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A. Introduction

If one accounts for the shift of women's work from the household to the market during the course of economic development, what does the trajectory of growth and structural change look like? In this paper, I present an accounting of one such shift by looking at the role of women in Taiwanese growth between 1965 and 1995, a thirty-year stretch when an enviable per capita market growth rate of 6.9 percent, which later came to be called the "East Asian miracle," was accompanied by large increases in female labor force participation.

One way to approach the interdependence of market and nonmarket work is by expanding measures of Gross Domestic Product (GDP) to include the value of nonmarket production. The problem of the underestimation of women's work in the United Nation's (UN) official System of National Accounts (SNA), which provide summary measures of economic performance and were intended to cover market transactions only, has been pointed out repeatedly since the late 1970s (Benería 1992a). The exclusion is substantial. Among existing studies on time use, non-SNA production on average absorbed as much labor time as SNA activities (Chadeau 1992; Goldschmidt-Clermont and Pagnossin-Aligisakes 1995). Studies from Australia, Canada, Finland, Norway, Sweden, and the U.S. show that nonmarket activities valued on the basis of labor inputs range between forty and sixty percent of the value of all output (Folbre 1997).

Partly as a result of pressure from the international women's community, in the 1993 SNA revision the UN Statistical Commission recommended that national statistical offices prepare estimates of economic activity outside present production boundaries. These accounts will be satellite accounts used in conjunction with traditional measures of market activity (Ironmonger 1996). As a first step in the Asian region, the United Nations Development Programme convened a workshop on integrating paid and unpaid work into national policies in South Korea in May 1997, inviting representatives from national statistical offices throughout Asia. A number of studies were commissioned for this meeting, but none evaluated the Taiwanese case (UNDP 1997). In May 1999, the Association for Asian Pacific Economic Cooperation (APEC) convened the last in a series of meetings to discuss the linkages between paid and unpaid work in human resource policy, and one of the papers commissioned re-estimated workers' aggregate earnings for the mid-1990s in Taiwan by adding in the value of unpaid family workers and full-time housewives (Tsay 1999). More will be said about this study below.

Efforts to improve the statistics are promising, but the lack of historical data means assessments of how women's work, both paid and unpaid, affect growth over the course of development are rare. There are notable exceptions to this gap: Wagman and Folbre (1996) evaluate growth in the market and nonmarket sectors in the early twentieth century U.S.; Aslaksen, Bjerkholt, Koren and Olsson (1998) do the same for Norway in the 1970s and 1980s. In this paper I build on these methodologies to consider the Taiwanese case, a case that is especially relevant to current debates about

growth and development because the female- and labor-intensive export-led growth model is still held up as a one to emulate.

I develop an alternative measure of economic production that accounts for both market and household production in the form of unpaid domestic services provided by women in the home, reevaluating growth over the course of Taiwan's export boom. I find that social services, a category that includes social services provided in the market and the home, has been the lead employer of Taiwanese labor between 1965 and 1995. Another key finding is that many of the factors driving growth in the market sector also shape growth in the household sector. Despite trend declines in the relative size of the household sector, it has probably continued to grow throughout this period, primarily because of productivity gains in household production and the effects of demographic change. At the core of this conclusion is the assumption that opportunity wages are a fair measure of the monetary value of women's work in the home.

Section B reviews the methodological and empirical literature on valuing this type of nonmarket work. In section C, I present a historical view of sectoral shifts in Taiwanese development that emphasizes the continuing importance of services. Section D presents the methodology and simulations that I use to portray growth and structural change in extended (market plus nonmarket) GDP in Taiwan. It opens by introducing an abstract model of household labor allocation (more fully developed in Appendix A) that will be used to assess the monetary value of unpaid production by women, then covers parameter estimation for the model, focusing on the productivity of household production and why opportunity wages are a good measure of nonmarket labor time for Taiwan. I then present the simulations themselves, and close by discussing the role of demographic change. Section E concludes.

B. A Review of the Literature

The methodological work in this field has focused on making estimation procedures commensurable with measures of market production used in the system of national accounts (Goldschmidt-Clermont 1993; Pyatt 1993). Since so much of the information required rests on entirely new processes of data collection heretofore unheard of in most national statistical offices, this aspect of the literature tends to be of the research agenda-setting variety.

Within this literature, there are two main approaches to appraising nonmarket work – output and input-based. Output-based approaches value the products of nonmarket work using the price of close market substitutes, often subtracting the cost of raw materials to get at net value added. Statisticians seem to prefer this method because it is an extension of that used for valuing subsistence production in agriculture, and because production boundaries are clear (only those activities with market substitutes get counted) (Ironmonger 1996; Pyatt 1993). This perceived advantage is also a weakness. Activities without close market substitutes are not included, so activities like childbearing, certainly an important feature of nonmarket value-added, or production for which markets have not yet developed (such as paid childcare in developing countries), are not assessed any value (Pyatt 1993). Additionally, data requirements are high, necessitating information not only about what households produce, but also about their relationship to marketed goods.

Perhaps as a result of these last challenges, most extant studies use input-based methods which value the labor time devoted to nonmarket production using one of two options. The first is the opportunity cost method, where the going wage rate for an individual of similar characteristics is multiplied by the time devoted to nonmarket production. A key drawback of this method is that wage rates are separate from the type of output produced, so identical products are valued differently according to who produces them (Chadeau 1992). Another problem is that systemic wage differentials between women and men get transferred to valuations of work in the home.

The second input-based method uses the price of hiring a market substitute, either specialized (as in using the going wage for the variety of services provided in the household), or generalized (as in using the wage for a general housekeeper). Using the wage rate for a general substitute is sometimes cited as a second-best solution (Goldschmidt-Clermont 1993), because it provides the most conservative estimate and seems closest to the supposed first-best output methodology. Its most salient weakness seems to be making the unlikely assumption that all household tasks could be performed by an unqualified housekeeper. But reverting to the specialist method brings with it the problem of assessing value for time that is spent at multiple tasks, such as looking after children while preparing the evening meal.

Regardless of the particular input method, resulting estimates are very sensitive to wage rates used. Using opportunity cost tends to give the highest value, and the global substitute method the lowest (Chadeau 1992). Still, in light of the fact that assessments based on household outputs require data that simply are not available in most cases, input-based methods remain the most popular methodology. For the study on Taiwan presented in this paper, data limitations necessitate using opportunity cost principles to value women's nonmarket time in the household. A microeconomic foundation for this methodology – one that is not typically considered in evaluations of using opportunity cost – is briefly introduced in section D and more fully discussed in Appendix A.

Shifting to the empirical side of the literature, most of this work is confined to studies in industrialized countries, mainly because these countries have been at the forefront of collecting the types of nationally representative time budget studies required. But studies in the developing world have been catalogued and the particular effects of the development process on women's time allocation discussed (Cloud and Garrett 1996; Goldschmidt-Clermont 1987; Harvey 1995; UN 1995a; UNDP 1997). The paucity of longitudinal time use data has meant that the bulk of studies focus on snapshot comparisons of the relative magnitudes of market and nonmarket production (e.g., Goldschmidt-Clermont and Pagnossin-Aligisakes 1995; Ironmonger 1996; UN 1995b). Still, some venture a more theoretical perspective to make up for gaps in the data, enabling a consideration of longitudinal changes in the size and scope of household production (Aslaksen, Bjerkholt and Olsson 1998; Aslaksen and Koren 1996; Wagman and Folbre 1996). It is in the latter largely experimental literature that my analysis necessarily lies.

