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SOCIAL EMULATION, THE EVOLUTION OF GENDER NORMS, AND INTERGENERATIONAL TRANSFERS: THREE ESSAYS ON THE ECONOMICS OF SOCIAL INTERACTIONS

A Dissertation Presented

by

SEUNG-YUN OH

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

May 2013

Economics

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A Dissertation Presented

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SEUNG-YUN OH

Approved as to style and content by:

Nancy Folbre, Chair

Samuel Bowles, Member

James Heintz, Member

Michael Ash, Department Chair Economics

DEDICATION

To my mother,

Yongja Kim

To my husband,

Sung-Ha Hwang

and

To my teacher,

Samuel Bowles

Thank you for all of your love, support, help, encouragement, and dedication.

ACKNOWLEDGMENTS

I would like to thank my advisors, Nancy Folbre and Samuel Bowles, for their support and advising on this research. Nancy Folbre inspired me with interesting questions and enriched my research agenda. Samuel Bowles taught me how to conduct research. I also would like to thank Gerald Epstein for his support and mentoring throughout my time at UMASS. I extend my gratitude to my committee member, James Heintz, for his helpful comments and suggestions.

I want to thank the Santa Fe Institute for providing a great research environment during my visits. I appreciate participants as well as organizers of the Analytical Political Economy (APE) workshop at the University of Massachusetts Amherst for their feedback and discussions. I also appreciate the help I received from the National Pension Service in Korea.

Special thanks to my friends, Hei-ja, Lynda, and Hasan for helping me get through difficult times. I want to thank David Nielsen for his help in editing the dissertation. Finally, I wish to express my deep gratitude to my husband, Sung-Ha Hwang, who has been there for me for the last ten years.

ABSTRACT

SOCIAL EMULATION, THE EVOLUTION OF GENDER NORMS, AND INTERGENERATIONAL TRANSFERS: THREE ESSAYS ON THE ECONOMICS OF SOCIAL INTERACTIONS MAY 2013

SEUNG-YUN OH, B.S., SEOUL NATIONAL UNIVERSITY Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST Directed by: Professor Nancy Folbre

In this dissertation, I develop theoretical models and an empirical study of the role of social interactions, the evolution of social norms, and their impact on individual behavior. Although my models are consistent with individual utility maximization, they generally emphasize social factors that channel individual decisions and/or shape individuals' preferences. I apply this approach to three different issues: labor supply, fertility decisions, and intergenerational transfers, generating predictions that are more consistent with observed empirical patterns of behavior than standard neoclassical approaches that assume independent preferences, perfect information, and efficient markets.

In the first essay, I explain the long-run evolution of working hours during the 20th century in developed countries: the substantial decline for the first three quarters of the 20th century and the deceleration or even reversal of the fall in working hours in the last quarter. I develop a model of the determination of working hours and how this process is affected by both the conflict between employers and employees and the employees' desire to emulate the consumption standards of the rich reference group. The model also explores the effects of direct and indirect policies to limit hours advocated by political representations of workers such as trade unions or leftist parties.

In the second essay, I study the coevolution of gender norms and fertility regimes. Since the 1990s, a new pattern of positive correlation between fertility rates and female labor force participation emerged in developed countries. This recent trend seems inconsistent with conventional economic approaches that explain fertility decline as a result of the increasing opportunity costs of childrearing, predicting a negative correlation between fertility and women's labor force participation. To address this puzzle, I develop a model of the evolution of gender norms and fertility in various economic environments influenced by the level of women's wages. Randomly matched spouses make choices related to fertility - labor supply and the division of household labor - based on their preferences shaped by gender norms. In the model, norm updating is influenced by both within-family payoffs and conformism payoffs from social interactions among the same sex. The model shows how changes in economic environments and the degree of conformism toward norms can alter fertility outcomes. The results suggest that the asymmetric evolution of gender norms between men and women could contribute to very low fertility, explaining the positive correlation between fertility and women's labor force participation.

Finally, I estimate the effect of exogenously introduced public pensions for the elderly on the amount of private transfers they receive. There has been a long debate whether public transfers crowd out private transfers. Previous empirical studies on this issue suffer from the endogeneity of income that contaminates estimates. I use an exogenously introduced public transfer, the Basic Old Age Pension in Korea, to test the crowding out hypothesis. A considerable proportion of the elderly population, especially women living without a spouse, do not experience the crowding out effect and moreover, among those who do, the size of the effect is relatively small. The results support the redistribution effect of the Basic Old Age Pension targeting the poor elderly in Korea.

Key words: working hours, Veblen effect, labor discipline, fertility, gender norms, conformism, intergenerational transfers, crowding out, public pensions

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CHAPTER 1

SOCIAL EMULATION, POLITICAL REPRESENTATION AND THE DETERMINATION OF WORKING HOURS

1.1 Introduction

On the eve of the First World War, workers in ten major industrial economies¹ spent, on average, a thousand hours more on the job a year than they did by the end of the 20th century. The decline was greatest early in the century, then the fall in working hours decelerated or even reversed in the last quarter of the 20th century in some nations. Despite the country differences, long-run trends in all countries are strikingly similar. The goal of this essay is to provide a model which can explain the long-run evolution of working hours during the 20th century.

I develop a model of the determination of hours in paid employment and how this process is affected by both the conflict between employers and employees and the employees' desire to emulate the consumption standards of the rich. In most models of labor supply, employees choose their working hours. In contrast to the standard labor supply models, I develop a labor discipline model in which hours are determined by employers and subject to complete contracts, but employee work

¹They are France, Germany, Netherland, Switzerland, U.K., Canada, U.S., Sweden, Australia, and Japan. See Oh, Park, and Bowles (2012) for more detailed information.

effort is not. I identify the conditions under which Veblen effects increase the hours sought by employees, and under which the hours selected by profit-maximizing employers will nonetheless exceed that preferred by employees.

Veblen pecuniary emulation effects occur in the model because even though the hours of work is selected by the employer, the employees' desire to emulate the rich reference group increases their desired level of working hours. This, in turn, influences the present value of the job at each level of hours chosen by the employer. The result is an increase in the employer's hours offer that minimizes the cost of satisfying a no-shirking constraint.

The conflict over working hours occurs although the employer takes into account the worker's hours preferences. Profit maximization constrained by the employee's best (effort) response function entails under-providing the amenity - in this case the workers' optimal choice of hours (as in the case of other costly workplace amenities (Bowles, 2004)). The firm's profit-maximizing choice of hours and wages is thus Pareto-inefficient, regardless of whether the workers would prefer fewer or more hours than the firm selects.

When employers offer longer hours than the hours preferred by workers, trade unions or political groups representing workers tend to advocate that government limit working hours directly or indirectly. I also study the effect of governmental interventions on equilibrium hours.

Other studies taking account of the fact that hours are chosen by employers, not employees, have demonstrated that inefficiently long working hours may occur when working time serves as a screening device for selecting workers with low disutility of work (Rebitzer and Taylor, 1995; Landers, Rebitzer, and Taylor, 1996) or with high productivity (Sousa-Posa and Ziegler, 2003). Others show that employees' desired and actual working hours may differ due to rising age-earning profiles adopted by employers to reduce the incentive to shirk under mandatory retirement (Lazear, 1981; Lang, 1989). My model differs from these papers in that neither preference heterogeneity nor screening plays a role in the model. Rather, working hours may be either shorter or longer than employees prefer, the difference arising from the fact that while working hours are subject to a complete contract, work itself is not and the employer's profit-maximizing labor discipline strategy is constrained by the employees' incentive compatibility constraint, not by the employees participation constraint. The model is further developed and empirically tested using a century-long data set for ten OECD countries in the related paper, Oh, Park, and Bowles (2012).

In the next section I model the conflict over working hours, stipulating conditions under which workers will prefer shorter hours than those selected by a profit-maximizing employer. Section 3 describes conditions under which increases in the incomes of the rich will increase equilibrium working hours. In section 4, I study the effects of government interventions on working hours.

1.2 Conflict over Working Hours

1.2.1 Workers

Workers derive utilities from consumption and leisure, but experience disutility from exerting effort. When employed, a worker spends h hours working at a wage rate w per hour, exerting per hour effort e. Individuals do not save, so the individual's own consumption is just income, wh. To model the effect of the conspicuous consumption of an individual's top-income reference group, I define effective consumption, x, as an individual's own consumption level minus the invidious consumption effect, namely a constant v (for Veblen) times the consumption level of the reference group(\hat{c}); $x = wh - v\hat{c}$. This form captures the fact that invidious comparisons with wealthier individuals both reduce one's own utility and raise the marginal utility of own consumption. I assume that the utility function is separable and additive. The utility of effective consumption in a given time period takes the following form;

$$C(x) = \frac{1}{1-\rho}(x^{1-\rho} - 1),$$

where the parameter ρ measures the rate at which the marginal utility of effective consumption diminishes. Workers' utility of the leisure l is L(l), where l = 1 - h, the time endowments are normalized to 1, and L is increasing and concave in its argument. Workers' disutility of work effort is increasing and convex in the total effort expended, g(eh). I assume for simplicity that workers provide either e = 0or e = 1. When employees shirk(e = 0), they do not experience disutility of work effort, g(0) = 0. When unemployed, a worker receives an unemployment benefit, b, so the effective consumption of the unemployed is $b - v\hat{c}$. The unemployed benefit is less than the income of the employed, wh > b, over the relevant ranges of wand h. Thus, I have following instantaneous utility functions for the non shirking employees (U^N) , the shirking employees (U^S) , and the unemployed (U^U) .

$$U^{N}(w,h;\hat{c}) = C(wh - v\hat{c}) + L(1-h) - g(h)$$
$$U^{S}(w,h;\hat{c}) = C(wh - v\hat{c}) + L(1-h)$$
$$U^{U}(\hat{c}) = C(b - v\hat{c}) + L(1)$$

The employee will choose not to shirk if the utility from shirking is no greater than the utility from not shirking. I derive the no-shirking condition(NSC) following Shapiro and Stiglitz (1984). The present value of the job for an employed shirker (V^N) , employed non-shirker (V^S) , and the present value of the unemployed (V^U) are

$$V^{N} = U^{N} + \frac{qV^{U} + (1-q)V^{N}}{1+r} \qquad \Leftrightarrow V^{N} = \frac{(1+r)U^{N} + qV^{U}}{r+q} \qquad (1.1)$$

$$V^{S} = U^{S} + \frac{(q+t)V^{U} + (1-q-t)V^{S}}{1+r} \Leftrightarrow V^{S} = \frac{(1+r)U^{S} + (q+t)V^{U}}{r+q+t}$$
(1.2)

$$V^{U} = U^{U} + \frac{\lambda V + (1 - \lambda)V^{U}}{1 + r} \qquad \Leftrightarrow V^{U} = \frac{(1 + r)U^{U} + \lambda V}{r + \lambda} \qquad (1.3)$$

where V is the expected utility of an employed worker, which equals V^N at the equilibrium. By solving (1.1) and (1.3), I get

$$\frac{r}{1+r}V^U = \frac{\lambda U^N + (r+q)U^U}{\lambda + r + q}$$
(1.4)

$$\frac{r}{1+r}V^N = \frac{(\lambda+r)U^N + qU^U}{\lambda+r+q}$$
(1.5)

The worker will choose not to shirk if $V^N \ge V^S$. Substituting (1.3) into (1.1) and (1.2), I get the no shirking condition,

$$\frac{U^N - U^U}{r + \lambda + q} \ge \frac{U^S - U^N}{t},\tag{1.6}$$

where $U^N - U^U = C(wh - v\hat{c}) + L(1 - h) - g(h) - C(b - v\hat{c}) - L(1)$; $U^S - U^N = g(h)$; q is the probability of per period job separation either by exogenous factors or retirement; λ is the per period job acquisition rate; and r denotes the per period discount rate. Employers can detect and dismiss shirkers with termination probability t, which is linear in working hours $(t = \tau h)$, where τ is a positive constant given by the nature of the production process. The left-hand side of (1.6) is the present value of the job rent, that is, the benefit of not shirking; the righthand side is the expected benefit of shirking, namely the per period utility gain from shirking on the job multiplied by the expected duration of a shirker's employment $(\frac{1}{t})$. Another expression of (1.6) in terms of per period job rent is

$$U^N - U^U \ge (r + \lambda + q) \frac{U^S - U^N}{t}$$

$$(1.7)$$

The right hand side of (1.7) is the minimum per period job rent sufficient to deter shirking, which is the expected benefit of shirking $\left(\frac{U^S-U^N}{t}\right)$ multiplied by the discount factor. I call the right hand side of (1.7) simply the expected benefit of shirking and denote it by $\eta(h)$, i.e. $\eta(h) := (r + \lambda + q)\frac{g(h)}{t(h)}$, where $g(h) = U^S - U^N$. Solving (1.7) as an equality for the wage, I get the no-shirking wage as a function of h and \hat{c} : $\tilde{w} = \tilde{w}(h, \hat{c})$. I call \tilde{w}_h the employer's marginal wage cost of increasing working hours.

1.2.2 The Firm

I assume that there is a large number of firms in the economy. An employer varies working hours, the number of workers, and the wage rate to maximize profits subject to a no shirking condition (NSC). Hiring shirking workers is not profitable (output is zero when an individual shirks). Thus, the firm's production function is f(nh), where f' > 0, f'' < 0. There is a positive employment cost (k) to employ a worker, independent of the number of hours, which consists of search, training, and related costs that do not vary with hours. Firm's profit maximization problem can be written as:

$$\max_{w,n,h} f(nh) - n(wh+k)$$

s.t. $w \ge \tilde{w}(h)$

Let (n^*, h^*) be the interior equilibrium that satisfies the following first order conditions.

$$\pi_n = h f' - (\tilde{w}h + k) = 0$$

$$\pi_h = n f' - n(\tilde{w}_h h + \tilde{w}) = 0$$

where $\pi(n,h) = f(nh) - n(\tilde{w}(h)h + k)$ and subscripts denote partial derivatives. From these two first order conditions, I find

$$\tilde{w}_h h = \frac{k}{h} \tag{1.8}$$

The employer offers the equilibrium hours h^* such that the marginal effect on the wage bill of increasing hours (the left hand side of (1.8)) is equal to the average (employment) cost per hour (the right hand side of (1.8)).

