau)W_H(R - \bar{c})]$$

Simplifying yields the desired result:

$$Welfare = W_H [h(1 - R + \bar{c}) + m(R - \bar{c})] + W_L [(1 - h)(1 - R + \bar{c})] - P_{dc}\bar{c} - m(1 - \tau)W_H(R - \bar{c})$$

The derivative of this welfare function with respect to the level of immigration  $m$  is,

therefore equal to

$$\frac{\delta Welfare}{\delta m} = (1 - R + \bar{c}) \left[ \frac{\delta W_H}{\delta m} h + \frac{\delta W_L}{\delta m} (1 - h) \right] + m \tau(R - \bar{c}) \frac{\delta W_H}{\delta m} + \tau(R - \bar{c}) W_H. \text{ For}$$

notational simplicity, we define:

$$X = \frac{\delta W_H}{\delta m} h + \frac{\delta W_L}{\delta m} (1 - h) \text{ and } Z = m \tau(R - \bar{c}) \frac{\delta W_H}{\delta m} + \tau(R - \bar{c}) W_H.$$

First, we show that  $Z$  is positive.

.Using [14] and [16],  $Z$  can be rewritten as

$$Z = \tau(R - \bar{c}) * \beta \left( \frac{(1 - h)(1 - R + \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} \right)^{1 - \beta} - m \beta (1 - \beta) \left( \frac{(1 - h)(1 - R + \bar{c})(R - \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} \right) \left( \frac{(1 - h)(1 - R + \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} \right)^{\beta}$$

This right hand side can be rewritten as

$$= \tau(R - \bar{c}) \beta \left[ \frac{(1 - h)(1 - R + \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} \right]^{\beta} \frac{(1 - h)(1 - R + \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} \left( 1 - \frac{m(1 - \beta)(R - \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} \right)$$

Note that as long as  $\beta > 0$ , then  $m(1 - \beta)(R - \bar{c}) < m(R - \bar{c})$ . Therefore,

$$\frac{m(1 - \beta)(R - \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})} < 1, \text{ and, as a result, } Z > 0.$$

To show that  $\frac{\delta Welfare}{\delta m} > 0$ , we only need to show that  $X$  is positive since

$1 - R + \bar{c}$  is positive. Using [15] and [16] and the definition of

$$\phi = \frac{h}{1 - h} + \frac{m(R - \bar{c})}{(1 - h)(1 - R + \bar{c})}, \text{ we can evaluate}$$

$$X = \beta(\beta - 1)\phi^{\beta - 1} \frac{\delta \phi}{\delta m} h + (1 - \beta)\beta\phi^{\beta - 1} \frac{\delta \phi}{\delta m} (1 - h). \text{ Simplifying, this gives}$$

$$X = (1 - \beta)\beta\phi^{\beta-1}(1 - h)\frac{\delta\phi}{\delta m}\left[1 - \frac{h(1 - R + \bar{c})}{h(1 - R + \bar{c}) + m(R - \bar{c})}\right].$$
 The term in the square bracket

is positive as long as  $m > 0$ . Since all other terms are positive,  $X > 0$ .

Therefore, since  $\frac{\delta Welfare}{\delta m} = (1 - R + \bar{c})X + Z$  and both  $X$  and  $Z$  are positive,

welfare is increasing in  $m$ .

□.

## Appendix C

In this appendix, we present an informal discussion of the case where there are a limited number of native private household workers. We use  $\lambda$  to designate the number of high skilled natives employing native private household workers. Each hiring household must hire exactly one private household worker so  $\lambda$  is also the number of low skilled natives working as private household workers. Without any immigration, the labor supply of high skilled and low skilled natives are:

$H + \hat{H} = h(1 - R + \bar{c}) + \lambda(R - \bar{c})$  and  $L + \hat{L} = (1 - R + \bar{c})(1 - h - \lambda)$ . This suggests that low and high skilled wages are given as

$$W_L = (1 - \beta) \left[ \frac{h(1 - R + \bar{c}) + \lambda(R - \bar{c})}{(1 - R + \bar{c})(1 - h - \lambda)} \right]^\beta$$

$$W_H = \beta \left[ \frac{(1 - R + \bar{c})(1 - h - \lambda)}{h(1 - R + \bar{c}) + \lambda(R - \bar{c})} \right]^{1 - \beta}.$$

Because we assume that only a small number of high skilled natives employ native private household workers, high skilled natives must be indifferent between employing native private household workers and using daycare centers. This implies that the following must hold:  $W_H(1 - \tau)(1 - R + \bar{c}) - P_{dc}\bar{c} = W_H(1 - \tau) - P_{hw}R$ . Low skilled natives work both in the formal sector and as private household workers. Therefore, they must be indifferent between both types of employment implying:

$W_{hw}(1 - \tau)(1 - R + \bar{c}) - \delta - P_{dc}\bar{c} = W_L(1 - \tau)(1 - R + \bar{c}) - P_{dc}\bar{c}$ . Putting these two conditions together gives:

$$W_L = \frac{W_H(1-\tau)(R-\bar{c})}{1-R+\bar{c}} + \frac{\bar{c}}{k(1-R+\bar{c})} - \frac{\delta}{(1-\tau)(1-R+\bar{c})}. \quad [23]$$

To be thorough, we should also state assumptions on the exogenous parameters such that  $W_H > W_L$ , all natives can afford daycare centers, equation [23] holds and  $0 \leq \lambda < h$ . However, because  $\lambda$  cannot be expressed explicitly, we do not create explicit assumptions but note that there are enough parameters ( $\beta, \delta, k, \bar{c}, h$ ) such that these assumptions apply.

With foreign private household workers, the supply of high-skilled native labor is  $H + \hat{H} = h(1-R+\bar{c}) + (m+\lambda)(R-\bar{c})$  where  $\lambda$  is again the number of high-skilled natives employing native private household workers, which is endogenous.

The supply of native low-skilled workers is:

$$L + \hat{L} = (1-R+\bar{c})(1-h-\lambda).$$

This gives wages for both types of natives:

$$W_L = (1-\beta) \left[ \frac{h(1-R+\bar{c}) + (m+\lambda)(R-\bar{c})}{(1-R+\bar{c})(1-h-\lambda)} \right]^\beta = (1-\beta)\phi^\beta$$

$$W_H = \beta \left[ \frac{(1-R+\bar{c})(1-h-\lambda)}{h(1-R+\bar{c}) + (m+\lambda)(R-\bar{c})} \right]^{1-\beta} = \beta\phi^{\beta-1}.$$

Equation [23] which combines the condition that high skilled natives are indifferent between employing native and foreign private household workers and utilizing daycare centers with the condition that low skilled natives are indifferent to working as private household workers and working in the formal sector can be replaced with the expressions for  $W_L$  and  $W_H$ :

$$(1-\beta)\phi^\beta - \frac{\beta\phi^{\beta-1}(1-\tau)(R-\bar{c})}{(1-R+c)} - \frac{\bar{c}}{k(1-R+\bar{c})} + \frac{\delta}{(1-\tau)(1-R+c)} = 0 = G(\lambda, m)$$

[24]

This condition gives a relationship between  $\lambda$  and  $m$ . Using the implicit function theorem, we can find  $\frac{\delta\lambda}{\delta m}$  which is negative. Because  $\frac{dW_i}{dm} = \frac{\partial W_i}{\partial \lambda} \frac{\partial \lambda}{\partial m} + \frac{\partial W_i}{\partial m}$ , after some algebra we find that  $\frac{dW_L}{dm} = \frac{dW_H}{dm} = 0$ .<sup>32</sup>

As foreign private household workers enter, they displace both native private household workers and the domestic work of high skilled natives previously using daycare. The proportion of low skilled and high skilled natives that are displaced are exactly such that native wages do not change. This result depends crucially on the two native type assumption and the assumption that very few high skilled natives employ native private household workers.

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<sup>32</sup> Proof with algebra omitted for sake of brevity.

## Appendix D

We construct an individual panel dataset from the public-use files of Argentina's Encuesta Permanente de Hogares (EPH), a household survey which occurs each May and October and which represents large cities.<sup>33</sup> In each wave, the household register identifies individuals who work as domestic servants. This is a restrictive definition of household workers, since it ignores all household workers excluded from the household register.

EPH is a rotating panel where each household should appear in four waves. Argentina's statistics institute (INDEC) follows only dwellings and not households, and sample attrition is substantial. To construct the panel, we use a set of survey-household-person links constructed by INDEC and available from the authors. Our estimates use only the balanced panel, consisting of individuals appearing in all four waves.

We also use the following sample exclusions. To enhance over-time comparability, we exclude the cities introduced to the sample frame in May 1998 and 2001. Household definitions and sample selection in the May 1998 are problematic, so we begin with the October 1998 wave. We also exclude households with more than one listed mother, and households where the number of children listed in a given age group is unreasonably large (for example, having four children aged 0-1).

We also extract a rotating individual panel from the public-use files of the 2001-2004 waves of the Israeli labor force survey. This survey only reports the number of weekly hours of domestic help a household has, so we define that a household has a domestic worker when it reports 40 or more weekly hours of domestic help. Where possible, we define all other variables similarly in the Argentine and Israeli data. In the

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<sup>33</sup> The public-use files are available at <http://www.indec.mecon.ar/dbindec/login.asp>.

Israeli panel a household appears for two waves, disappears for two, then reappears for two more waves. Again, due to attrition, we only use the balanced panel.

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