One way to consider the range of empirical literature is by the stated intentions of its authors, as these indicate the broad utility of compiling even the most tentative of estimates. Some studies directly respond to the oversight of women's work prescribed

by current methods in the international system of national accounts (Hamid 1997; INSTRAW 1996; Ironmonger 1996). Others emphasize the size and importance of women's work in overall production, a contribution that remains sizable even in the most advanced stages of industrialization (Acharya 1997; Goldschmidt-Clermont 1987; Oda and Sato 1997; Tomoda 1985). Some, as is the intent of this study, focus on the issue of illusory growth brought about by structural change and the shift of women's work from the nonmarket to the market sphere (Cloud and Garrett 1996; Goldschmidt-Clermont 1987). In a more unusual effort, Benhabib, Rogerson and Wright (1991) incorporate homework with a real business cycle model and find that it greatly improves the model's predictive ability. On a somewhat related front, others use valuations of women's nonmarket work to reassess income inequality within countries (Aslaksen and Koren 1996; Goldschmidt-Clermont and Pagnossin-Aligisakes 1995; INSTRAW 1995; Parente, Rogerson and Wright 1996).

It is in this last category of studies that I found one of two attempts to assess women's nonmarket work in Taiwan. T. Paul Schultz (1999) explores how the shift in women's work time affected household income inequality in Taiwan during the period 1976-95 by doing an empirical estimation of full income (the income a household would have if everyone worked in the market full-time). Using what would be classified as an opportunity cost approach, he finds that inequality in full income per capita declined across households over this time period, contrary to what other studies based on only money income have found. The focus of my study is different from that of Schultz's; his is on the issue of income inequality and mine on growth and structural change within Taiwan's household service sector. But we do share a perspective built on the continued importance of household work in Taiwan's economy, the topic of section C.

The second attempt was the study commissioned by APEC for a 1999 conference on integrating linkages between paid and unpaid work into human resource policy mentioned above. Ching-ling Tsay (1999) measures women's potential contributions to market production by estimating market earnings for unpaid workers and full-time housewives (termed "housekeepers") in Taiwan between 1992 and 1997. Using an opportunity cost approach buffeted by some time use data, Tsay estimates that the aggregate earnings of female workers in the paid labor force would increase by 15 percent if the potential earnings of unpaid family workers were added, and 33 percent if housekeepers were added[1], for a potential total increase of 48 percent. Household work for women already in the labor force were not included in these figures, however, and it is not clear what sorts of work constitute housekeeping work in the time budget study. Although Tsay's work is not strictly comparable to the study undertaken in this paper, it does indicate the continued significance of women's nonmarket work in the Taiwanese economy.

C. The Domestic Service Sector in Taiwan

The scope of nonmarket production is a wide one, encompassing more than just unpaid domestic services provided primarily by women in the household. But since the

[1] The original figure for housekeepers was 66 percent, but Tsay cuts this in half due to information from a 1998 time budget study that indicated that women not in the labor force did about 3.5 hours of household work per day, about half as many hours of work as their self-employed counterparts did on the job (Tsay 1999: 4).

focus of this study is the direct consequences on production of the transfer in women's labor time from the home to the marketplace, I confine my analysis of unpaid work to those whose primary occupation has been classified in the Taiwanese census as "keeping house."[2,3] Before shifting to the estimation procedure and the simulations themselves, it would be helpful to describe the relative size of the household sector labor force.

Consider figure 1, which compares market labor force participation rates for men and women with the "housewife" labor force participation rate between 1965 and 1995 in Taiwan. The latter is measured as the number of housewives divided by the female population over fifteen.[4] Male labor force participation has steadily declined since the 1960s, largely as a result of increased time spent in education and earlier retirement, while women's has increased from 33 to 45 percent. Older women have increased their labor force participation rates as younger women have elected to stay in school longer as well. After an early rise in the labor force participation of very young women, it is among older (but not elderly) women that sustained increases in female labor participation continued.

Table 1 lists age-specific labor force participation rates for women and men between 1978 and 1995, the earliest years available. It gives a clearer picture of what drives the convergence in labor force participation between women and men. In both 1978 and 1995, young women between the ages of 15 and 24 were more likely to go out to work than their young male counterparts, but both female and male youth participation rates fell as education became a more extended vocation in Taiwan. Among older women and men, there is a slight convergence in labor force participation, but older women still work for pay a lot less frequently than older men. Women over the age of 55 increased their participation rate from 0.10 in 1978 to 0.15 in 1995; the rate for men over 55 declined from 0.53 to 0.40, an indication of earlier retirement.

Figure 1 also shows that the participation rate for housewives declined, starting at over 50 percent in 1965 and declining to a little over 33.5 percent in 1995. This path is clearly closely associated with female market labor force participation – the two participation rates have a correlation coefficient of –0.94. The exception to the trend decline in the housewife participation rate is the period between 1974 and 1981, a time when Taiwan struggled with the effects of two oil crises and a bout of inflation. Figure 1 also suggests that female market employment in Taiwan has been pro-cyclical, with women moving out of the market sector and into the household sector in times of recession, a finding concluded in other analyses as well (Yang 1998).

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[2] Besides housekeeping, other reasons recorded by the Census for nonparticipation in the labor force include: attending school, intend to look for work but not yet doing so, being aged or disabled, and "other."

[3] There is no sex disaggregation within the category "keeping house." Of those classified as not in the labor force, of which keeping house is a subset, women constitute the vast majority. This fact as well as wide documentation that Taiwanese women do most of the housework makes me comfortable using housewife as a synonym for this category.

[4] Since "aged" is a separate category, one can conclude that elderly women do retire from housekeeping.

Evaluating in terms of employment numbers, how big is the unpaid domestic service sector relative to other sectors in Taiwan? Table 2 details the sectoral composition of the Taiwanese labor force, including housewives, at various points in its industrial development. In 1965, the unpaid domestic service sector was second only to agriculture in employment. Later, agriculture declined significantly and industry, especially manufacturing, became the main employer of Taiwanese labor. Even though the proportion of women working solely in the home declined, the early dynamics of the demographic transition guaranteed continued expansion in the home sector.

Table 3 presents the sectoral distribution of the market labor force over the same time period. The shift from agriculture to industry and services was dramatic; if one combines the categories commerce, business and social services in an aggregate service sector, employment there increased from 26 percent of the paid labor force in 1965 to 47 percent in 1995. Table 4 repeats the sectoral distribution by employment, but it also includes those whose primary occupation was unpaid housework as a part of the labor force in the category "social services."[5] Looked at this way, social services has been the primary sectoral employer in Taiwan since the beginning of its industrialization boom in the mid 1960s. Even though industrial employment gained a significant number of jobs, social services continued to hold its own. This interpretation provides a different perspective than that which is widely emphasized in the literature. Despite the shift away from agriculture and into industry that is often cited as a marker of development, the importance of social services never appreciably waned.

These figures do mask, however, the shift in the relative size of the household sector as expanding market growth drew more labor out of the home and into the marketplace. In the next section I will quantify these differences more precisely by assessing growth in the unpaid domestic service sector in terms of the value of its labor inputs.