Figure 1 illustrates the profit-maximizing choice of working hours by the employer given by the tangency of the iso-profit locus to the no shirking condition. I also see that when k = 0, the slope of the NSC and the slope of the iso-profit function are zero, while they are positive when k > 0.

I now determine \tilde{w}_h the marginal wage cost of increasing working hours (namely, the slope of the NSC in Figure 1). By differentiating (1.7) with respect to h, I get

$$C'(\tilde{w} + h\tilde{w}_h) - L' - g' = \eta' \tag{1.9}$$

where $\eta'(h) = (\frac{r+\lambda+q}{t})(g'-\frac{t'}{t}g)$ is the marginal effect of an increase in hours on the expected benefit of shirking (namely the increased marginal disutility of providing effort minus the effect of greater hours on the probability of termination). The



Figure 1. The employer's profit-maximizing choice of working hours subject to the NSC. The slope of the tangent line between the NSC and the iso-profit function is zero when k = 0 and positive when k > 0.

terms on the left hand side of (1.9) give the effects of an increase in working hours on the per period job rent by raising income and so utilities of consumption $(C'(\tilde{w}+h\tilde{w}_h))$, reducing worker's leisure (-L'), and increasing the disutility of effort (-g') respectively. By rearranging (1.9), I get the expression of \tilde{w}_h as follows.

$$\tilde{w}_h = -\frac{\tilde{w}C' - L' - g'}{hC'} + \frac{\eta'}{hC'}$$
(1.10)

The first term on the right hand side is the marginal rate of substitution between hours and wages on the employees' indifference locus $\left(-\frac{V_h^N}{V_w^N} = -\frac{\tilde{w}C'-L'-g'}{hC'}\right)$. Note that $\eta'(h)$ in the second term is positive for all h because I have $g' > \frac{t'}{t}g = \frac{g}{h}$ from the assumptions, $\frac{t'}{t} = \frac{1}{h}$ and g(0) = 0, g'' > 0. Therefore, the NSC is always "steeper" than the employee's indifference locus. Intuitively, the marginal effect on no shirking wage of an increase in working hours (\tilde{w}_h) will depend on two required compensations: to make no-shirking workers indifferent $\left(-\frac{\tilde{w}C'-L'-g'}{hC'}\right)$, and to offset the induced incentive to shirk because of the prolonged working hours $\left(\frac{\eta'}{hC'}\right)$.

I now explore the conditions under which employees would prefer to work longer

or shorter hours than h^* .

1.2.3 Conflict over Working Hours

Employers have an interest in providing hours that employees prefer because by doing so, they enhance the present value of the job rent and thereby reduce the noshirking wage. But here are two sources of conflict over working hours. To produce the same output, shorter hours require paying the fixed employment cost (k) for more employees, so the interests of the employer and employee are not perfectly aligned when k > 0. Employer and employee interests diverge in a second way; one that may offset the first. Variations in hours affect the expected benefits of shirking $(\eta'(h)$ in equation (1.10)). This effect is positive (the effect of greater hours on the marginal disutility of not shirking exceeding the effect on the likelihood that a shirker will be detected), so it provides a motive for the employer to offer fewer hours than the employee would prefer. When expected-benefits-of-shirking effect exceeds the employment-cost effect, workers will prefer more hours than employers provide.

Since it is profitable for the employer to hire non-shirking employees, he offers no-shirking wage and the employed workers will not shirk, so I derive workers' optimal hours for non-shirking employees. Suppose that for some arbitrary wage, workers were to choose working hours: they would maximize the present value of the job, $V^N = \frac{(\lambda+r)U^N+qU^U}{r(\lambda+r+q)}$, by choosing the optimal hours. Let $h^o = h^o(w)$ be the worker's optimal working hours determined by equating the marginal utility of the increased consumption made possible by greater hours to the disutility of lost leisure and increased on the job effort, or

$$U_h^N(w, h^o(w)) = wC' - L' - g' = 0, \text{ for a given } w$$
(1.11)

It is easy to check that h^o is a local maximum, satisfying the second order condition, $U_{hh}^N = (w^2 C'' + L'' - g'') < 0$, because C'' < 0, $L'' \le 0$, and g'' > 0. When U_h^N is evaluated at the equilibrium (no shirking) wage and workers' optimal hours, I have $U_h^N(w^*, h^o(w^*)) = 0$. If I evaluate U_h^N at the equilibrium hours and wages (w^*, h^*) , there are three possibilities: $U_h^N(w^*, h^*) < 0$, $U_h^N(w^*, h^*) > 0$, or $U_h^N(w^*, h^*) = 0$. The sign of $U_h^N(w^*, h^*)$ determines whether workers prefer longer $(U_h^N(w^*, h^*) > 0)$ or shorter $(U_h^N(w^*, h^*) < 0)$ hours than h^* . If $U_h^N(w^*, h^*) < 0$, then $U_h^N(w^*, h^*) < U_h^N(w^*, h^o(w^*)) = 0$, thus, workers will prefer shorter hours than the equilibrium hours, $h^* > h^o$, because the marginal utility is decreasing in h $(U_{hh}^N < 0)$ given a wage.

I now show that whether the workers' optimal working hours are equal to, shorter, or longer than that the employer offers will be determined by the size of the fixed employment cost, k, and the size of the effect of hours on the expected benefits of shirking $(\eta'(h))$. By substituting (1.10) into (1.8), I get the employer's equilibrium condition from which h^* is determined:

$$k = h^2 \tilde{w}_h = -\frac{h}{C'} (\tilde{w}C' - L' - g') + \underbrace{\frac{h}{C'} \eta'}_{(+)}$$
(1.12)

If I evaluate the term $(\tilde{w}C' - L' - g')$ at the equilibrium hours and wage (h^*, w^*) , it is the same as $U_h^N(w^*, h^*)$. When k = 0, the term should be positive because $\eta'(h) > 0$ for all h. Then the marginal rate of substitution of between hours and wages on the employees' indifference locus $\left(-\frac{\tilde{w}C' - L' - g'}{hC'}\right)$ will be negative at (h^*, w^*) . Panel A in Figure 2 shows workers' indifference loci \bar{V}^N that go through $(w^*, h^o(w^*))$ and (w^*, h^*) when k = 0. The slope of \bar{V}^N at workers' optimal hours is zero, while it is negative at the equilibrium. Thus, the workers' optimal hours are longer than h^* . Panel B shows the case of positive k. If $k = \frac{h}{C'}\eta'$ at the equilibrium, then from (1.12), $(\tilde{w}C' - L' - g')$ will be zero, so workers' optimal hours and the equilibrium hours at the wage w^* will coincide. I denote k^o the corresponding fixed cost. Finally, if $k > \frac{h}{C'}\eta'$, the term $(\tilde{w}C' - L' - g')$ will be negative $(U_h^N(w^*, h^*) < 0)$, so the slope of \bar{V}^N at the equilibrium is positive. This implies workers prefer shorter hours than h^* , as shown in Panel C in Figure 2.



Figure 2. Optimal hours for employers and employees for various k

The economic intuition is the following. The difference between workers' and

employer's optimal choices of h comes from the employment cost and the effect of h on the benefit of shirking, $\eta'(h)$. If there is no employment cost, the fact that an increase in h raises the benefit of shirking and therefore requires a higher no shirking wage will induce the employer to offer shorter working hours than workers prefer (Panel A in Figure 2). However, if the employment cost is greater than the effect on the benefit of shirking it will be profitable for the employer to hire fewer workers with longer hours than the hours preferred by employees at the no shirking wage. I record this observation as Proposition 1.2.1.

Proposition 1.2.1 (Conflict over hours) If $k > \frac{h^*}{C'}\eta'$ $(k < \frac{h^*}{C'}\eta')$ at the equilibrium, the employer selects longer (shorter) working hours than workers prefer.

It is noteworthy that the equilibrium hours of work and wage will be Pareto inefficient even in the case (Panel B in Figure 2) where there is no conflict over working hours. This result follows directly from the fact that the employer maximizes profits subject to the no shirking condition – an incentive compatibility constraint based on the employee's best response – rather than the employee's participation constraint. The economic intuition is clear from Panel B in Figure 2, where the shaded lens indicates the set of Pareto improvements over $\{h^*, w^*\}$. Here I illustrate Pareto inefficiency. Let $(w, h) = (h^* + \Delta h, w^* + \Delta w)$ be a pair of wages and hours near the equilibrium (h^*, w^*) with sufficiently small $(\Delta h, \Delta w)$ such that $-\frac{V_h^N}{V_w^N}(h^*, w^*) < \frac{\Delta w}{\Delta h} < \tilde{w}_h(h^*)$, then both workers and the employer can be better off by the small increases in h and w. First, I evaluate V^N at $(h^* + \Delta h, w^* + \Delta w)$, then

$$\begin{aligned} V^N(h^* + \Delta h, w^* + \Delta w) &\simeq V^N(h^*, w^*) + V^N_w \Delta w + V^N_h \Delta h \\ &> V^N(h^*, w^*) + V^N_w (-\frac{V^N_h}{V^N_w} \Delta h) + V^N_h \Delta h \\ &= V^N(h^*, w^*) \end{aligned}$$

Second, I evaluate the iso-profit function, $\bar{\pi}(n, h, w) = f(nh) - n(wh+k)$ at $(n^*, h^* + \Delta h, w^* + \Delta w)$, then I have

$$\bar{\pi}(n^*, h^* + \Delta h, w^* + \Delta w) \simeq \bar{\pi}(n^*, h^*, w^*) + \bar{\pi}_w \Delta w + \bar{\pi}_h \Delta h$$

$$> \bar{\pi}(n^*, h^*, w^*) + \bar{\pi}_w \Delta w + \bar{\pi}_h \frac{\Delta w}{\tilde{w}_h}$$

$$= \bar{\pi}(n^*, h^*, w^*) + (\bar{\pi}_w \tilde{w}_h + \bar{\pi}_h) \frac{\Delta w}{\tilde{w}_h}$$

$$= \bar{\pi}(n^*, h^*, w^*)$$

The last equality holds because from the employer's first order condition I have $\pi_h(n^*, h^*) = \bar{\pi}_w \tilde{w}_h + \bar{\pi}_h = 0$. Thus, both workers and the employer are better off.

Implementation of the increase in wages and hours that would carry out the Pareto improvements as a Nash equilibrium, however, is impossible, because the small change in $(\Delta h, \Delta w)$ satisfying $\frac{\Delta w}{\Delta h} < \tilde{w}_h(h^*)$ violates the NSC.

1.3 The Veblen Effect

The conflict over working hours (Proposition 1.2.1) occurs because on the margin the firm evaluates the hours-wages trade off differently from workers. By contrast, the Veblen effect on working hours occurs because the firm responds to the change in workers' preferences that result from an increase in consumption by a rich reference group (\hat{c}) , which alters the workers' wages-hours trade off, inducing them to prefer more hours. To see this I begin with the effect of \hat{c} on worker's optimal working hours from (1.11):

$$h_{\hat{c}}^{o} = \frac{wvC''}{w^{2}C'' + L'' - g''} > 0$$

Thus, the increase in the consumption of the top reference group induces workers to desire longer working hours. Now I perform the comparative statics of the changes in \hat{c} on the equilibrium working hours, which I call Veblen effect. No shirking wage is now a function of h and \hat{c} ; $\tilde{w} = \tilde{w}(h, \hat{c})$. Applying Cramer's rule and the implicit function theorem, I get

$$\frac{dh^*}{d\hat{c}} = \frac{\pi_{nh}\pi_{n\hat{c}} - \pi_{nn}\pi_{h\hat{c}}}{|H|}$$
(1.13)

$$\frac{dn^{*}}{d\hat{c}} = \frac{\pi_{nh}\pi_{h\hat{c}} - \pi_{hh}\pi_{n\hat{c}}}{|H|}$$
(1.14)

where |H| is the determinant of the Hessian matrix. The Hessian matrix is given as:

$$H = \left(\begin{array}{cc} \pi_{nn} & \pi_{nh} \\ \\ \pi_{hn} & \pi_{hh} \end{array}\right)$$

where the second derivatives are

$$\pi_{nn} = f''h^{2}$$

$$\pi_{nh} = f''nh + f' - (\tilde{w} + h\tilde{w}_{h}) = f''nh \qquad (1.15)$$

$$\pi_{hh} = f''n^{2} - n(2\tilde{w}_{h} + h \tilde{w}_{hh})$$

The second equation in (1.15) holds because $\pi_h = f'n - n(\tilde{w} + h\tilde{w}_h) = 0$. For h^* to be the strict maximum of the profit function, the Hessian matrix must be negative definite. I have $\pi_{nn} < 0$, and |H| is

$$|H| = \begin{vmatrix} \pi_{nn} & \pi_{nh} \\ \pi_{hn} & \pi_{hh} \end{vmatrix} = \pi_{nn}\pi_{hh} - \pi_{nh}^2 > 0$$
$$= -f''nh^2(2\tilde{w}_h + h \ \tilde{w}_{hh})$$

Since f'' < 0, the sufficient condition for the maximum is $2\tilde{w}_h + h \tilde{w}_{hh} > 0$. I have

$$\pi_{n\hat{c}} = -h\tilde{w}_{\hat{c}}$$
$$\pi_{h\hat{c}} = -n(\tilde{w}_{\hat{c}} + h\tilde{w}_{h\hat{c}})$$

Thus, from (1.15) and (1.13), the effect of an increase in \hat{c} on the equilibrium h^* is

$$\frac{dh^*}{d\hat{c}} = \frac{-f''nh^2\tilde{w}_{\hat{c}} + f''nh^2(\tilde{w}_{\hat{c}} + h\tilde{w}_{h\hat{c}})}{|H|} = \frac{f''nh^3\tilde{w}_{h\hat{c}}}{|H|}$$
(1.16)

where the denominator, $|H| = -f'' n h^2 (2\tilde{w}_h + h \ \tilde{w}_{hh})$, is positive for a maximum profit.