D. Growth and Structural Change in Market and Domestic Production

The goal of this section is to develop a model for assessing the value of the unpaid domestic service sector in Taiwan, and then to investigate how the inclusion of that sector in production figures affected the course of what will be referred to as extended (market plus nonmarket) growth between 1965 and 1995. It opens by introducing an abstract household model that will provide a theoretical basis for the simulations to follow.

1. Modeling the Value of Women's Household Work in Taiwan

The approach taken to modeling the household in this paper is a rather standard one, building on the notion formalized by Gary Becker (1965) that the household is both a unit of production and consumption, and closely following the methodology outlined in Wagman and Folbre (1996). The goal of this model is to derive an expression for the money value of women's nonmarket production to a representative household in terms that can be estimated using the data available. A detailed derivation of the model is

[5] Note that unpaid family workers who work in that capacity for more than fifteen hours during the reference week are also considered part of the labor force by the Census.

presented in Appendix A, but its general form is reproduced in equation (12) below to give the reader a sense of the parameters employed.

$$(12) \qquad ph = \frac{w}{\alpha}(L + \lambda t_y^*) \qquad \text{where} \qquad -1 < \lambda < 0; \quad 0 < \alpha < 1$$

Terms represent the following: ph is the monetary value of household production; w is the average female market wage; α is the elasticity of output with respect to labor inputs in the household production function; L is the average work time of women who do no market labor; λ is the rate of substitution between household and market work; t_y^* is the optimal market work time for women, so λt_y^* is the amount of household work done by women who also have a job in the market. The final equation used breaks down t_y^* into actual market work time by making use of the female unemployment rate (equation 15 in Appendix A).

Getting some of the measures used in the abstract model to figure the money value of women's unpaid household services is more straightforward than others. Time series labor force participation data of the type discussed in section C on the Taiwanese domestic service sector, combined with time use data, give numbers for women's work time in the household and the labor market; there is also a time series for female unemployment rates. Choosing a series for w and α, both of which bear important assumptions about the level and course of the productivity of household work, as well as λ, which will significantly affect recorded declines in household sector labor time, require more careful thought and explanation.

There are two aspects to time: quality and quantity. Measuring quality means accounting for labor productivity, or output per person hour. In terms of the productivity of labor engaged in household work, there are important reasons to think that despite the decline in the relative magnitude of unpaid housework recorded in a number of studies of industrialization and women's time allocation, reflecting the increased participation of women in the labor market as in Taiwan, these declines in quantity of time could also be a result of increases in the productivity of unpaid work (Chadeau 1992). To see why this might be the case, consider that measures of labor productivity capture three effects: the amount of tangible capital employed, the average quality of labor and the efficiency with which labor and capital are used.

Taking the issue of capital intensity in the household sector first, in general women's work tends to be undercapitalized relative to men's (Dixon-Mueller and Anker 1988). But the basic changes that accompany development can vastly alter the productivity of household work. Examples include the availability of tap water, gas fuel and electric utilities, as well as ownership of time-saving appliances such as washing machines and refrigerators (Floro 1997; UN 1991). These changes are not necessarily unidirectional, though. Some have argued that household capital and time are not substitutable, and that increases in household capital have been complemented by a rise in the absolute and proportionate time spent in housework (Goldschmidt-Clermont 1987). But these have certainly also been associated with a rise in household welfare.

Household consumption and utility service numbers for Taiwan do suggest that household production has become more capital intensive in the period considered. The population served by tap water increased from 30.8 percent in 1961 to 89.3 percent in 1997; those serviced by electricity increased from 74.7 to 99.7 percent in the same time period (DGBAS, *Social Indicators*). Numbers on household capital were only available as far back as 1976, but the percent of households with washing machines increased from 38.6 to 94 percent between 1976 and 1997 (DGBAS, *Social Indicators*).

Perhaps the greatest improvements have come with the average quality of labor engaged in household work in Taiwan. Declines in mortality following World War II mark improved health among the Taiwanese population in the post-war years. Education, which has been a key feature in studies of declines in fertility and infant mortality (Sen 1993), has also been shown to have considerable effects on how women value their own household productivity (Gronau 1973a). Table 5 documents the dramatic improvements in average education levels in Taiwan since the 1950s by both population totals and sex. In 1951, 82.3 percent of the female population was recorded as either illiterate or self-educated; by 1995 it had declined to 12.4 percent. The proportion of women in the population with a degree from senior high school and above has also witnessed a dramatic increase, with 47.5 percent of the female population having at least a senior high or vocational school degree in 1995. Clearly, the average quality of labor engaged in household work as measured by health and education has increased considerably through the course of Taiwan's industrialization.

There are also important reasons to believe that the third component of labor productivity in the household sector, the efficiency with which labor is used, has increased along the course of economic development. Nancy Folbre long ago pointed out that if the primary goal of households was to survive and subsist, then there should be a process by which inefficient households would be eliminated, implying that the efficiency of domestic and market workers is probably comparable (Folbre 1982). The evolution of household technology, as touched on in the discussion of capital use above, has made it easier to substitute market goods for own time in household production, probably leading to a greater responsiveness of women's labor supply to changes in money wages and therefore greater efficiency in household labor allocation (Juster and Stafford 1991). One signal of this enhanced efficiency is the shift from unpaid to paid services through the course of development (Aslaksen, Bjerkholt, Koren and Olsson 1998).

Other examples of development and structural change experienced in Taiwan that might have increased household efficiency include the decline in infant mortality and urbanization. Declines in infant mortality enhance efficiency by lowering the probability of investment loss and facilitating increased investments of time and resources per child. Urbanization brings with it economies of proximity, where access to a multitude of goods and services expands opportunities for substituting market for household goods and time, as well as affords opportunities to benefit from economies of scale provided in public infrastructure such as education and healthcare.[6]

[6] There can be notable diseconomies of urbanization, though, as anyone with urban experience can attest to. Urbanization can rule out some types of household labor that may in fact be more efficient

All of these factors suggest that despite the relative decline in household labor participation experienced in Taiwan, increases in the productivity of household labor could well have compensated for this decline. The same factors driving labor productivity in the market sector probably drove productivity improvements in the household sector as well – improvements in education and health, expansions in market scope, and increased availability of capital. Using a time series of female market wages as a proxy for the value of their labor inputs in the household sector captures this parallel – at least the extent to which women's market wages are linked to the productivity of their labor time[7] – and it is this measure that will be used in the simulations to follow.[8]

Declines in leisure time may also work against the decline in household labor time suggested by the increase in female market labor force participation. Working for pay does not make housework time decline as much as one might think; a number of time use studies have clearly shown that working for pay often results in a double day for women, where they accommodate increased market participation with less leisure time (Chadeau 1992; DaVanzo and Lee 1983; Floro 1997; Tsuya 1997; UN 1995b).

The extent to which this double bind applies to the Taiwanese case probably varies over the course of development. Initial increases in the female paid labor force were largely the result of the entry of young girls into export factories, some of whom were either consequently excused from household work in recognition of their financial contributions to their natal families (Kung 1983), or whose residence away from home near urban factories or export processing zones drew their unpaid labor out of the household pool (Lim 1993). Married women and women with children were left out of the initial flurry of new manufacturing jobs, but with continued increases in labor demand, the myriad of small labor–intensive enterprises throughout Taiwan's cities, towns and even living rooms increasingly drew on the labor of married women without taking them far from home (Brinton, Lee and Parish 1995; Hsiung 1996). In 1980, a quarter of women between ages 30 and 44 worked in manufacturing as compared to under 10 percent in 1970 (Hsiung 1996: 38). And between 1978 and 1997, the labor force participation rate for married women increased from 32 to 46 percent (DGBAS, *Yearbook of Manpower Survey Statistics*).

As a result, the rate of substitution between market and nonmarket work was probably higher in the early years when young girls with fewer domestic responsibilities shifted into the market labor force. But as more married women were drawn into market labor, one would expect more of a decline in leisure time than

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than market production, such as tending a small garden. But the points about economies of proximity and access still hold.

[7] This measure probably understates enhancements in women's market productivity as evidenced by the stubbornness of the gender wage gap in Taiwan despite a closing of the gender-based education and skill gap. In a study of the gender wage gap between 1978 and 1992 in Taiwan, which found that the female-male earnings ratio remained at 65 percent, the authors suggest that wage discrimination against female workers has increased over time (Zveglich, Rodgers and Rodgers 1997). In another study, Gunseli Berik finds that the industrial restructuring of "mature export-led growth" in Taiwan (beginning in the 1980s) has contributed to increased gender wage inequality, partly as a result of the shift in women's jobs towards salaried positions, which has reduced women's wages (Berik 2000).

[8] Other studies that use a similar methodology include: Aslaksen, Bjerkholt, Koren and Olsson (1998); Hamid (1997); and Oda and Sato (1997).

unpaid domestic labor. With no solid longitudinal data on time use that would allow for such an estimate, in the simulation discussed below I will use a value of –0.75, meaning that for every hour worked in the market, household labor time declines by 45 minutes. This rate is probably high, and will lead to more conservative estimates of nonmarket work time. Lower values are also explored using sensitivity analysis.

A last word is required on an estimate for α, or the elasticity of household output with respect to labor inputs. In his original work on the Cobb-Douglas production function, Paul Douglas used a value of 0.75 (Douglas 1948). In his growth decomposition analysis for Taiwan between 1966 and 1990, Alwyn Young (1995) found a value of 0.74 for the market sector. In the main simulation exercises below, I have chosen to use Douglas's original estimate, which is probably not far off in light of Young's work.

2. The Simulation

As stated above, for the purposes of immediate discussion the values for λ and α will be –0.75 and 0.75 respectively; details on the balance of the data (opportunity wages, time and the labor force) are given in Appendix B.[9]

Starting off with a comparison of total market (M) and nonmarket (N) production, the simulations indicate that the relative size of the household sector declined significantly, going from about 31 percent of market sector size in 1965 to 17 percent in 1995. But the decline is not a consistent one. There was an upswing in the size of the household sector in the mid-1970s that will be discussed more completely below. If one counts only housewives (leaving out the issue of the rate of substitution between market and nonmarket work), the figures are 26 and 13 percent respectively. Because of the substantial decline in nonmarket work when women take a paying job that is assumed in this model, and because of the continued significance of full-time housekeeping in the Taiwanese economy, women who work only in the home dominate the trajectory of domestic production.

To what extent has this decline in the relative size of domestic production affected extended (M+N) growth? Table 6 presents five-year averages for per capita real growth rates of market, nonmarket, and extended (M+N) production. Accounting for the household sector pulls down overall growth an average of 0.43 percent per year between 1965 and 1995. But the effect varies in direction and magnitude over time.

In the first two decades considered (1965-84), the household sector had its greatest effect on growth. Between 1965 and 1974, slower growth in the household sector lowered extended GDP growth rates by about 0.9 percent a year. In the period 1975-79, however, the household sector somewhat compensated for the oil crisis-induced slowdown in the market sector, contributing an average of 0.41 percent a year to extended GDP growth and drawing it up to an 8.42 percent per capita growth rate. This result is also consistent with the story told about the pro-cyclical nature of female

[9] The full set of simulation results, including a variety of sensitivity analyses and a more detailed explanation of the how the simulations were run, are available from author.

market employment above – when the economy slows down, women's work shifts back to the household sector.

The next five year period, 1980-84, carried with it a recession in 1981-82 spurred by the second oil crisis, but this time growth in the household sector lagged behind market GDP, depressing extended per capita growth to an average of 4.43 percent a year as compared to 5.43 percent for per capita market growth. There are two reasons for this. The first is that female real wage growth was significantly negative in the three (inflationary) years 1980-82, meaning that the real value of domestic output declined as well (since it is valued using opportunity wages). Secondly, the proportion of housewives in the working population declined. Looking back at figure 1 on labor force participation rates, what began as a re-entry into the household sector in 1974 peaked in 1978, and then began to decline again in the recession years. At the same time, women's participation in market work began to increase in 1982 after about a six-year plateau, reaching its peak for the entire thirty-year period in 1987 and suggesting that women in the household sector shifted activities to the market sector. This pattern contradicts the received wisdom of women's pro-cyclical employment in Taiwan, and suggests that a reconsideration of this conclusion is warranted, at least for the early 1980s.

By the late-1980s, household sector growth continued to lag behind that of market GDP, but the size of the consequent slowdown in extended GDP was much smaller than earlier periods (0.09 percent in 1985-90 and 0.31 percent in 1991-95), primarily because the size of the household sector relative to that of the market sector continued to decline throughout the entire period, despite the sort of leveling in the participation rate for household work indicated in figure 1.

What is impressive about these figures is that despite the trend decline in participation rates for housewives between 1965 and 1995, the nonmarket sector continued to grow a per capita average of 4.71 percent. Continued growth is to a large extent due to productivity improvements (as measured by opportunity wages) in the household sector, and to a lesser extent due to the age structure effect, where despite the decline in the housewife participation rate, the number of women engaged primarily in unpaid housekeeping has continued to increase since the mid 1960s. This point will be discussed in the next section on the role of demographic change.

What might these numbers look like if opportunity wages used to measure the household sector stayed the same between 1965 and 1995, that is, there was no productivity growth in the domestic sector? Average per capita growth in the household sector would decline to –0.33 percent annually, a significant difference from the 4.71 percent figure when productivity is allowed to increase along with the market sector's. Per capita extended (M+N) growth would decline to an average of 5.95 percent a year, as compared to the 6.37 percent extended growth and 6.8 percent market growth in table 6. This difference is significant, but perhaps not as much as one might expect in light of the dramatic declines in nonmarket sector participation.

Taking up the issue of how sensitive these estimates are to the parameters used, the following tests were applied: using three different values for λ (-0.75, -0.5, and

–0.25); using three different values for α, (0.75, 0.5, and 0.2); and accounting for only housewives.

Referring to table 7, lower values for λ, the rate of substitution between nonmarket and market work, do not have much effect on (M+N) growth. The average growth for extended per capita GDP is 6.37 percent when $\lambda = -0.75$; at –0.5 it is 6.38 percent, and at –0.25 it is 6.39 percent. Of course, the figures for nonmarket growth alone are more sensitive to changes in λ. Looking at changes in per capita nonmarket production, the values for growth over the period 1965 to 1995 when $\lambda = -0.75$, –0.5 and –0.25 are 4.71, 5.01, and 5.23 percent respectively. Using a higher value for the rate of substitution between market and nonmarket work gives lower estimates (as women who work in the market lower their nonmarket labor time by a greater amount the higher the value for λ), so the main figures discussed use the more conservative value of –0.75.