Before I find $\tilde{w}_{h\hat{c}}$, I need to calculate $\tilde{w}_{\hat{c}}$. From the NSC, I get

$$\tilde{w}_{\hat{c}} = \frac{v}{hC'}(C' - C'_U) < 0 \tag{1.17}$$

where C'_U is the unemployed workers' marginal utility of consumption evaluated at $b - v\tilde{c}$; i.e. $C'_U = C'(b - v\hat{c})$. I have $\tilde{w}_{\hat{c}} < 0$, because the marginal utility of effective consumption of the unemployed is greater than that of the employed ($C' < C'_U$ because $wh - v\tilde{c} > b - v\tilde{c}$ and C'' < 0), so the increase in \hat{c} raises the value of the

employment rent $(U^N - U^U)$, while the increase in \hat{c} has no effect on the expected benefit of shirking $(\eta(h))$. Thus, the employer can induce effort with a lower wage than before.

I then find $w_{h\hat{c}}$ using (1.10) and (1.17):

$$\tilde{w}_{h\hat{c}} = -\frac{C''(h \ \tilde{w}_{\hat{c}} - v)}{hC'^2} \underbrace{\{-(\tilde{w}C' - L' - g') + \eta'\}}_{(+)} - \frac{1}{hC'} \{\tilde{w}_{\hat{c}}C' + \tilde{w}C''(h \ \tilde{w}_{\hat{c}} - v)\}$$

$$(1.18)$$

Proposition 1.3.1 provides an intuitive sufficient condition under which the increase in the consumption of the top reference group lowers the marginal wage cost of increasing working hours, so the employer offers longer working hours.

Proposition 1.3.1 (Veblen effect) If $\rho > \frac{w^*h^* - v\hat{c}}{w^*h^*}$, then the increase in \hat{c} raises the equilibrium working hours.

Proof. From the assumption, I have

$$-\frac{C''}{C'}(w^*h^*-v\hat{c})=\rho>\frac{w^*h^*-v\hat{c}}{w^*h^*}$$

Then $C' + w^*h^*C'' < 0$, and $(C' + w^*h^*C'')\tilde{w}_{\hat{c}} - vw^*C'' > 0$, so the second term in (1.18) is negative. I know that the term $-(\tilde{w}C' - L' - g') + \eta'$ is positive from (1.10) because I have $\tilde{w}_h > 0$. So, the first term on the right hand side of (1.18) is negative because C'' < 0 and $\tilde{w}_{\hat{c}} < 0$. Therefore, I have $\tilde{w}_{h\hat{c}} < 0$, and I conclude $\frac{dh^*}{d\hat{c}} > 0$ from equation (1.16)

I illustrate the Veblen effect in Figure 3. For any given h, an increase in the income of the top reference group lowers the no-shirking wage ($\tilde{w}_{\hat{c}} < 0$) and lowers the cost of increasing hours ($\tilde{w}_{h\hat{c}} < 0$), which rotates the $\tilde{w}(h, \hat{c}_1)$ clockwise to $\tilde{w}(h, \hat{c}_2)$. Thus, equilibrium working hours are longer.



Figure 3. The Veblen effect (increase in \hat{c}) This figure illustrates the effect of an increase in \hat{c} ($\hat{c}_1 < \hat{c}_2$) on the equilibrium working hours. The equilibrium h_1^* and h_2^* correspond to \hat{c}_1 and \hat{c}_2 respectively.

Intuitively, if the increase in \hat{c} lowers \tilde{w}_h (the marginal cost of increasing h), then given the concavity of the production function, the firm in response will raise working hours to satisfy the first order condition. This gives us the Veblen effect. The increase in \hat{c} lowers \tilde{w}_h because i) it lowers effective consumption, and so raises C' since I have C'' < 0, ii) raises the job rent, so the firm can lower the wage, which I already showed, namely $\tilde{w}_{\hat{c}} < 0$. However, the increase in \hat{c} also has an offsetting effect on \tilde{w}_h because the lowered wage weakens the income effect of h that enables the employer to reduce the no-shirking wage. The first effect inducing the employer to offer longer working hours will dominate the second effect if workers' C'' is large relative to C' in absolute value. Note that the condition $\rho > \frac{w^*h^*-v\hat{c}}{w^*h^*}$ does not require an implausible level of concavity of the workers' utility function; a logarithmic function ($\rho \to 1$) satisfies the condition for example, and for a substantial Veblen effect considerably less concave functions do as well.

1.4 Policies to Limit Working Hours

The working hours observed in any economy are determined in part by the competitive and non-cooperative interactions of workers and employers, as I have modeled them above. But working hours are typically also influenced by collective action by workers, their employers and governments. If employers offer longer hours than the working hours desired by employees, trade unions and political parties representing workers may advocate government interventions to reduce working hours. I consider two kinds of interventions: direct interventions, in which a national trade union or the government simply imposes the maximum working time; and indirect interventions, in which the government adopts policies to affect the employers' choice of working hours.

1.4.1 Direct Limits on Working Hours

Political representation of workers may advocate government interventions to impose maximum working hours, preserving the equilibrium wage and compensating the profit loss by reducing the fixed cost of employment with subsidy. The direct intervention of legal hours restriction is a long-run policy, so I consider it in a general equilibrium model. Suppose a general equilibrium $(h^*, n^*, w^*, \lambda^*)$ in which the employer chooses h, n, w given fixed cost of employment k, and workers prefer shorter hours than offered by the employer given the equilibrium wage.

In a general equilibrium the job acquisition rate is endogenously determined, so I first endogenize λ . Let N be the total number of workers (both employed and unemployed), and m be aggregate employment, which is m = Mn, where M is the number of firms and n is the number of employees of each identical firm. The number of firms will be determined by the zero profit condition (ZPC). In a steady state the flow into the unemployment pool is equal to the flow out, $qm = \lambda(N-m)$, so $\lambda = \frac{qm}{N-m}$. Now the NSC has two endogenous variables, h and λ .

$$U^N - U^U \ge (r + \lambda + q) \frac{U^S - U^N}{t} \Leftrightarrow w \ge \hat{w}(h, \lambda)$$

I have $\hat{w}_{\lambda} = \frac{1}{hC'} \frac{g}{t} > 0$, and $\frac{d\lambda}{dm} > 0$, so the increase in aggregate employment raises the no shirking wage, $\hat{w}_m = \hat{w}_{\lambda} \frac{d\lambda}{dm} > 0$.

Unlike individual workers, who take the wage as given and just think about whether fewer or more hours at that wage would be nice, I assume that the union knows that i) the job acquisition rate λ is influenced by the total number of employees, and ii) the no shirking wage is affected by h and λ . The union cares about both employed and unemployed workers, so I derive the union's utility, denoted by V^T , as the normalized sum of all workers' utilities:

$$V^T = \frac{m}{N}V^N + \frac{N-m}{N}V^U$$

where $\frac{m}{N}$ is the ratio of employed to total workers. Trade unions may value expanding employment more highly than this "sum of worker utility" approach possibly because they would like to increase membership or have pro-poor distributional values (Alesina, Algan, Cahuc, and Giuliano, 2010). But I adopt this formulation here for simplicity, and because it could arguably be the objective function of a social planner maximizing social welfare. From the equation $\lambda = \frac{qm}{N-m}$, I get $\frac{m}{N} = \frac{\lambda}{\lambda+q}$ and $\frac{N-m}{N} = \frac{q}{\lambda+q}$, I can simplify V^T further as follows:

$$V^T = \frac{1+r}{r} \frac{\lambda U^N + q U^U}{\lambda + q}$$

The job acquisition rate positively affects the union's utility, $V_{\lambda}^{T} = \frac{1+r}{r} \frac{q(U^{N}-U^{U})}{(\lambda+q)^{2}} >$

0, so the union prefers high aggregate employment, $V_m^T = V_\lambda^T \frac{d\lambda}{dm} > 0$. Note that the job acquisition rate negatively affects the employer's profit, $\pi_\lambda = -nh\hat{w}_\lambda < 0$, which implies $\pi_m < 0$. Thus, I can verify that the union and the employer are at conflict over aggregate employment.

Denote the maximum hour limit by $\hat{h}(< h^*)$ and the reduced fixed cost of employment which guarantees restoring the ZPC by \hat{k} . The employer will choose maximum hours \hat{h} because $\pi_h|_{h< h^*} > 0$, and the optimal number of workers by solving (1.19) given the fixed cost of employment, and government finally chooses \hat{k} from the ZPC. The new set of values $(\hat{h}, \hat{n}, w^*, \hat{k})$ satisfies the following two equations:

$$\pi_n = \hat{h}f' - \{w^*\hat{h} + \hat{k}\} = 0 \tag{1.19}$$

$$f(n^*h^*) - n^*(w^*h^* + k) = f(\hat{n}\hat{h}) - \bar{n}(w^*\hat{h} + \hat{k})$$
(1.20)

Note that the number of firms M does not change because the profits are restored; thus, if I have $\hat{n} > n^*$, then the job acquisition rate corresponding to \hat{h} is higher than before $(\hat{\lambda} > \lambda^*)$.

To determine the effect of the reduction in hours on the number of workers hired by a firm, I differentiate the firm's first order condition with respect to h given the wage (w^*) and the fixed cost (k):

$$\frac{dn}{dh} = -\frac{n}{h} - \frac{f' - \hat{w} - h\hat{w}_h}{h^2 f''}$$
(1.21)

The first term on the right hand side of (1.21) is the substitution effect: to produce the same amount as before with fewer hours the firm needs more workers (this is substitution along a given iso-quant). The second term is offsetting the substitution effect because the firm may produce less output due to the reduced profit by the reduction in h. Since $f' - w = \frac{k}{h} > 0$ for any positive k, I need the condition, $f' + nhf'' < w^*$ to have $\frac{dn}{dh} < 0$. Let $f(x) = x^{\beta}$, $0 < \beta < 1$, be the production function (or revenue). Then the condition for $\frac{dn}{dh} < 0$ is $\beta < \frac{w^*}{f'(nh)}$. Note that the condition can be expressed as $\beta^2(nh)^{\beta-1} < w^*$, and the term $\beta^2(nh)^{\beta-1}$ is increasing in β , so the employer hires more workers in response to the restriction on working hours, if the production function is sufficiently concave (low β). Thus, given the equilibrium wage and the fixed cost, the reduction function is sufficiently concave. If government compensates firms by lowering the fixed cost of employment to restore the profit as the same as previous equilibrium, then the number of workers of each firm will be even larger.

Proposition 1.4.1 In a competitive market equilibrium in which employees prefer shorter working hours than offered by employers, the policy imposing the maximum hours accompanied with preserved wage and compensation on the profit loss by reducing the fixed cost of employment makes the union better off while leaving employers indifferent, if the production function is sufficiently concave such that $\beta < \frac{w^*}{f'(\hat{n}\hat{h})}$ at the new policy equilibrium.

Proof. Since the ZPC holds for both cases, employers are indifferent under the policy. I compare union's utilities under the two equilibria. From the condition $\beta < \frac{w^*}{f'(\hat{n}\hat{h})}$, I know that $\hat{n} > n^*$ and $\hat{\lambda} > \lambda^*$. Since the equilibrium wage is the same, I rewrite union's utility as follows;

$$V^{T}(h,\lambda) = \frac{1+r}{r} \{ \frac{\lambda}{\lambda+q} U^{N}(w^{*},h) + \frac{q}{\lambda+q} U^{U} \}$$

I know that $V_{\lambda}^{T} > 0$, and $V_{h}^{T}|_{(w^{*},h^{*})} = \frac{1+r}{r} \frac{\lambda}{\lambda+q} \frac{dU^{N}}{dh} < 0$ because $\frac{dU^{N}}{dh}(w^{*},h^{*}) < 0$. The maximum hours \hat{h} shorter than h^{*} (but no shorter than individual workers' optimal) will increase union's utility. The union is better off in the new equilibrium than the laissez-faire one: $V^{T}(\hat{h}, \hat{\lambda}) > V^{T}(h^{*}, \lambda^{*})$.

1.4.2 Indirect Policies to Limit Working Hours

Other policies may affect working hours by altering the conditions under which the employer chooses working hours. I introduce two policies: an employment subsidy that lowers the fixed cost of hiring; an increase in the unemployment benefit which raises workers' fallback and no shirking wage. I assume that these are shortrun policies so I consider λ an exogenous variable and I do not study financing these programs.

First, I consider the employment subsidy policy whereby the firm receives an amount s > 0 for each employee. The employer's profit maximization problem becomes:

$$\max_{w,n,h} \pi = f(nh) - n(wh + k - s)$$

s.t. $w \ge \tilde{w}(h)$

From the two first order conditions, I get the equilibrium condition analogous to (1.8):

$$\tilde{w}_h h = \frac{k-s}{h} \tag{1.22}$$

The result is clear if I compare (1.8) and (1.22). The employment subsidy lowers the marginal cost of employment and raises the relative cost of increasing working hours, as a result, the employer will offer shorter working hours. Second, I study the effect of an increase in unemployment benefit. Now the no-shirking wage is a function of h and b, $\tilde{w} = \tilde{w}(h, b)$. Using the result of (1.16), I have

$$\frac{dh^*}{db} = \frac{f''nh^3\tilde{w}_{hb}}{|H|} \tag{1.23}$$

By differentiating the NSC and \tilde{w}_h with respect to b, I get

$$\tilde{w}_b = \frac{C'_U}{hC'} > 0 \tag{1.24}$$

$$\tilde{w}_{hb}(h,b) = -\frac{C''\tilde{w}_b}{C'^2} \underbrace{\{-(\tilde{w}C' - L' - g') + \eta'\}}_{(+)} - \frac{\hat{w}_b}{hC'}(C' + whC'') \quad (1.25)$$

An increase in unemployment benefits will (under the stated conditions) decrease the job rent (equation (1.24)), and raise the cost of increasing hours of work (equation (1.25)), so the employer offers shorter working hours. This result is the opposite of the displacement of the NSC shown in Figure 3. An increase in the unemployment benefit shifts up the NSC because the job rent decreases, so the employer needs to pay a higher no-shirking wage. In addition, it also increases the slope of the no shirking wage function, as a result, it reduces the equilibrium hours. Proposition 1.4.2 summarizes the effects of both policies.