Shifts in α, the elasticity of household output with respect to labor inputs, have more dramatic effects. Looking at the extended per capita growth numbers in table 8, the thirty-year average growth numbers are 6.37, 6.23 and 5.82 percent when α moves from 0.75 to 0.5 to 0.2 (and $\lambda = -0.75$). But I do have some confidence in using the value 0.75 in light of Alwyn Young's work on the market sector in Taiwan (1995).

Rerunning the simulations with only full-time housewives slows down household sector growth, but not by much. Recall that in the core model, per capita nonmarket growth averages 4.71 percent between 1965 and 1995 (table 6); when only considering housewives (and a value of $\alpha = 0.75$), that figure is 4.28 percent. The figures for extended per capita growth are the same 6.37 percent. Clearly, the number of women who engage in full-time housework dominate the trajectory of growth in these simulations, due both to their numbers (an age structure effect as discussed below), and the higher value of λ used in the simulations.

Varying opportunity wages (and household productivity) gives the most significant changes, as discussed above, and indicate that in the more immediate future it is crucial to improve this data by using household surveys to get a more accurate assessment of opportunity wages. In general though, the estimates are not extremely sensitive to changes in parameters, and conservative choices have been exercised wherever possible.

3. The Role of Demographic Change

Population dynamics arose as a key determinant of the simulation results above. The role of demographic change is important because the demographic transition took record time in East Asia. In Europe, it took more than one hundred years. In post-war East Asia, it took about thirty, resulting in an incredibly compressed demographic gift to growth - the dramatic increases in worker to population ratios throughout East Asia during the high growth decades. Bloom and Williamson (1997) assess the demographic gift in Asia by separating age structure from population effects in standard growth regressions. They find that the rise in the relative size of the economically active population accounted for between 1.4 and 1.9 percent of East Asian annual per capita GDP growth between 1965 and 1990 - almost a third of observed growth over the

period. It should be noted that Bloom and Williamson's approach combines three disparate elements in the demographic gift: the movement of women into the paid labor force, the movement of men out of the paid labor force and into early retirement, and fertility decline.

Looking at the specific history of Taiwan, changes in age structure can be traced using the course of the dependency ratio, or the ratio of youth and old-age dependents to those in their economically active years. Table 9 presents dependency ratios for Taiwan between 1958 and 1995, including the absolute change from year to year. Since the 1960s, the dependency ratio steeply declined, going from 94.4 in 1958 to 45.8 in 1995. Even though that decline slowed down somewhat over the late 1980s and early 1990s, for the period under consideration, demographic change still bodes well for growth.

The changes in age structure that have lead to low dependency ratios have been a result of fertility decline in Taiwan. Declines in fertility commenced after the abrupt reductions in mortality following World War II, but the speed of decline picked up substantially in the 1960s. The total fertility rate (defined as the sum of current age-specific birth rates for women ages 15-49) fell from 5.1 children per woman in 1964 to 1.8 as early as 1985; it reached 1.7 in 1995 (DGBAS, *Statistical Yearbook*). Although the greatest declines in total fertility rates occurred among older age groups, one can attribute more than half of the decline in youth dependency since 1965 to Taiwanese women under 24, 70 percent if one includes the 25-29 year old age group (author's calculations based on DGBAS data). This is because of the dynamics of the demographic transition itself, as declining infant mortality rates in the 1950s spurred a bulge in population, with the result that women in their early childbearing years in the 1960s and 1970s greatly outnumbered their older counterparts.

Why did young women in Taiwan have fewer children? One early factor was their increasing market employment and consequent age of marriage. The initial years of Taiwan's export-led boom drew the large pool of young, unmarried women into the manufacturing labor force, a group commonly referred to as "working daughters" (Greenhalgh 1988; Kung 1983; Lim 1993; Salaff 1981). This supporting role was a newfound one in traditional Chinese culture for daughters, where patrilocal residence, patrilineal descent and inheritance, and the responsibility of sons for old age care of parents shaped traditional notions that daughters were "goods on which one loses" and "water spilled on the ground" (Greenhalgh 1988: 49). Working for pay and delaying marriage afforded families an opportunity to recoup these losses and daughters to repay them, at least in the early years of Taiwanese development when parents could still exert a strong hold on working children. Since nearly all births happen within marriage in Taiwan, increasing labor force participation and delaying marriage meant fertility decline.

Another important factor in declining fertility in Taiwan was the rise in female education (Schultz 1973). Indeed, it is education that is most often cited within the population and development literature as the key factor in fertility decline (Sen 1993; UN 1995b).[10]

[10] An interesting empirical literature has risen up about the relationship between female autonomy and fertility decline in developing countries, emphasizing the linkages between female

There are two ways the demographic gift affected the nonmarket sector that are relevant to the issue of growth and structural change. First, the growth effects of the demographic transition's change in age structure are evident in the nonmarket as well as the market sector. Even though the participation rate for full-time household work has been on the decline (see figure 1), the total number of women choosing nonmarket work has continued to increase (see table 2) because of the peaks in population growth in the 1950s. And even though many women have chosen paying jobs, they still do some nonmarket work in the home. Despite the decline in the *proportion* of women doing full-time household work, the demographic gift contributed to continued growth in this sector simply because the number of women doing any amount of housework relative to the entire population increased so dramatically.

To understand the structure of this effect in the nonmarket sector, I use a measure I term the "housekeeping dependency rate," or the ratio of youth and old age dependents to women doing full-time housework. In 1965, this rate was 353, meaning that there were about 3.5 youth and old age dependents per full-time housewife. By 1995, this number had declined to 193, giving 1.9 youth and old age dependents per full-time housewife. Even though these figures do not account for the housework time of women in the paid labor force, it is clear that the sheer numbers of women primarily engaged in housekeeping and continued fertility decline sidestepped what might have been a contraction in the nonmarket sector.

How much did the demographic transition "give" to the nonmarket sector during this period? If one reruns the simulations maintaining the age structure in 1965 but letting all other factors vary, estimates for nonmarket growth rates decline by an average of three percentage points, cutting these rates by about half. Looking back at Table 6, that means nonmarket growth only reaches a thirty-year average of 2.35 rather than 4.71 percent. Depriving the nonmarket sector of its demographic gift does not completely reverse its growth, but it does take out a substantial proportion.

The second way that the demographic gift has affected the nonmarket sector is by changing the composition of care. As fertility declines and the population ages, less care time is spent on young children and more on the elderly, with probably an overall decline in care time relative to physical maintenance and management time. These issues could also affect one's assessment of the productivity of nonmarket work – but only a more detailed analysis of time use would offer the information necessary.

These points do indicate, though, that there is a potential down side to the demographic gift, both in the nonmarket and market sectors. The large cohort of workers with lower fertility that swelled the relative ranks of the economically active population will eventually become elderly, and the demographic gift could become a drain on the working-age population. In terms of the overall dependency rates covered above, although the rate continues to decline, the elderly constitute an increasing share of dependents. In 1965, those 65 and over constituted 5.6 percent of all dependents; in 1995 that share had risen to 24 percent.