Proposition 1.4.2 (Public policy effects) Equilibrium working hours are reduced by the following policies:

- *i*) an employment subsidy
- ii) an increase in unemployment benefit conditional on $\rho > \frac{w^*h^* v\hat{c}}{w^*h^*}$

Proof. i) Employment subsidy

Let (n^*, h^*) be the interior equilibrium and it satisfies the following first order
conditions

$$\pi_n = f'h - (\tilde{w}h + (k - s)) = 0$$

$$\pi_h = f'n - n(\tilde{w} + h \ \tilde{w}_h) = 0$$

The second derivatives are

$$\pi_{hs} = 0, \ \pi_{ns} = 1$$

Again from (1.15) and (1.13) I have

$$\frac{dh^*}{ds} = \frac{f''nh}{|H|} < 0$$

ii) Unemployment benefit

Since $\tilde{w}_b > 0$, C'' < 0, and $-(\tilde{w}C' - L' - g') + \eta' > 0$, the first term in (1.25) is positive. I have $C' + w^*h^*C'' < 0$ for $\rho > \frac{w^*h^* - v\hat{c}}{w^*h^*}$, then the second term of (1.25) is also positive, therefore $\tilde{w}_{hb}(h^*, b) > 0$. From (1.23) I have $\frac{dh^*}{db} < 0$.

1.5 Conclusion

I have provided a new model of equilibrium working hours selected by a profitmaximizing employer who also selects a wage rate to satisfy a no-shirking condition. Unlike the standard model of labor supply in which employees face a parametric wage and trades-off between leisure and goods to maximize utility, here the employees' leisure-labor trade-offs affect hours indirectly by altering the cost to the employer of satisfying a labor discipline condition necessitated by the incomplete nature of the employment contract.

In addition to institutional realism – the employer, not the worker, chooses the

hours offer – there are attractive features to the model. First, by embedding it in a principal agent model, I extend the analysis of the comparison-based utility that produces Veblen effects when employees seek to emulate the consumption standards of the rich. Second, I provide a model – the first to my knowledge – of one of the most important social conflicts from the beginning of the Industrial Revolution until the Great Depression: the opposing interests of workers and their employers concerning the length of the working day. Third, I identify conditions in this setting under which employees would prefer to work longer (as well as less) than the hours selected by the employer. Fourth, I show that improvements in the employees' fallback position, which occurred in part through the expansion of the welfare state in the countries under study, will reduce equilibrium working hours. Finally and perhaps surprisingly, I can show that the equilibrium hours resulting from the interaction of the profit-maximizing employer and the utility maximizing employee are Pareto inefficient even if the equilibrium hours selected by the employer do not differ from those that maximize the present value of employee utility.

The results of the model are consistent with the following explanation of the deceleration or even reversal of the fall in working hours during the last quarter of the past century. As equilibrium hours approached those preferred by workers, further reductions in working hours dropped in importance on the agendas of the organizations and parties representing workers; moreover, the increase in top income shares (in some countries) led employees to place a higher value on longer hours.

CHAPTER 2

THE EVOLUTION OF GENDER NORMS, DIVISION OF LABOR AND FERTILITY

2.1 Introduction

During the 20th century the total fertility rate declined substantially in many countries as women's participation in the labor force increased. In the final decades of that century, however, fertility trends stabilized in some countries, revealing a new pattern of positive correlation between fertility and female labor force participation. Israel, Sweden, the U.S., and Norway, countries with relatively high levels of female participation in paid employment also have relatively high fertility rates (at or slightly above replacement levels). By contrast, Japan, Spain, and Italy with relatively low levels of female participation, have relatively low fertility rates (well below replacement levels) (Feyrer, Sacerdote, and Dora, 2008). This recent trend seems inconsistent with conventional economic approaches (Mincer, 1963; Becker, 1965; Willis, 1973) that explain fertility decline as a result of increasing opportunity costs of childrearing, predicting a negative correlation between fertility and women's labor force participation.

Fertility rates have declined particularly rapidly in Asia, from 5.3 children per woman in the late 1960s to 1.6 now. In Asian countries with the lowest marriage rates, the fertility rate is even lower, close to 1.0 (The Economist, August 2011). Below-replacement fertility rates result from both low marital fertility and nonmarriage and/or delayed marriage. Strong traditional gender roles in those countries make it difficult for married women to both engage in paid employment and fulfill responsibilities for family care. Yet, despite low levels of paid employment, married women seem reluctant to have large numbers of children.

In this essay I suggest that the asymmetric evolution of gender norms between men and women could contribute to very low fertility, providing an explanation for the positive relation between fertility and women's labor force participation. I consider two gender norms: a traditional "separate spheres" norm and an egalitarian "shared care" norm. The "separate spheres" norm dictates traditional gender roles in which men specialize in both wage employment and the public sphere whereas women specialize in family care and the private sphere. The "shared care" norm allows women to engage in market work, with men and women sharing the cost of household labor and childrearing.

In a standard model of the marriage market, potential spouses try to find the best possible match. But this does not necessarily imply that they are able to find matches with spouses who share norms and preferences regarding the division of labor. Unlike other factors determining sorting in the marriage market - such as wealth, education, and outward appearance - potential partners may be unable to accurately observe one another's norms, which are easily misrepresented. In addition, if gender norms evolve asymmetrically between men and women - for example, most men conform to traditional gender norms, while most women conform to more egalitarian norms – it could be hard to find a partner who shares the same norms. A person could decide to marry someone with different norms because it is better than not marrying at all. Non-marriage can also be viewed as a possible outcome

of the mismatched norm problem.

My approach differs from traditional economic theories of marriage in two ways. First, in contrast to Beckerian models, in which perfect specialization between men and women - corresponding to separate spheres norm - is considered efficient, I assume that marriage based on shared care norms can be more efficient in certain environments because diversification provides insurance against unemployment and strengthens paternal ties to children. Second, in contrast with the Coase Theorem, which assumes individuals can always implement efficient solutions through bargaining over redistribution, I emphasize bargaining rigidities that can lead to inefficient outcomes such as couples with mismatched preferences or a tendency to decline marriage.

I develop a model of the evolution of gender norms and fertility decisions in an asymmetric two-population game using evolutionary game theory. In the model, spouses are randomly matched regarding their norms. I refer to gender norms that have been "internalized" and have become in a sense a "preference". I define gender norms as informal governing rules that specify the division of labor: men decide whether to provide help on childrearing, while women decide whether to engage in market work. Fertility results from the choices that spouses make. If both husband and wife adhere to a separate spheres norm, then the wife will stay at home and tend to have high fertility. If both adhere to a shared care norm, the wife is likely to work and the husband provides help with childrearing. Her fertility will be lower than in the first case, due to the opportunity costs of childrearing, but intermediate levels will still be achieved. Among couples with mismatched norms, especially if husbands adhere to separate spheres norms but their wives have shared care norms, couples tend to have low fertility due to possible conflict over child care. Wives are likely to work whereas husbands do not provide help with childrearing. In this case wives will respond by lowering their fertility far below replacement levels because they are likely to suffer from "dual burden". If husbands adhere to shared care norms but their wives adhere to separate sphere norms, conflict could also arise over the wives' foregone market income (the husbands may want wives to contribute to the household with market income, while they themselves are willing to work fewer hours to be fathers). However, the conflict over child care, which is crucial in determining fertility, would be far less than with the other mismatched couples.

In the model, I consider women's market wage as an important economic factor that influences women's time allocation between market work and household work. Here women's market wage is considered as an expected wage which is determined by both women's wage level and job opportunity because high wages do not necessarily go along with high female employment. In developed countries where women's wages and opportunities for paid employment are sufficiently high, women adhering to shared care norms will have higher payoffs than women residing in less developed countries.

Individuals have a tendency to adopt a particular behavior prevalent in the population (Boyd and Richerson, 1985; Bowles, 2004). Boyd and Richerson (1985) define conformist transmission as a tendency to copy the most frequent behavior in the population. Akerlof and Kranton (2000) argue that violating a society's behavioral prescriptions evokes utility loss such as anxiety and discomfort. Similarly, the formation of an individual's gender norm is influenced by other agents' norms, especially those of the same sex. Most studies on norm evolution consider norms as average behavior and the conformist payoff is modeled as utility gain depending on how close their action approximates the social norm. Thus, the conformist payoffs depend on the frequency of agents adopting the behavior. However, specifying the

frequency of norms is insufficient to explain the transition of norms - the intensity of norms also matters. Even though the traditional "separate spheres" gender norm has weakened over time in many societies, including the U.S., it remains firmly entrenched in East Asian countries, especially Japan and South Korea. Thus, I consider the degree of conformity, which captures the extent to which individuals in a society attach themselves to a norm. The greater a society's conformity toward existing norms, the greater the resistance to a transition to new norms.

Gender norms concerning division of labor are readily tested empirically. The International Social Survey Programme (ISSP) Family and Changing Gender Roles survey includes specific questions on gender roles such as "A man's job is to earn money, a woman's job is to look after the home and family", and "What most women really want is a home and children". Analyzing such data, several recent studies attempt to explain international differences in fertility rates by investigating the relationships among gender inequality, the division of household labor, women's labor supply and fertility decisions. Using the ISSP Family and Changing Gender Roles survey, Laat and Sanz (2006) distinguish gender attitudes within households from average attitudes of a society. They show that households with less egalitarian attitudes tend to have more children in a country; however, countries with less egalitarian views tend to have low fertility because the average attitude plays a role as social externality. Using the same data, Feyrer, Sacerdote, and Dora (2008) also find a positive relation between men's household work and the total fertility rate, and between government family subsidies and fertility. Mills, Mencarini, Tanturri, and Begall (2008) compare gender equity and fertility decisions between Italy and Netherlands. They find that an unequal division of household labor is significantly associated with women's fertility intentions when those women already suffer from a "dual burden" or "second shift". This literature, however, does not explicitly explore the effect of asymmetric gender norms on fertility decisions.

Evolutionary approaches to family have mainly dealt with issues such as the degree of altruism corresponding to biological relatedness (Hamilton, 1964); parent-offspring conflict (Trivers, 1974); sibling rivalry; gender differences in reproductive cost which implies a conflict over quality/quantity trade-offs between males and females (Folbre, 2006); and son preferences (Edlund, 1999). However, few studies to date have paid attention to the evolution of gender norms. Iversen and Rosenbluth (2006) describe how different modes of production affect inter-gender bargaining power and the evolution of social norms, arguing that patriarchal social norms are the result of bargaining dynamics in labor-intensive agricultural societies. Some previous studies show the differences between patriarchal and egalitarian family contracts (Braunstein and Folbre, 2001; Geddes and Lueck, 2002; Folbre, 2006). By adding the insight that norms are internalized preferences that influence fertility decisions, this paper builds on existing studies by providing a formal model of the evolution of gender norms and emphasizing in particular the role of conformism.

To examine the evolutionary process of changes in gender norms, I employ evolutionary game theory in which norm updating is determined partly by the within-family payoffs based on each spouse's norm, and partly by the influence of social interactions among the same sex. First, I find evolutionary stable strategies of gender norms and corresponding fertility equilibrium in various economic environments. Then I examine how conformism alters the equilibrium. Second, I employ a stochastic evolutionary model to study equilibrium selection in the longrun. In contrast to static and deterministic evolutionary games, stochastic games have an advantage in selecting equilibrium. The model extends existing stochastic evolutionary game theory in that it studies joint dynamics of between groups and within group interactions for asymmetric two-population games. Section 2 provides the main model. In section 3 I apply the result of the model to fertility decisions. In section 4 I study equilibrium selection in the long run. Concluding remarks follow.

2.2 The Model

Suppose a society consists of N males and N females. For simplicity, I assume a constant gender ratio. There are two types of gender norms regarding the division of labor within family: a traditional separate spheres norm denoted by T and an egalitarian shared care norm by E. Each individual is endowed with a norm before marriage. When a male and a female are matched into a family, they choose strategies about how to divide household work and market work. A husband has two choices whether to share childrearing work: {Not Help (NH), Help (H)}. A wife also has two choices whether to engage in market work: {Not Work(NW), Work(W)}. The choices are made corresponding to their norms: a husband with T norm will not help, while a husband with E norm will help; a wife with T norm will not work, while a wife with E norm will work.

Each individual has identical preferences about the number of children and consumption. The utility of having children is simply the number of children, n, which is determined by joint decision of husband and wife; it is a function of a couple's time spent on childrearing. Let t_m and t_f be the time devoted to childrearing and the fertility function is given as $n(t_m, t_f)$, where n is increasing in both arguments. For simplicity I disregard financial costs of raising children. I assume all income is spent, so the consumption of an individual is simply the income of the individual. All husbands work outside and earn the same income. If a husband chooses to help on childrearing, he pays the cost of help, denoted by g > 0, which can be regarded as foregone leisure time. Wives are endowed with time=1 and allocate their time between childrearing $(t_f = h)$ and market work (1-h).