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education and autonomy and challenging the seeming dominance of family planning as a solution to high population growth (Abadian 1996; Schuler, Hashemi and Riley 1997; Sen 1993). These approaches might be useful in reassessing Asian fertility decline as demographers often focus on the effectiveness of contraceptive use as opposed to changes in women's roles (Bloom and Williamson 1997; Lim 1993).

E. Conclusion

Raising the market labor force participation of women, especially women with high levels of human capital (measured in terms of education and health) was a key feature of the Taiwanese miracle. These contributions were to some extent at the expense of the household sector, but not as much as one might expect looking at the raw numbers due to productivity gains in the household sector and the demographic gift. Low unemployment and the continued expansion of labor demand was an important partner in this course because real wage growth made working for pay an avenue for expanding consumption and enhancing investments in children, rather than a way to cope with economic hardship.

From a development perspective, the Taiwanese case contains some important lessons about growth and structural change in extended production. In the most general sense, it was found that many of the factors driving growth in the market sector spurred growth in the household sector as well, a finding that may seem counter-intuitive in light of the dramatic changes in female labor force participation. Enhancements in labor productivity and fertility decline worked in similar ways in the two sectors, indicating the importance of productivity-enhancing public investments in human as well as household capital. These investments not only augment labor's direct contributions to growth, they also preserve production in the household sector in ways that complement the continued supply of high-skilled labor. Still, these complementarities probably occurred in a context of increased total work time for women, where women who worked for pay continued to provide some amount of nonmarket labor.

The gifts of productivity increases and fertility decline that underlie continued growth in the household sector could slow down and even reverse in the near future. As the relative proportion of the elderly population grows, changes in the composition of care toward the elderly necessitate more careful thinking about how the composition of care affects the productivity of nonmarket work, and about how social policy can help ensure that increased demands on the household sector are met by increases in the productivity of labor rather than greater work loads for women.

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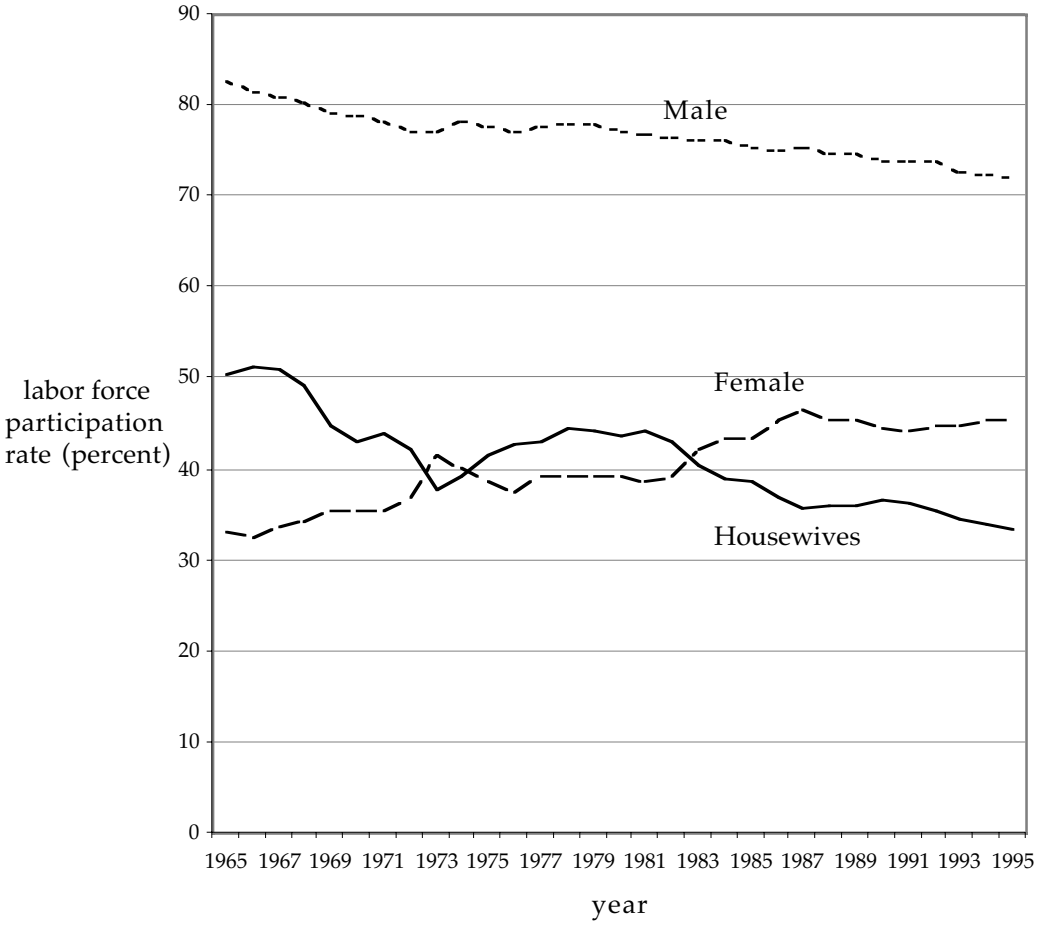
Figure 1. Labor Force Participation Rates in Taiwan, 1965-95



Notes: The series "male" and "female" indicate number in the market labor force/population over 15 years old. "Housewives" mesaures number of housewives/population female over 15 years old.
Source: Author's calculations based on data from DGBAS, *Statistical Yearbook of the Republic of China*.

Table 1. Age-Specific Labor Force Participation Rates by Sex

	15-24 year olds		55 years old +	
	women	**men**	**women**	**men**
1978	0.50	0.46	0.11	0.53
1995	0.39	0.32	0.15	0.40

Source: Author's calculations based on DGBAS, *Yearbook of Manpower Survey Statistics.*

Table 2. Sectoral Composition of the Labor Force in Taiwan *(thousands)*

year	agricul-ture	industry	commerce	business services	social services	house-work
1965	1,748	1,019	389	40	568	1,667
1975	1,681	2,242	775	88	736	2,011
1985	1,297	3,466	1,336	190	1,114	2,491
1995	954	3,972	1,919	534	1,664	2,624

Notes: Agriculture also includes forestry and fishing. Industry includes manufacturing, mechanical and mining. Business services includes finance, insurance, real estate and business; social services includes social, personal and public administration, all in the paid sector; housework denotes all those counted outside the labor force who were classified as primarily engaged in "housekeeping."
Source: DGBAS, *Statistical Yearbook of the Republic of China*, various years.

Table 3. Sectoral Distribution of the Market Labor Force in Taiwan

year	agriculture	industry	commerce	business services	social services
1965	46%	27%	10%	1%	15%
1975	30%	41%	14%	2%	13%
1985	18%	47%	18%	3%	15%
1995	11%	44%	21%	6%	18%

Note and sources: See table 2.

Table 4. Sectoral Distribution of the Total Labor Force in Taiwan
(percent of paid plus unpaid workers)

year	agriculture	industry	commerce	business services	social services
1965	32%	19%	7%	1%	41%
1975	22%	30%	10%	1%	36%
1985	13%	35%	14%	2%	36%
1995	8%	34%	16%	5%	37%

Note and sources: See table 2, except for the category social services, which now includes those counted as doing unpaid housework. Paid plus unpaid workers equals the market labor force plus those counted as doing unpaid housework.

Table 5. Educational Progress in Taiwan, 1951-95
(percent of the population)

	illiterate/self-educated			senior high, vocational school & above		
	total	**male**	**female**	**total**	**male**	**female**
1951	64.6%	49.1%	82.3%	5.2%	5.7%	3.1%
1995	8.5%	4.6%	12.4%	50.1%	52.7%	47.5%

Source: Author's calculations based on data from DGBAS, *Yearbook of Manpower Statistics*

Table 6 . Comparing Market and Extended Per Capita Real Growth in Taiwan, 1965-95

	Market (M) only	Nonmarket (N) only	M + N
λ =	**NA**	**-0.75**	**-0.75**
α =	**NA**	**0.75**	**0.75**
1965-69	6.00%	3.12%	5.33%
1970-74	8.07%	3.77%	7.17%
1975-79	8.01%	10.22%	8.42%
1980-84	5.43%	0.04%	4.43%
1985-90	7.24%	6.77%	7.16%
1991-95	5.67%	3.63%	5.36%
30-year avg	**6.80%**	**4.71%**	**6.37%**

Source: Author's calculations.

Table 7. Nonmarket and Extended Per Capital Real Growth with Varying Rates of Substitution Between Market and Nonmarket Work (λ)

	Nonmarket (N) only			M+N		
λ =	**-0.75**	**-0.5**	**-0.25**	**-0.75**	**-0.5**	**-0.25**
α =	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**	**0.75**
1965-69	3.12%	3.53%	3.84%	5.33%	5.36%	5.39%
1970-74	3.77%	4.43%	4.92%	7.17%	7.21%	7.24%
1975-79	10.22%	9.79%	9.47%	8.42%	8.38%	8.35%
1980-84	0.04%	0.69%	1.16%	4.43%	4.41%	4.39%
1985-90	6.77%	6.98%	7.13%	7.16%	7.19%	7.21%
1991-95	3.63%	3.96%	4.19%	5.36%	5.36%	5.36%
30-year avg	**4.71%**	**5.01%**	**5.23%**	**6.37%**	**6.38%**	**6.39%**

Source: Author's calculations.

Table 8. Nonmarket and Extended Per Capital Real Growth with Varying Rates of Elasticity of Household Output to Labor Inputs (α)

	Nonmarket (N) only			M+N		
λ =	**-0.75**	**-0.75**	**-0.75**	**-0.75**	**-0.75**	**-0.75**
α =	**0.75**	**0.5**	**0.2**	**0.75**	**0.5**	**0.2**
1965-69	3.12%	3.24%	3.39%	5.33%	5.14%	4.61%
1970-74	3.77%	3.77%	3.78%	7.17%	6.86%	5.95%
1975-79	10.22%	10.25%	10.29%	8.42%	8.57%	9.05%
1980-84	0.04%	-0.01%	-0.08%	4.43%	4.05%	2.91%
1985-90	6.77%	6.80%	6.84%	7.16%	7.13%	7.06%
1991-95	3.63%	3.61%	3.59%	5.36%	5.23%	4.84%
30-year avg	**4.71%**	**4.73%**	**4.75%**	**6.37%**	**6.23%**	**5.82%**

Source: Author's calculations.

Table 9. The Dependency Ratio in Taiwan, 1958-1995

year	dependency ratio	difference
1958	94.4	
1965	90.6	-03.8
1975	63.5	-27.1
1985	53.0	-10.5
1995	45.8	-07.2

Notes: The dependency ratio equals the population under age fifteen and over age sixty-four, divided by the population between the ages fifteen and sixty-four, times 100. Beginning in 1969, figures include armed forces living on military bases and inmates of institutions, which were previously omitted.
Source: Author's calculations based on DGBAS, *Statistical Yearbook of the Republic of China*.

Appendix A

This appendix lays out in detail the derivation of the household model used for the simulations. Household utility is based on the consumption and leisure of its members, so decisionmaking is limited to splitting members' time between work and leisure. Men do only market work; women can engage in market or nonmarket work in the household. For tractability production and leisure are represented as additively separable in the household's collective utility function, so decisions about the allocation of household members' time can be treated on an individual basis. This assumption does not preclude differential power in decisionmaking, only that decisions are based on maximizing an individual's contribution to household consumption and the leisure time of all household members is valued equally. In this context the latter assumption is certainly more problematic than the former, but it results in a more conservative estimate of women's total work time.

Household utility U is derived from both women's contributions to consumption C and their leisure time t_ℓ as indicated in equation (1); primes indicate derivatives. Consumption goods can be either bought on the market y or produced by women in the household h. Nonmarket or household production h is a result of women's nonmarket labor time input t_h as in equation (2), so total consumption is a function of women's household labor time t_h, market labor time t_y, their market wages w and prices for market goods p, as represented by equation (3).[11] Equation (4) is a time constraint, and shows that total available time T (perhaps twenty-four hours less time for sleeping) is divisible among market time, household labor time and leisure time.

(1) $U = U(C, t_\ell)$ $\qquad U' > 0; \quad U'' < 0$

(2) $h = h(t_h)$ $\qquad h(0) = 0; \quad h' > 0; \quad h'' < 0$

(3) $C = y + h = \dfrac{wt_y}{p} + h(t_h)$

(4) $T = t_y + t_h + t_\ell$

By substituting equations (2)-(4) into equation (1), one can derive the household's objective function as shown in equation (5), the maximization of which gives the first order conditions shown in (6).

(5) $U\left(\dfrac{w(T - t_h - t_\ell)}{p} + h(t_h), t_\ell\right)$

[11] Note that home-produced goods and goods bought on the market are perfect substitutes – which implies that market and nonmarket labor time are also substitutes since money can always substitute for time in this model. If market and nonmarket goods were not perfect substitutes, as say, could be the case when would-be parents prefer the production of children over any market good, the components of equation (3) would carry additional parameters, but the mechanics of the problem would not be changed. Maintaining this substitution does make using opportunity wages to measure nonmarket time a more intuitive option.

(6) $h' = \frac{w}{p}$ $\frac{\partial U}{\partial t_\ell} = \frac{w}{p}$ $h' = \frac{\partial U}{\partial t_\ell}$ where $h' = \frac{\partial h}{\partial t_h}$

These results for a utility maximum are standard ones. At an optimum, the marginal product of a woman's household labor time should be at least equal to the opportunity cost of her time as valued by the market in terms of her real wage foregone, as well as equal to the marginal utility to the household of another unit of her leisure time.

The next step involves assigning a functional form to the nonmarket production function; following Wagman and Folbre (1996) a standard Cobb-Douglas form was chosen as shown in (7), where b and α are constants and the κ_i's are capital inputs into household production.

(7) $h = bt_h^{\alpha} \prod \kappa_i^{\alpha_i}$ $0 < \alpha < 1$

Taking the first derivative with respect to household labor time, and substituting in the first order condition $h' = w/p$ from (6), gives an expression for the monetary value of household production to the household as shown in equation (8). On the right hand side of equation (8) are the elements to be estimated – the market wage that a woman may command w, the elasticity of output with respect to labor inputs in the household production function α, and the optimal amount of nonmarket labor time t_h^*.