I assume random matching and there are four possible outcomes. When both spouses have T norm, the wife will stay at home spending her entire time on childrearing, so they will have high fertility. When a male with T norm is matched by a female with E norm, the wife will engage in market work, splitting her time between market work and childrearing, while the husband will not help with childrearing, so the fertility will be the lowest. When both spouses have E norm, the wife will work outside but the husband provides help with childrearing, so they will have intermediate level fertility. Finally, when a male with E norm is matched by a female with T norm - the wife will stay at home and the husband is willing to help - their fertility will be high. By letting $n_H := n(g, 1) = n(0, 1), n_M := n(g, h),$ and $n_L := n(0, h)$, where $n_H > n_M > n_L$, the fertility results corresponding to four matching outcomes are given as:

$$(T,T) \Leftrightarrow (NH, NW) : n_H$$
$$(E,T) \Leftrightarrow (H,NW) : n_H$$
$$(E,E) \Leftrightarrow (H, NW) : n_M$$
$$(T,E) \Leftrightarrow (NH, W) : n_L$$

I assume that husband's earning (I) is the same for any family and is shared by his family members, so I simply subtract the husband's income from all payoffs. A wife's earning can also be shared by her husband, but I disregard the husband's benefit from the wife's wages because it does not alter the husband's choice; given a wife's choice of work, a husband will receive the same benefit from whatever choices he makes. The underlying payoffs of all outcomes are given as follows:

Female
Male
$$\begin{tabular}{|c|c|c|c|c|} \hline Not Work & Work & Work & \\ \hline Not Help & (n_H, n_H) & (n_L, n_L + w) & \\ \hline Help & (n_H - g, n_H) & (n_M - g, n_M + w) & \\ \hline \end{tabular}$$

Without loss of generality, I assume that $n_H = 3n$, $n_M = 2n$, $n_L = n$. Thus, the within-family payoffs become

Female
Male
$$\begin{tabular}{|c|c|c|c|c|} \hline Male & \hline Not Work & Work \\ \hline Not Help & (3n, 3n) & (n, n+w) \\ \hline Help & (3n-g, 3n) & (2n-g, 2n+w) \\ \hline \end{tabular}$$

$$(2.1)$$

It is assumed that having children is desirable and worth the cost for husbands: n > g.

I denote the population fraction of T norm in a male population by x and the fraction of T norm in a female population by y. Let s = (x, y) be the population state of norms. The set of all s = (x, y) is

$$S = \{(x, y); x = \frac{i}{N}, y = \frac{j}{N}, \text{ for } i, j = 0, 1, ..., N\}$$
(2.2)

The utility (U) of an agent is the sum of two payoffs: a payoff from a family (π^W) , and a payoff from social interactions (π^B) . Let the within-family payoff of player *i* with a norm *k* in a population state of (x, y) be $\pi^W(i, k, (x, y))$, where i = m (male) or *f* (female), k = T or *E*. Due to random matching, a male will be matched by a female with *T* norm with probability *y* and a female with *E* norm with probability 1-y. For example, a male with T norm will have the expected payoff, 3ny+n(1-y). Similarly the expected payoffs of other cases are as follows:

$$\pi^{W}(m, T, (x, y)) = 3ny + n(1 - y)$$

$$\pi^{W}(m, E, (x, y)) = (3n - g)y + (2n - g)(1 - y)$$

$$\pi^{W}(f, T, (x, y)) = 3nx + 3n(1 - x) = 3n$$

$$\pi^{W}(f, E, (x, y)) = (n + w)x + (2n + w)(1 - x)$$
(2.3)

Agents derive utilities from social interactions by conforming their norms to others. Let the degree of conformism be σ . The conformist payoff of a norm will become higher as more people adopt the norm, so the conformist payoff also depends on the population fraction of the norm. Let $\pi^B(i, k, (x, y))$ be the conformist payoff of a player *i* with a norm *k* in a population state (x, y). Then,

$$\pi^{B}(m, T, (x, y)) = x\sigma, \ \pi^{B}(m, E, (x, y)) = (1 - x)\sigma$$
$$\pi^{B}(f, T, (x, y)) = y\sigma, \ \pi^{B}(f, E, (x, y)) = (1 - y)\sigma$$

The total payoff of an individual i with a k norm in a population state (x, y) is denoted by $U(i, k, (x, y)) = \pi^{W}(i, k, (x, y)) + \pi^{B}(i, k, (x, y))$. The total payoffs are:

$$U(m, T, (x, y)) = 3ny + n(1 - y) + x\sigma$$

$$U(m, E, (x, y)) = (3n - g)y + (2n - g)(1 - y) + (1 - x)\sigma$$

$$U(f, T, (x, y)) = 3n + y\sigma$$

$$U(f, E, (x, y)) = (n + w)x + (2n + w)(1 - x) + (1 - y)\sigma$$
(2.4)

2.3 Coevolution of Norms and Fertility

The primary goal is to study the effect of conformism on the evolution of norms, and consequently, fertility decisions. In this section I will study replicator dynamics to find the asymptotically stable equilibrium. In a two-population and two-strategy game, an asymptotically stable equilibrium is also an Evolutionary Stable Strategy (ESS).

2.3.1 Equilibrium without Conformism

First, as a bench mark, I find the gender norm equilibrium and the corresponding fertility without conformism. From the payoff matrix in (2.1), it is easy to predict equilibrium. When women's wages are very low, staying at home will be the dominant strategy for a wife whomever she is matched with. Given that wives stay at home, husbands are better off by not helping. Thus, everyone in the population adopts T norm. On the other hand, if women's wages are very high, more women will adopt an egalitarian norm and engage in market work, and husbands also adopt an egalitarian norm corresponding to an increase in population fraction of female with E norm. I will verify this intuition by solving the replicator dynamics of the game.

The replicator equations for the game are given as:

$$\dot{x} = x(1-x)\{\pi^{W}(m,T,(x,y)) - \pi^{W}(m,E,(x,y))\}$$

$$\dot{y} = y(1-y)\{\pi^{W}(f,T,(x,y)) - \pi^{W}(f,E,(x,y))\}$$
(2.5)

The stationary states for (2.5) are defined to be the state (x, y) where $\dot{x} = 0$ and $\dot{y} = 0$. By solving $\pi^{W}(m, T, (x, y)) = \pi^{W}(m, E, (x, y))$ and $\pi^{W}(f, T, (x, y)) =$ $\pi^{W}(f, E, (x, y))$, all stationary states can be found.

$$(x^*, y^*) = (0, 0), \ (0, 1), \ (1, 0), \ (1, 1), \ (\frac{w - n}{n}, y), \ (x, \frac{n - g}{n})$$

It is easy to check that $\dot{x} > 0$ if $y > \frac{n-g}{n}$ and $\dot{y} > 0$ if $x > \frac{w-n}{n}$. Note that the asymptotically stable equilibrium of the replicator dynamics differs depending on women's market wage, and this gives three wage regimes:

(i)
$$w < n$$
, (ii) $n < w < 2n$, (iii) $2n < w$ (2.6)

Since n > g, the value $\frac{n-g}{n}$ lies between 0 and 1. Thus, the population fraction of male with T norm will increase if the population fraction of female with T norm is greater than $\frac{n-g}{n}$ and vice versa. This holds for all three cases. Regarding the evolution of y, each wage regime will induce different results. For the case (i), the value $\frac{w-n}{n}$ is negative; then $x > \frac{w-n}{n} > 0$ and $\dot{y} > 0$ for all values of x. All the states converge to the state (1,1) in which everyone adopts T norm and families have high fertility. In the case of (iii), the value $\frac{w-n}{n}$ is greater than 1, which implies $x < \frac{w-n}{n} < 1$ and $\dot{y} < 0$ for all values of x. As a result, the population fraction of female with T norm decreases. Thus, the state (0,0), in which all adopt E norm, is the only asymptotically stable state for the case. The vector field diagrams for the three cases are given in Figure 4. Panel I, II, and III correspond to the case (i), (ii), and (iii).

For the case (ii), there are two asymptotically stable equilibria and corresponding two ESSs. The value $\frac{w-n}{n}$ is between 0 and 1; thus, y can increase or decrease contingent on the state of x whether x is greater or less than $\frac{w-n}{n}$. "History matters" in this case because a population will move towards (1,1) or (0,0) depending



Figure 4. Replicator dynamics and ESS without conformism Panel I, II, and III show the replicator dynamics for (i) w < n, (ii) n < w < 2n, and (iii) 2n < w, respectively. The ESSs are shown in bold dots. The vertical and horizontal lines inside the boxes are trajectories of the stationary states.

on the initial state as shown in Panel II. Note that when there is no conformism the mismatched norm cannot be an ESS. Proposition 2.3.1 reports the result.

Proposition 2.3.1 There are the following fertility regimes as a result of the evolution of gender norms.

- If women's wage is sufficiently low such that w < n, the population state of all male and female adopting a separate spheres norm is an ESS and families will have high fertility.
- If women's wage is an intermediate level such that n < w < 2n, both all adopting a separate spheres norm and having high fertility and all adopting a shared care norm and having intermediate level fertility are ESSs.
- If women's wage is sufficiently high such that 2n < w, the population state of all male and female adopting a shared care norm is an ESS and families will have intermediate level fertility.



Figure 5. Replicator dynamics with conformist payoff only The vertical and horizontal lines inside the box are trajectories of the stationary states. The states, (x, y) = (0, 0), (1, 0), (0, 1), and (1, 1) are ESS.

2.3.2 Equilibrium with Conformism

As an extreme case, consider first that individuals care only about what others do; people have only conformist payoffs. Then the replicator equations are given as:

$$\dot{x} = x(1-x)\{\pi^{B}(m,T,(x,y)) - \pi^{B}(m,E,(x,y))\}$$
$$\dot{y} = y(1-y)\{\pi^{B}(f,T,(x,y)) - \pi^{B}(f,E,(x,y))\}$$

The stationary states are $(x^*, y^*) = (0, 0)$, (0, 1), (1, 0), (1, 1), $(\frac{1}{2}, y)$, $(x, \frac{1}{2})$. Individuals simply adopt the norm which is prevalent (greater than $\frac{1}{2}$) in a society. The vector field diagram is given in Figure 5. All four states, (0,0), (0,1), (1,0) and (1,1), are asymptotically stable and ESS.

Now I study equilibrium with conformism. Agents update their norms consid-



Figure 6. Replicator dynamics with within-family and conformist payoffs The lines inside the box are trajectories of the stationary states. The shaded area is the basin of attraction for the population state (1,0).

ering both payoffs. The replicator equations are given as:

$$\dot{x} = x(1-x)\{U(m,T,(x,y)) - U(m,E,(x,y))\}$$

$$\dot{y} = y(1-y)\{U(f,T,(x,y)) - U(f,E,(x,y))\}$$
(2.7)

From the equation system (2.7), we can find the critical values ensuring $\dot{x} = 0$ and $\dot{y} = 0$ are (x, y) satisfying both $x = \frac{1}{2} + \frac{n-g}{2\sigma} - \frac{n}{2\sigma}y$ and $y = \frac{1}{2} + \frac{w-n}{2\sigma} - \frac{n}{2\sigma}x$. Conformist payoff tilts the solution trajectories. Now the mismatched norm outcome can be asymptotically stable and ESS. Figure 6 illustrates the situation.

The condition, under which the state (1,0) is asymptotically stable and becomes an ESS, can be seen in Figure 6. The shaded area is the basin of attraction for the state (1,0). If an initial population lies in the shaded area, it will converge to the mismatched norm equilibrium (1,0). The stationary solution trajectory of $\dot{x} = 0$ includes the state $(x, y) = (\frac{1}{2} + \frac{n-g}{2\sigma}, 0)$ and $\dot{y} = 0$ includes the state $(1, \frac{1}{2} - \frac{2n-w}{2\sigma})$. The state (1,0) will have a basin of attraction when $x = \frac{1}{2} + \frac{n-g}{2\sigma}$ lies between 0 and 1 for $\dot{x} = 0$ trajectory; and $y = \frac{1}{2} - \frac{2n-w}{2\sigma}$ lies between 0 and 1 for $\dot{y} = 0$ trajectory. This leads to the following Proposition 2.3.2:

Proposition 2.3.2 Suppose the degree of conformism is sufficiently high such that $\sigma > n - g$ and $\sigma > |2n - w|$. Then the state (1,0) is an ESS and it has a basin of attraction satisfying $x > \frac{1}{2} + \frac{n-g}{2\sigma} - \frac{n}{2\sigma}y$ and $y < \frac{1}{2} + \frac{w-n}{2\sigma} - \frac{n}{2\sigma}x$.

Proof. If $x > \frac{1}{2} + \frac{n-g}{2\sigma} - \frac{n}{2\sigma}y$ and $y < \frac{1}{2} + \frac{w-n}{2\sigma} - \frac{n}{2\sigma}x$, we have $\dot{x} > 0$ and $\dot{y} < 0$ from (2.7). Thus, the population fraction of males with T norm and the population fraction of females with E norm increase, converging to the state (1,0).

Now I explore how conformism alters a society's norm equilibrium and fertility. Consider the case (iii) when wage is high, w > 2n, in (2.6). The state (0, 0), all males and females adopt E norm, is the only ESS if there is no conformism. If the degree of conformism is high enough such that $\sigma > n - g$, then the set of states satisfying $x > \frac{1}{2} + \frac{n-g}{2\sigma} - \frac{n}{2\sigma}y$ and $y < \frac{1}{2} + \frac{w-n}{2\sigma} - \frac{n}{2\sigma}x$ converges to the state (1,0); all males adopt T norm while all females adopt E norm, and families will have very low fertility. Figure 7 shows an example of the case (iii). The left hand side graph describes the vector field of the replicator dynamics without conformism and the right hand side graph is the vector field with conformism.

The Proposition 2.3.2 suggests that under conformism, there can be multiple ESSs even though a unique ESS is obtained without conformism. This illustrates the role of conformism in explaining mismatched norms and low fertility equilibrium. Consider two societies with traditional norms: one with a relatively low degree of conformism and the other with a relatively high degree of conformism. Suppose women's market wage increased sufficiently in both societies. In a society with weak conformism, people will transform their attitude to being egalitarian, responding to the change in economic incentives. This can happen even when the



Figure 7. Replicator dynamics with and without conformism The vector fields illustrate the case (iii) when women's wage is high. Panel A shows the replicator dynamics of the case without conformism and its ESS is (x, y) = (0, 0). Panel B is for the case with conformism and its ESSs are (x, y) = (0, 0), (1, 0), and (1, 1).

majority of the population is still traditional because the loss in the conformist payoff by shifting to minor norms (egalitarian norm) can be compensated by an increase in within-family payoff. In the end the entire population of the society will become egalitarian and the society will converge to shared care norms. However, in a society with strong conformism men would stick to the existing traditional norm while women change their attitude to an egalitarian norm. This can happen when the gains by shifting to an egalitarian norm and engaging in market work dominate the lost conformist payoff of being traditional for women, but are insufficient for men. As a result, a society with strong conformism converges to the mismatched norm equilibrium and will have very low fertility. Conformism stagnates the transition of a society from being traditional to egalitarian.