(8) $ph(t_h^*) = \frac{wt_h^*}{\alpha}$

Estimating women's nonmarket labor time requires more than just accounting for all those women whose work is solely in the home because when women work in the market, there is a less than proportional decline in their household production. (This phenomenon captures the decline in leisure time that entering the labor force often brings for women who take on what has become known as the "double day.") One can see this relationship by totally differentiating the first order conditions in (6), which gives the equality in (9).

(9) $\frac{\partial^2 U}{\partial t_\ell^2} = -h''\left(\frac{1}{1 + dt_y^*/dt_h^*}\right)$

Since $\frac{\partial^2 U}{\partial t_\ell^2} < 0$, this implies that $-1 < \frac{dt_h^*}{dt_y^*} < 0$, meaning that as a woman's market labor time increases by one unit, her household labor time declines by less than one unit. In this light, assume that the rate of substitution between household and market work equals some constant λ, as shown in (10).

(10) $\frac{dt_h^*}{dt_y^*} = \lambda$ $-1 < \lambda < 0$

Getting from here to an estimable equation using aggregate statistics is straightforward. Equation (11) can be read as an expression for nonmarket labor time across a population of women, where L represents the average work time of women who do no market labor, and λt_y^* the decline in that labor time pursuant to taking a job in the market. Assuming that the aggregate distribution of women between market and nonmarket work is a reasonable estimation of this split, substituting (11) into (8) to get equation (12) gives a formula for the aggregate value of women's nonmarket production in terms of their forgone market wage, the productivity of household labor, the rate of substitution between household and market labor, and women's market employment rates.

(11) $\quad t_h^* = L + \lambda t_y^*$

(12) $\quad ph = \frac{w}{\alpha}(L + \lambda t_y^*) \qquad$ where $\qquad -1 < \lambda < 0\,; \quad 0 < \alpha < 1$

What about unemployment? When considering labor force statistics, one does not actually observe t_y^*, but rather the employment of women who have successfully found paying work. Actual employment, t_y^0, is also a function of the female unemployment rate, r. Assuming that women who are unemployed allocate that labor time to nonmarket work, actual household work, t_h^0, is a function of both the optimal amount of household work and women's unemployment in the marketplace, as shown in equation (13).

(13) $\quad t_h^0 = t_h^* + rt_y^*$

Substituting this expression back into (7), the household production function, and using the first order conditions for an optimum, one can derive an expression for household production that reflects how unemployment affects household labor time, as in equation (14).

(14) $\quad h(t_h^0) = \frac{w}{p\alpha}\left(t_h^* + rt_y^*\right)^{\alpha}\left(t_h^*\right)^{1-\alpha}$

Using actual values for t_h^* and t_y^*, equation (15) gives an expression for the value of female household labor time comparable to (12), but that incorporates the effects of female unemployment.

(15) $\quad ph(t_h^0) = \frac{w}{\alpha}\left(L + \frac{(\lambda - r)}{(1 - r)}t_y^0\right)^{\alpha}\left(L + \frac{\lambda}{(1 - r)}t_y^0\right)^{1-\alpha}$

In the absence of large-scale time budget data, equation (15) allows one to work with macrodata on women's labor force participation while preserving important microeconomic concepts such as the productivity of nonmarket labor and the rate of

substitution between market and nonmarket labor. Equation (15) also addresses the problem of the valuation of nonmarket production by focusing on a particular household's valuation of those services, given prevailing markets and the state of household technology. But markets do carry with them broad social assessments, such as the gender wage gap, that affect a household's labor allocation and may greatly underestimate the real value of women's household work. In light of this gap, one might then treat resulting estimates as a lower bound.

Appendix B

B.1 Wage Series

Wage data was culled from macrodata published in the *Yearbook of Earnings and Productivity Statistics* and the *Statistical Yearbook of the Republic of China*, and represent probably the weakest link in the simulations. A complete series for female wages, by sector, industry or occupation, was unavailable all the way back to 1965, so I constructed a series for female wages. The discussion below always refers to real wages, which were deduced using Taiwan's consumer price index and are all presented in 1991NT$, as are the real GDP numbers used.

Industry Data on wages for female workers was only available back to 1981. To extend the series back to 1965, the annual growth rate of total (male and female) manufacturing wages for each year was used. Galenson (1979: 417) documents a small decline in the gender wage gap in manufacturing (also the sector with nearly all of female industrial employment) during the late 1960s and early 1970s, indicating that female manufacturing wages rose at a slightly faster rate than male wages, and using overall real wage growth numbers is a reasonable option.

Services This category includes personal, community and social services. Data on wages for female non-supervisory service workers was available back to 1979. No other data on wages in the service sector before 1979 was available (male, female or averages), so I took the average growth rate of real wages for Taiwanese women employed in services between 1982 and 1995, 5.0 percent, and used this to extend the services series to 1965. (The years 1979-81 contained substantial declines in real wages probably due to the oil crisis-inspired recession; I left out these years in the average because including them gave a 2.68 average growth rate for services, with the consequence of giving very high estimates for service sector wages in the 1960s.)

Agriculture Data on agricultural wages were difficult to find, and I experimented with dividing farm household employee compensation by the number of employees per household (statistics kept in the national accounts). But the results seemed out of proportion with wages in manufacturing and services, as well as literature on Taiwanese agricultural incomes. Also, households are categorized by the occupation of the household head, and many women living in rural areas whose husband's or father's chief occupation was farming actually worked in the industrial sector (Levenson 1996). In the end I opted to leave these figures out of the wage series.

Since the wages used in the simulation model represent opportunity cost (versus the cost of replacement services), I used the distribution of female workers by sector as a weight for the relevant wage (only women employed in services and industry were used to figure the weights). The final result is a series of hourly real wages in 1991NT$.

B.2 Hours

I also drew working time data from the *Yearbook of Earnings and Productivity Statistics* and the *Statistical Yearbook of the Republic of China*. These published direct data

on average monthly work time for female manufacturing workers in the years 1965-72 and 1981-95. In the earlier period these exceeded male hours by a few hours a month, but then declined below average male hours by about seven hours a month in the later period, so for the intervening period I felt it reasonable to use average hours for the manufacturing sector as a whole. Dividing women's average monthly working hours in manufacturing by twenty-six (for a six-day work week) gives a daily average of 10 hours in 1965 and 8.2 hours in 1995.

For services I was only able to get data (both for women and the sector as a whole) beginning in 1979, and women's work time in services exceeded their work time in manufacturing by an average of four percent for the data available – a significant amount. To err on the conservative side, I elected to use manufacturing work time data for the entire series.

Without the benefit of time use data on women's work time in the home, I used women's average work time in manufacturing as a proxy for the nonmarket work time of women who do not have a paying job. This seems a conservative estimate, as aggregate time use surveys indicate a pretty even split between housework and market work for women even in the more industrialized countries (Juster and Stafford 1991).

B.3 Housewives, the female labor force and unemployment

Data on the number of housewives, the female labor force and the female unemployment rate were all available for the period 1965-95 in the *Statistical Yearbook of the Republic of China*. The term housewives refers to those categorized in the *Statistical Yearbook* as "not in the paid labor force" by reason of being "busy with housework."