2.4 Equilibrium Selection: Stochastic Evolutionary Model

In the previous section, we have seen that conformism induces multiple equilibria. Now the question is which of the equilibria is likely to be observed in the long-run? The deterministic dynamic is limited in the sense that it cannot predict a unique equilibrium. I employ a stochastic evolutionary model to study equilibrium selection. First, I define a continuous time Markov process. Each agent possesses a random alarm clock with the same rate 1. The first time one of the alarm clocks goes off, the agent possessing that clock receives the norm updating opportunity and the chosen agent updates his or her norm according to a norm updating probability which will be specified later. After the norm updating, the agent picks his or her partner randomly from the opposite sex population and forms a family.

Since only one agent is to revise his or her strategy at a time, the states change only by $\frac{1}{N}$. Let $x^{\pm} = x \pm \frac{1}{N}$ and $y^{\pm} = y \pm \frac{1}{N}$ for shorthand notation to denote the changes in states. When an individual is chosen to update his or her norm given a state (x, y), there are four possible transitions from the current state to a different state: (x^+, y) , (x^-, y) , (x, y^+) and (x, y^-) . For any two states $(x, y), (x, y)' \in S$ and $(x, y) \neq (x, y)'$, I assign a nonnegative number $\alpha((x, y), (x, y)')$ that denotes the rate at which the chain changes from the state (x, y) to the state (x, y)' (Lawler, 2006). For example, $\alpha((x, y), (x^+, y))$ is the revision rate at which a male with Enorm is chosen, and given the payoffs, he updates his norm from E to T. The revision rates are as follows:

$$\begin{aligned} \alpha((x,y),(x^{+},y)) &= (1-x) \frac{\exp[\frac{1}{\eta}U(m,T,(x^{+},y))]}{\exp[\frac{1}{\eta}U(m,E,(x,y))] + \exp[\frac{1}{\eta}U(m,T,(x^{+},y))]} \\ \alpha((x,y),(x^{-},y)) &= x \frac{\exp[\frac{1}{\eta}U(m,E,(x^{-},y))]}{\exp[\frac{1}{\eta}U(m,T,(x,y))] + \exp[\frac{1}{\eta}U(m,E,(x^{-},y))]} \\ \alpha((x,y),(x,y^{+})) &= (1-y) \frac{\exp[\frac{1}{\eta}U(f,E,(x,y))] + \exp[\frac{1}{\eta}U(f,T,(x,y^{+}))]}{\exp[\frac{1}{\eta}U(f,E,(x,y))] + \exp[\frac{1}{\eta}U(f,T,(x,y^{+}))]} \\ \alpha((x,y),(x,y^{-})) &= y \frac{\exp[\frac{1}{\eta}U(f,T,(x,y))] + \exp[\frac{1}{\eta}U(f,E,(x,y^{-}))]}{\exp[\frac{1}{\eta}U(f,T,(x,y))] + \exp[\frac{1}{\eta}U(f,E,(x,y^{-}))]} \end{aligned}$$

The values inside the exponential function are the total payoff of individual i with his or her norm given a state. Thus, the revision rate increases in the payoff of the target norm to which the revising-agent changes his or her current norm. For the revision rate in (2.8), I use so-called "clever payoff evaluation" rule (Sandholm, 1998). This means that each agent compares the payoff of the current strategy in the current state and the payoff of the target strategy in the future state in which the agent plays his or her target strategy. The parameter $\eta \geq 0$ is the parameter representing the degree of noise. When $\eta \to \infty$, the terms in the revision rates in (2.8) approach $\frac{1}{2}$, implying that the strategy-revising individuals ignore the payoffs and randomize between strategies. This case represents the situation where the observations of payoffs are too noisy, so the individual decision is highly perturbed by a noise. If $\eta \to 0$, then the terms in revision rates assume the value 1 if and only if the utility of the target strategy is higher than the utility of the current strategy. In other words, the strategy-revising individual surely chooses the best response in a given state. In this case, highly rational behaviors pervade with no perturbation. For this reason, equation (2.8) is called a "perturbed best response rule" and the parameter η captures the degree of noise in the system.

In stochastic evolutionary game theory, the potential functions are frequently adopted to find the explicit expressions for the stationary distribution. I first define a function V, called a "potential function":

$$V(x,y) = N[gxy + (g - 2n + w)x(1 - y) + (w - n)(1 - x)(1 - y)] \quad (2.9)$$
$$+ \frac{N}{2}[x^{2}\sigma + y^{2}\sigma + (1 - x)^{2}\sigma + (1 - y)^{2}\sigma]$$

The first term comes from within-family payoffs depending on the spouse's norm; the second term from the conformist payoffs.

Since the state space is finite and the chain is irreducible (any state can be reached by any other state), the system admits a unique stationary distribution (Lawler, 2006). Let L be the infinitesimal generator of the chain specifying rates at which the chain jumps from a current state to a new state: $(L)_{((x,y),(x,y)')} =$ $\alpha((x,y),(x,y)')$ if $(x,y) \neq (x,y)'$ and $(L)_{((x,y),(x,y))} = -\sum_{(x,y)'\in S} \alpha((x,y),(x,y)')$. Then the stationary distribution is defined as follows:

$$\mu(\{x,y\}) = \frac{\binom{N}{Nx}\binom{N}{Ny}\exp[\frac{1}{\eta}V(x,y)]}{\sum_{(x,y)\in S}\binom{N}{Nx}\binom{N}{Ny}\exp[\frac{1}{\eta}V(x,y)]}$$
(2.10)

The condition for detailed balances needs to be checked, i.e.

$$\mu((x, y))\alpha((x, y), (x, y)')$$

= $\mu((x, y)')\alpha((x, y)', (x, y))$, for all (x, y) and $(x, y)'$

There are only four possible cases to check.

$$\frac{\alpha((x,y),(x^{\pm},y))}{\alpha((x^{\pm},y),(x,y))} = \frac{\mu(\{x^{\pm},y\})}{\mu(\{x,y\})}, \quad \frac{\alpha((x,y),(x,y^{\pm}))}{\alpha((x,y^{\pm}),(x,y))} = \frac{\mu(\{x,y^{\pm}\})}{\mu(\{x,y\})}$$

By symmetry, it is enough to show for the case of (x^+, y) and (x, y^+) .

Proposition 2.4.1 (Stationary distribution) The stationary distribution for the Markov chain defined by L is given by (2.10).

Proof. First I check the reversibility between the states (x, y) and (x^+, y) . I find the ratio of the revision rates from (2.4) and (2.8) as follows:

$$\begin{aligned} \frac{\alpha((x,y),(x^+,y))}{\alpha((x^+,y),(x,y))} &= \frac{1-x}{x^+} \frac{\frac{\exp[\beta U(m,T,(x^+,y))]}{\exp[\beta U(m,E,(x,y))] + \exp[\beta U(m,T,(x^+,y))]}}{\frac{\exp[\beta U(m,E,(x,y))]}{\exp[\beta U(m,T,(x^+,y))] + \exp[\beta U(m,E,(x,y))]}} \\ &= \frac{1-x}{x^+} \frac{\exp[\beta U(m,T,(x^+,y)) - U(m,E,(x,y))]}{\exp[\beta U(m,T,(x^+,y)) - U(m,E,(x,y))]} \\ &= \frac{1-x}{x^+} \exp[\beta \{3ny + n(1-y) + x^+\sigma - (3n-g)y - (2n-g)(1-y) - (1-x)\sigma\}] \\ &= \frac{1-x}{x^+} \exp[\beta \{gy - (n-g)(1-y) + 2\sigma x + (\frac{1-N}{N})\sigma\}] \end{aligned}$$

Then I find the ratio of stationary distributions from (2.10):

$$\frac{\mu(\{x^+, y\})}{\mu(\{x, y\})} = \frac{\frac{\binom{N}{Nx^+}\binom{N}{Ny}\exp[\frac{1}{\eta}V(x^+, y)]}{\sum_{(x,y)\in S}\binom{N}{Nx}\binom{N}{Ny}\exp[\frac{1}{\eta}V(x, y)]}}{\frac{\binom{N}{Nx}\binom{N}{Ny}\exp[\frac{1}{\eta}V(x, y)]}{\sum_{(x,y)\in S}\binom{N}{Nx}\binom{N}{Ny}\exp[\frac{1}{\eta}V(x, y)]}}$$
$$= \exp[\beta\{V(x^+, y) - V(x, y)\}]\frac{\binom{N}{Nx^+}\binom{N}{Ny}}{\binom{N}{Nx}\binom{N}{Ny}}$$

I show the result of the ratio of the reference distributions first.

$$\frac{\binom{N}{Nx^+}\binom{N}{Ny}}{\binom{N}{Nx}\binom{N}{Ny}} = \frac{\frac{N!}{(Nx^+)!(N-Nx^+)!}}{\frac{N!}{Nx!(N-Nx)!}}$$
$$= \frac{1-x}{x^+}$$

Using the potential function (2.9), the term $V(x^+, y) - V(x, y)$ can be calculated as follows:

$$\begin{split} V(x^+, y) &- V(x, y) \\ = & N[gx^+y + (g-2n+w)x^+(1-y) + (w-n)(1-x^+)(1-y) \\ &-gxy - (g-2n+w)x(1-y) - (w-n)(1-x)(1-y)] \\ &+ \frac{N}{2}[(x^+)^2\sigma + y^2\sigma + (1-x^+)^2\sigma + (1-y)^2\sigma \\ &-x^2\sigma - y^2\sigma - (1-x)^2\sigma - (1-y)^2\sigma] \\ = & gy - (n-g)(1-y) + 2\sigma x + (\frac{1-N}{N})\sigma \end{split}$$

From the two results above, I have

$$\frac{\mu(\{x^+, y\})}{\mu(\{x, y\})} = \frac{1-x}{x^+} \exp[\beta N(gy - (n-g)(1-y) + 2\sigma x)]$$

Similarly, I check the reversibility between (x, y) and (x, y^+) . I find the ratio of the revision rates from (2.4) and (2.8) as follows:

$$\begin{aligned} \frac{\alpha((x,y),(x,y^{+}))}{\alpha((x,y^{+}),(x,y))} &= \frac{1-y}{y^{+}} \frac{\frac{\exp[\beta U(f,T,(x,y^{+}))]}{\exp[\beta U(f,E,(x,y))] + \exp[\beta U(f,T,(x,y^{+}))]}} \\ &= \frac{1-y}{y^{+}} \frac{\exp[\beta U(f,E,(x,y))]}{\exp[\beta U(f,T,(x,y^{+}))] + \exp[\beta U(f,E,(x,y))]} \\ &= \frac{1-y}{y^{+}} \exp[\beta \{U(f,T,(x,y^{+})) - U(f,E,(x,y))\}] \\ &= \frac{1-y}{y^{+}} \exp[\beta \{nx + n - w + 2\sigma y + (\frac{1-N}{N})\sigma\}] \end{aligned}$$

Then I find the ratio of stationary distributions from (2.9) and (2.10):

$$\frac{\mu(\{x,y^+\})}{\mu(\{x,y\})} = \frac{\frac{\binom{N}{N_x}\binom{N}{N_y^+} \exp[\frac{1}{\eta}V(x,y^+)]}{\sum_{(x,y)\in S}\binom{N}{N_x}\binom{N}{N_y} \exp[\frac{1}{\eta}V(x,y)]}}{\frac{\binom{N}{N_x}\binom{N}{N_y} \exp[\frac{1}{\eta}V(x,y)]}{\sum_{(x,y)\in S}\binom{N}{N_x}\binom{N}{N_y} \exp[\frac{1}{\eta}V(x,y)]}} = \exp[\beta\{V(x,y^+) - V(x,y)\}]\frac{\binom{N}{N_x}\binom{N}{N_y^+}}{\binom{N}{N_x}\binom{N}{N_y}}$$

Then, by the similar calculation, I have

$$\frac{\binom{N}{Nx}\binom{N}{Ny^+}}{\binom{N}{Nx}\binom{N}{Ny}} = \frac{1-y}{y^+}$$
$$V(x,y^+) - V(x,y) = nx + n - w + 2\sigma y + (\frac{1-N}{N})\sigma$$

Therefore, I have the following result.

$$\frac{\mu(\{x,y^+\})}{\mu(\{x,y\})} = \frac{1-y}{y^+} \exp[\beta\{nx+n-w+2\sigma y + (\frac{1-N}{N})\sigma\}]$$

I verify that the distribution (2.9) satisfies the detailed balances.

Young (1998) studies a given Markov process and its perturbed Markov processes by adding small errors and defines a stochastically stable state as a state with a positive probability when the perturbation vanishes. In our current setting, the perturbed processes in Young's specification correspond to the class of stochastic processes defined by L parameterized by η , and the unperturbed process can be viewed as the best response dynamics obtained by $\eta \rightarrow 0$. The Stochastically Stable State (SSS), thus, concerns only the state when η vanishes. Compared to this, the advantage of the explicit expression for the stationary distribution (2.10) is its both allowing us to study the case of non-vanishing η as well as the limit of vanishing η and providing more information about the long-run property of the system than does SSS.

The state (x, y), which maximizes the potential function V(x, y), is the SSS of the game since as $\eta \to 0$, all weights will be put on this state. From the shape of potential function V, it is easy to see that the local maximum occurs only at the vertices, (1, 1), (1, 0), (0, 1), and (0, 0). Thus, SSS is where the potential function, V, is maximized. Plugging these four states into (2.9) gives

$$V(1,1) = Ng + N\sigma$$

$$V(0,0) = N(w-n) + N\sigma$$

$$V(1,0) = N(g-2n+w) + N\sigma$$

$$V(0,1) = N\sigma$$
(2.11)

First, it is obvious that the state (0,1) and (1,0) cannot be an SSS because g > 0and n > g, V(0,1) < V(1,1) and V(1,0) < V(0,0). State (1,1) or (0,0) will be an SSS. When w < n + g, the value of the potential function at the state of all male and female adopting T norm is higher than the value of the potential function at the state of all male and female adopting E norm, i.e. V(1,1) > V(0,0). The following results hold.

(1)
$$(x, y) = (1, 1)$$
 is SSS if $w < n + g$
(2) $(x, y) = (0, 0)$ is SSS if $w > n + g$

Wive's wages (w), the utility from children (n), and husbands' cost of childrearing (g) determine SSS. Proposition 2.4.2 reports the results regarding equilibrium norms and fertility.

Proposition 2.4.2 Depending on women's wage and the cost of childrearing, there

are the following fertility regimes as a result of the evolution of gender norms.

- If women's wage is sufficiently low such that w < n+g, all males and females adopt a separate spheres norm and high fertility is likely to be observed.
- If women's wage is sufficiently high such that w > n + g, all males and females adopt a shared care norm and intermediate level of fertility is likely to be observed.

In the previous section, we have seen that there are different ESSs corresponding to women's market wage. Cases (i) and (iii) have only one ESS for each, so equilibrium selection is not required. But case (ii) has two ESSs, and the long run equilibrium can be selected using the result of Proposition 2.4.2. If n < w < n + g, the separate spheres norm will be selected, but if n + g < w < 2n, the shared care norm will be selected.

Equation (2.11) shows that the conformist component in the potential function, $N\sigma$, appears in all four states, implying that conformism does not alter the equilibrium selection. In this model, the equilibrium selection process totally depends on the underlying payoffs within families. The reason is because of the assumption that the degree of conformism toward both norms is equal. Since conformist behavior adopts a frequent norm in a population, it is reasonable to assume an unbiased degree of conformism. However, the model can be easily modified to make the degree of conformism vary by gender. Let σ_m and σ_f be the degree of conformism by male and female, respectively. Then the potential function in (2.9) becomes

$$V(x,y) = N[gxy + (g - 2n + w)x(1 - y) + (w - n)(1 - x)(1 - y)]$$

+
$$\frac{N}{2}[x^{2}\sigma_{m} + y^{2}\sigma_{f} + (1 - x)^{2}\sigma_{m} + (1 - y)^{2}\sigma_{f}]$$

And the corresponding potentials of four states are

$$V(1,1) = Ng + \frac{N}{2}(\sigma_m + \sigma_f)$$

$$V(0,0) = N(w-n) + \frac{N}{2}(\sigma_m + \sigma_f)$$

$$V(1,0) = N(g-2n+w) + \frac{N}{2}(\sigma_m + \sigma_f)$$

$$V(0,1) = \frac{N}{2}(\sigma_m + \sigma_f)$$

Similar to the unbiased degree of conformism, the conformist component in the potential function, $\frac{N}{2}(\sigma_m + \sigma_f)$, appears in all four states. Even though different degrees of conformism by gender are allowed, this does not alter the SSS chosen in the case without conformism. According to the model, the mismatched norm state may be an absorbing state for a while, but as long as women's market work is compensated sufficiently highly, we will observe intermediate level fertility in the long-run.

2.5 Conclusion

I explore the evolution of gender norms and fertility regimes in the presence of conformism under various economic environments and show how conformism alters the equilibrium. For example, even though families with both spouses having shared care norms receive higher within-family payoffs than families with mismatched norms (male with T norm and female with E norm), and if individuals obtain strong conformist payoffs, the state of mismatched norms might be an ESS or an absorbing state in the evolutionary process. In this paper I confine the investigation to the evolution of gender norms and fertility, but the result holds for any asymmetric game that admits potential functions.

According to the choice rule, I adopted the perturbed best response. Perturbed best response works as follows; when an individual is chosen to revise his strategy, he/she chooses the strategy with the highest payoff among all possible strategies with some degree of mistakes. Specifically I adopt the "logit choice rule" (McKelvey and Palfrey, 1995; Young, 1998). In this case one can choose any strategies even though they have disappeared in the system, so the stochastic process is irreducible (every state can be reached from an arbitrary state by the evolution of time) and admits a unique stationary distribution. The advantage of the logit choice rule is that under this strategy-revision rule, the unique stationary distribution can be computed explicitly; thus, one can easily study the long run property of the system, e.g. stochastic stabilities, by analyzing the expression of the stationary distribution. By contrast, the imitation rule is such that upon revision opportunity an agent compares his/her payoff of current strategy to the payoff of a matched agent, and he/she imitates the other agent's strategy only when the other's payoff is higher (Weibull, 1995). Under this dynamic if some strategies disappear, they do not reappear in the system; thus, the system is reducible and admits multiple absorbing states. Accommodating an imitation rule to this model would prove an interesting extension.

CHAPTER 3

DO PUBLIC TRANSFERS CROWD OUT PRIVATE SUPPORT TO THE ELDERLY? EVIDENCE FROM THE BASIC OLD AGE PENSION IN SOUTH KOREA

3.1 Introduction

Intergenerational transfers from adult children to their elderly parents have played a crucial role in old-age income security in some countries. Financial assistance from adult children still represents a substantial portion of the elderly's income in many developing countries. However, economic development and wage employment increase the earning opportunities of adult children outside the family, making them less dependent on family assets and reducing the economic incentives for transfers to parents. Public pension systems serve as an enforcement device that makes it impossible for the younger generation to free ride and default on its obligations to the older generation (Sinn, 2004). Public pension systems were first introduced in Germany to improve the miserable conditions of the elderly. Most of the advanced capitalist countries now have either universal or means-tested public pension systems, and many developing countries such as South Africa and South Korea have established such systems since the 1990s. Redistribution policies targeting the poor elderly in developing countries may have limited effectiveness if public intergenerational transfers "crowd out" private transfers. From an empirical point of view, it is difficult to directly test the effect of public transfers on private transfers, partly because of the lack of adequate data: data sets containing both private transfers and public transfers are scarce. Many developing countries for which information about private transfers exists have no public pension programs or spend only a negligible fraction of their budgets on public transfers of income.

Most empirical research on inter-vivos transfers has focused on affluent countries such as the U.S. But public pension systems have been adopted long ago in those countries, making it hard to find exogenously introduced public transfers data. Empirical studies of developed countries test the crowding-out hypothesis by examining the changes in private transfers in response to changes in income of recipients and donors. In advanced countries, net private cash transfers flow downwards, so parents are donors and adult children are recipients, while the flow is opposite in developing countries.

Most of these studies, however, suffer from endogeneity problems. If individuals adjust their income because they receive or expect to receive private transfers, income effects on private transfers can be under-estimated. If omitted variables are positively correlated with both income and private transfer receipts, income effects can be over-estimated (Juarez, 2009). The best way to address the endogeneity problem is to exploit a natural experiment in which an exogenous increase in public transfers occurs, affecting some, but not all, potential recipients of both private and public transfers. A couple of recent studies have addressed endogeneity problems by using exogenously introduced public transfers. Jensen (2003) assesses the crowding out effect of the rapidly increased state old age pensions in 1992 in South Africa. Juarez (2009) estimates the marginal effects of income on the amount of private transfers received by elderly, using eligibility for a demogrant for Mexico City residents who are at least 70 years old as an instrument variable.

Recent policy changes in South Korea provide another opportunity. The Korean government introduced a non-contributory public transfer program, the so-called "Basic Old Age Pension," beginning January 2008. This pension is given to individuals aged 65 and above in the bottom 60% of the income and property distribution of the elderly population. The Korean Retirement and Income Study collects data on private transfers as well as the amount of money that each individual received as "Basic Old Age Pension" (BOAP). In contrast to both studies (Jensen, 2003; Juarez, 2009) which use repeated cross sectional data, the KReIS is a longitudinal survey, making it possible to track the changes in private transfers for individuals before and after the Basic Old Age Pension. I use this data to test the hypothesis that public transfers have crowded out private transfers in Korea. I estimate the crowding out effect employing the Difference-in-Difference method, comparing the change in private transfers before and after receipt of the Basic Old Age Pension for pensioners and non-pensioners.

In section 2 I review the relevant theories on crowding out, and in section 3 I provide information on the Basic Old Age Pension in Korea. In Section 4 I describe the data set and outline my empirical strategy. Section 5 presents the results.

3.2 Literature Review

Whether public transfers crowd out private transfers depends on the relative importance of economic incentives versus altruistic preferences in the provision of private transfers (see Cox (1987); Cox and Fafchamps (2008) for a comprehensive survey of this issue). Barro (1974), for instance, argues that if the motivation is altruistic, the redistribution of a dollar from donors to recipients through public transfers will be fully offset by corresponding decreases in private transfers, having little effect on the distribution of economic well-being. However, if private transfers are implicit payments for the services provided by recipients (exchange motivation), private transfers could increase along with the income of the recipients (Bernheim, Shleifer, and Summers, 1985; Cox and Rank, 1992). According to Cox (1987), given the exchange motive, increases in recipients' income would decrease their supply of services and cause an upward movement along the donors' demand, raising the implicit price of services. Thus, if recipients' services lack close substitutes, the demand would be inelastic and the amount of the transfer would increase with the recipients' income. In this case redistribution can be reinforced. Cox (1987) also shows that altruism is more likely to dominate when the income of the recipient is lower, implying that relatively poor individuals could experience larger reduction in private transfers when they receive public transfers. Not only inter-vivos transfers but bequests are another form of private transfers. Bernheim, Shleifer, and Summers (1985) explore the implications of exchange motivation. They find positive correlation between children's services (contacts) to their parents and the parents' estate in the U.S. in 1969–75. On the other hand, Tomes (1981) using a sample of estates probated in the Cleveland, Ohio, area in 1964-65, finds that larger bequests are associated with lower recipient income, which is consistent with altruism.

Most empirical studies of inter-vivo transfers in advanced countries show that crowding out either does not take place (Lucas and Stark, 1985; Cox, 1987; Cox and Rank, 1992; Cox, 1998) or is negligible (Cox and Jakubson, 1995; Altonji, Hayashi, and Kotlikoff, 1997). Cox and Rank (1992) find that the coefficient of recipient (adult children) earnings minus the coefficient of parental earnings is only 0.3, which should be -1 under the null hypothesis of altruism. Altonji, Hayashi, and Kotlikoff (1997) find that private transfers decrease by 13 cents per dollar. Recent studies directly testing the crowding out effect of public transfers in developing countries show mixed results. Albarran and Attanasio (2002) studying the PROGRESA programme in Mexico show there is no crowding out. Juarez (2009) finds that a one peso increase in the elderly's income decreases the private transfers they receive by 86 cents. Jensen (2003) also finds an additional rand of public pension income decreases private transfers by 0.30 rand in South Africa.

There are reasons other than the exchange motive that crowding out might not occur. First, working age adults may derive more satisfaction from providing transfers to elderly parents themselves than by the government in what Andreoni (1989, 1990) terms "warm glow" giving with impure altruism. Second, either a filial norm that adult children should take care of their old parents or social norms regarding minimum acceptable living standards may influence transfers. Children in countries with strong family ties and filial norms may be less responsive in their private transfers to the introduction of public transfers to their elder parents. If publicly provided transfers do not boost the elderly parents above a threshold, adult children would still provide support to help their parents achieve the socially acceptable minimum. Only if public transfers lift elderly parents over the threshold would children's contributions be completely crowded out. Third, if adult children treat parents the way they hope to be treated by their own children, hoping to establish a "demonstration effect", then crowding out may not occur (Cox and Stark, 1996). It is important to point out that altruistic motivation induces crowding out only in the standard model of altruism in which other regarding preferences place a positive weight on someone else's utility (e.g. Becker and others). Ethical motivations such as filial norms do not necessarily induce crowding out as in the standard

treatment of altruism.

This essay will build on the existing literature in three ways: i) providing a direct test of the crowding out effect of public transfers by using data including both public and private transfers; ii) providing a more accurate test of this issue by employing panel data; iii) adding empirical results from the South Korean case in particular.

3.3 Description of the Basic Old Age Pension (BOAP)

Korea's population is rapidly aging. The elderly (65 and older) portion of the total population was 5.1% in 1990 but more than doubled to 11.8% in 2012. Publicly mandated old age income security in Korea consists of public pension schemes and retirement allowance programs. The public pension schemes are divided into two groups: the Special Occupational Pension Schemes (SOPS) for civil servants, military personnel, and private school teachers; and the National Pension System (NPS) for the rest of the population. The National Pension System was expanded nation-wide in the late 1990s. According to the Social Survey conducted by Statistics Korea in 2012, only 31.8% of population aged 65 and above benefited from public income security schemes; 40.2% of the aged population reported no income or property. In that year, 38% of the population aged 65 and above lived together with adult children.

In January 2008, to alleviate the economic hardship of the elderly, the Korean government introduced the Basic Old Age Pension for those at least 70 years old (extended to those aged 65 and above beginning July 2008). It is a kind of demogrant because it is neither taxable nor requires previous contribution. The government establishes the baseline level of income and property to be eligible for the Basic Old-Age Pension. Those people who lie in the bottom 60% of income distribution of the entire elderly population over 65 in 2008 were eligible for the pension. Beginning in 2009, the pension covers the bottom 70% of the entire elderly population aged 65 and above.

Only the income and property of a person and his or her spouse is counted. The income and property of the person responsible for supporting the elderly (such as adult children) are not considered and private transfer income is not recognized as income. The monthly recognized income is the sum of monthly income and property converted to a monthly amount at an annual interest rate of 5% (8% for financial property). The monthly pension payment is 84,000 KRW (about \$76) for a single person and if both spouses are eligible for the pension, then each receives 67,000 KRW (\$61) (each with 20% reduction from a single recipient payment). Table 1 reports the monthly pension as a percentage of monthly income for the recipients. This pension represents a substantial amount of the pensioner's income, accounting for 13-39% of income in 2008. There is a large difference between men and women in terms of monthly income. Women's income is much less than men and elderly women are clearly more dependent on the pension than elderly men.

	Single recipients		Married recipients		Total
	men	women	men	women	-
monthly income	669.77	329.90	1059.90	175.40	568.92
	(1345.43)	(874.89)	(1621.01)	(496.79)	(1223.52)
monthly pension	83.79	82.99	71.46	68.32	76.02
amount received	(8.20)	(7.74)	(11.00)	(9.00)	(11.28)
% of pension in income	12.51%	25.16%	6.74%	38.95%	13.36%

Table 1. The Basic Old Age Pension and income of recipients in 2008All money values are in 2008 KRW (in thousand). Standard deviations are inparentheses. Source: Author's calculation using the pension recipients from theKorean Retirement and Income Study(KReIS).
For all elderly aged 60 or above in the survey, the monthly income (not including BOAP) for single male is 700,000 KRW and for single female is 330,000 KRW, while the monthly income for a married male is 1,060,000 KRW and for a married female is 175,000 KRW.

Table 2 shows the classification of recipients by pension amount in February 2008. Conditional on pension eligibility, 94% of recipients are paid a fixed amount (maximum) regardless of their income level. The remaining 6% are paid an adjusted amount to prevent income reversal between recipients and non-recipients so that the income of recipients after the pension will still remain lower than the income of non-pensioners.

	Total Number	Number of Recipients	
classification	of recipients	received max amount	%
Single recipient	1,302,404	$1,251,243^{a}$	96.10%
Single recipient with spouse	$172,\!331$	$158,360^{a}$	91.90%
Both spouses received	472,476	$429,124^{b}$	90.80%
Total	1,947,211	1,838,727	94%

Table 2. All recipients by pension amount as of February 2008 a:84,000 KRW, b: 67,000 KRW. Source: Ministry for HealthWelfare and Family Affairs, 2008.

3.4 Data and Empirical Strategy

I used a sample of individuals at least 60 years old from the Korean Retirement and Income Study. This is a longitudinal survey conducted every two years by the National Pension Service since 2005. I used the second (2007) and third (2009) survey¹ to include the period before and after the Basic Old Age Pension.

¹The survey asks participants to report their income of the previous year; thus, the incomes are for the year of 2006 and 2008 respectively.

The KReIS survey includes around 5,000 households with interviews of each household's member over age 50, providing both individual and household level data. It contains information on income from different sources including public pensions and private cash transfers. In the second survey, personal questionnaires on income and expenditures are collected by couples units, while by individuals in the third survey. Thus, I separated the data into single and couple data sets. The number of individuals aged 60 and above without a spouse who participated in both the 2nd and 3rd surveys is 1489 (the number of female respondents is approximately five times larger than that of male respondents) and the number of individuals aged 60 and above with spouses who participated in both the 2nd and 3rd surveys is 3714 (1857 couples).

To measure the crowding out effect of the Basic Old Age Pension on private transfers to the elderly, I employ the Difference-in-Difference (DID) strategy, which consists of comparing the change in private transfers for pensioners (treatment group) to the change in private transfers for non-pensioners (control group). Let T_{igt} denote private transfers of *i* who belongs to a group, g={Pensioners, Nonpensioners}, at time t={Pre, Post} and let \overline{T}_{igt} be the mean of private transfers. A simple DID estimator can be written as:

$$(\overline{T}_{pensioner, post} - \overline{T}_{pensioner, pre}) - (\overline{T}_{non-pensioner, post} - \overline{T}_{non-pensioner, pre})$$

This removes biases in post-pension comparisons between the treatment and control group that could result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could result from trends. The underlying assumption for this DID strategy is that the outcome in both the treatment and control groups would follow the same time trend in the absence of the treatment. Note that the assumption does not require both groups to have the same mean for the subject of interest at a point in time.

The DID estimate can be calculated by subtracting the change in private transfers for non-pensioners from the change in private transfers for pensioners. The DID estimate and its standard error can be easily calculated when implemented as a regression. The corresponding regression equation is

$$T_{igt} = \beta_0 + \beta_1 Post_t + \beta_2 Pensioner_g + \beta_3 (Post_t * Pensioner_g) + \varepsilon_{igt}$$
(3.1)

The coefficient of the second-level interaction (β_3) is the DID estimate which captures all variation in private transfers specific to the treatments (relative to controls) for pensioners after the introduction of the national BOAP in 2008. The interpretation of the coefficients of regression equation (3.1) is given below.

$$\begin{split} \widehat{\beta}_0 &= \overline{T}_{non-pensioner, \ pre} \\ \widehat{\beta}_1 &= \overline{T}_{non-pensioner, \ post} - \overline{T}_{non-pensioner, \ pre} \\ \widehat{\beta}_2 &= \overline{T}_{pensioner, \ pre} - \overline{T}_{non-pensioner, \ pre} \\ \widehat{\beta}_3 &= (\overline{T}_{pensioner, \ post} - \overline{T}_{pensioner, \ pre}) - (\overline{T}_{non-pensioner, \ post} - \overline{T}_{non-pensioner, \ pre}) \end{split}$$

Demographic and individual characteristics might cause differences in private transfers even for the same group. The sampling variance of the DID estimate can be reduced by controlling for other observables that affect the private transfers. The regression equation has the following form:

$$T_{igt} = \beta_0 + \beta_1 Post_t + \beta_2 Pensioner_g + \beta_3 (Post_t * Pensioner_g) + \gamma X_{igt} + \varepsilon_{igt}$$

where X is a vector of other observable individual characteristics such as income

of recipients, household size, the number of children, education, sex, cohabitation with adult children, health problems, and providing care for grandchildren.

3.5 Results

3.5.1 Descriptive Statistics

Since the 1980s familial support for the elderly has declined in both financial assistance and coresidence in Korea (Kim, 2010). According to Kim (2010), private transfers from adult children to elderly parents (aged 60 or above) declined as a percentage of elderly parent's income from 72.4% in 1980, 56.3% in 1995, and 31.1% in 2003. Table 3 and 4 provide summary statistics on private transfers between parents and adult children as well as coresidence in 2006 and 2008, calculated from the Korean Retirement and Income Study. I calculated net private transfers from children by subtracting the total annual transfer to children from the total annual transfer receipts from children.

I report transfers for those elderly aged 60 and above because the official retirement age in Korea is 60 and the average effective age of retirement (the average age of exit from the labor force) was 70 during 2006-2011 according to OECD employment data. Earnings from jobs that people take after retiring from their first job tend to be lower. Thus, I consider two age cohorts of the elderly sharing similar characteristics regarding their structure of income throughout the analysis: those aged 60-69 and those aged 70 and above. Since the elderly aged 65 or above are eligible for the pension, I consider three age-thresholds, 60-64, 65-69 and 70 or above in 2008.

Descriptive results for the single elderly are presented in Table 3. Transfers in

Age and	Period	Transfers	Transfers	Net transfer	Coresidence
Pension		from children	to children	from children	
70+	Pre	2544.94	221.38	2330.19	0.43
Pensioner		(3429.25)	(787.1)	(3416.37)	(0.5)
	Post	2045.56	89.42	1955.26	0.43
		(3038.15)	(428.16)	(2975.09)	(0.5)
70+	Pre	2968.64	686.1	2291.66	0.43
Non-		(4431.22)	(2424.29)	(5159.47)	(0.5)
pensioner	Post	1870.7	336.76	1533.93	0.41
		(3348.87)	(1498.84)	(3715.95)	(0.49)
65-69	Pre	2737.45	285.68	2462.13	0.41
Pensioner		(4141.14)	(674.07)	(4182.03)	(0.49)
	Post	2081.08	191.35	1902.22	0.38
		(4911.18)	(560.73)	(4909.92)	(0.49)
65-69	Pre	2783.31	680.69	2102.62	0.49
Non-		(4168.75)	(2144)	(4920.58)	(0.5)
pensioner	Post	2183.53	252.69	1924.89	0.44
		(3304.67)	(1038.2)	(3321.6)	(0.5)
60-64	Pre	3378.15	251.85	3122.89	0.48
Bottom		(4434.54)	(961.74)	(4521.12)	(0.5)
60%	Post	2307.39	107.71	2198.87	0.44
		(3218.72)	(423.34)	(3193.5)	(0.5)
60-64	Pre	3035.12	968.29	2066.83	0.61
Top 40%		(3139.95)	(2359)	(4062.89)	(0.49)
	Post	1665.61	561.95	1103.66	0.51
		(2594.6)	(1546.27)	(3053.44)	(0.51)

Table 3. Average private transfers for the single elderly aged 60+ by pension receipt status and time All money values are in 2008 KRW (in thousand). Standard Deviations are in parentheses. Source: Author's calculation using a sample of the elderly aged 60 and above from the Korean Retirement and Income Study.

both directions from children and to children decreased in 2008 compared to 2006 for all age cohorts. Pensioners or relatively poor elderly (those in the bottom 60% of income distribution among the participants in the survey) tended to receive larger amounts of transfers from their children compared to non-pensioners or relatively rich elderly (those in the top 40% of income distribution). For the single elderly there was no significant change in coresidence in terms of age thresholds and pension status.

Table 4 shows the values for elderly couples. Note that for couples aged 70 or above, the net transfers from children increased in Post period (2008) relative to Pre period (2006) for both pensioners and non-pensioners. Except for the elderly 70+, financial support from children decreased for all couples. Net transfers from children also increased for pensioners, relatively poor couples aged 60-64 and non-pensioner couples aged 65-69, but this is not because adult children increased their support, but because the reduction in transfers to children was lager than than the reduction in transfers from children. It would be more informative to study both transfers from children and net transfers from children. Transfers from children depend solely on the adult children's decision, whereas the net transfers from children depend on both the parents' and children's decision. Since I lack data on children's income, it is implicitly assumed that children's income is constant.

The percentage living with children decreases with age from roughly 60% for age 60-64 to 25% for 70 or above for elderly couples, while the percentage of coresidence changed little for the single elderly. For all age cohorts of elderly couples, the number of couples living with their children slightly decreased in 2008. Elderly couples who are pensioners are less likely to coreside with adult children than affluent elderly couples. The overall time trend of both financial and coresidence (as a form of in-kind supports) is downward.

Age and	Period	Transfers	Transfers	Net transfer	Coresidence
Pension		from children	to children	from children	
70+	Pre	3259.57	494.45	2771.34	0.27
Pensioner		(3898.72)	(1390.04)	(4245.46)	(0.44)
	Post	3522.97	327.76	3192.34	0.25
		(5092.74)	(861.51)	(5095.13)	(0.43)
70+	Pre	2893.41	888.97	2004.93	0.22
Non-		(4213.72)	(2396.48)	(4763.43)	(0.41)
pensioner	Post	3077.38	574.58	2494.26	0.21
		(4529.44)	(2124.61)	(5061.59)	(0.4)
65-69	Pre	2988.56	566.03	2428.13	0.37
Pensioner		(4343.65)	(1201.81)	(4429.55)	(0.48)
	Post	2554.41	615.72	1934.99	0.31
		(3289.69)	(3451.58)	(4733.16)	(0.47)
65-69	Pre	2002.93	1364.27	630.11	0.45
Non-		(3879.25)	(3939.69)	(5763.29)	(0.5)
pensioner	Post	1680.14	778.82	890.72	0.35
		(3871.86)	(3554.68)	(5310.39)	(0.48)
60-64	Pre	2336.12	1395.19	963.13	0.59
Bottom		(3701.43)	(2970.92)	(4616.86)	(0.49)
60%	Post	2215.31	685.49	1529.82	0.52
		(4645.13)	(2997.42)	(5502.6)	(0.5)
60-64	Pre	1712.99	3206.64	1493.66	0.63
Top 40%		(4293.77)	(5812.86)	(7229.12)	(0.49)
	Post	1135.56	2529.9	1395.31	0.48
		(2172.57)	(6914.42)	(7383.07)	(0.5)

Table 4. Average private transfers for elderly couples aged 60+ by pension receipt status and time Non-pensioner includes all couples with no spouse receives pension. All money values are in 2008 KRW (in thousand). Standard Deviations are in parentheses. Source: Author's calculation using a sample of the elderly aged 60 and above from the Korean Retirement and Income Study.

	Single					
	Pens	sioner	Non-pensioner			
Variables	Pre pension	Post pension	Pre pension	Post pension		
Income	2797.87	1593.54	7713.00	8882.44		
	(7984.68)	(2623.42)	(18367.06)	(15784.22)		
Household size	2.33	2.24	2.24	2.12		
	(1.65)	(1.62)	(1.54)	(1.51)		
No. of children	4.08	4.01	3.27	3.23		
	(1.99)	(2.00)	(1.67)	(1.65)		
Education	1.65	1.65	2.29	2.31		
	(0.84)	(0.85)	(1.19)	(1.20)		
Caregiving	0.08	0.05	0.11	0.10		
	(0.27)	(0.22)	(0.32)	(0.31)		
Health problem	0.71	0.76	0.69	0.72		
	(0.45)	(0.43)	(0.46)	(0.45)		
		Cou	ıple			
	Pens	sioner	Non-pensioner			
Variables	Pre pension	Post pension	Pre pension	Post pension		
т				1		
Income	8250.97	5853.44	21825.86	21831.02		
Income	8250.97 (13973.63)	5853.44 (6944.82)	$21825.86 \\ (20733.87)$	$ \begin{array}{r} 21831.02 \\ (23999.36) \end{array} $		
Income Household size	$8250.97 \\ (13973.63) \\ 2.73$	$5853.44 \\ (6944.82) \\ 2.66$	$21825.86 \\ (20733.87) \\ 2.89$	$ \begin{array}{r} 21831.02 \\ (23999.36) \\ 2.72 \end{array} $		
Income Household size	$\begin{array}{c} 8250.97 \\ (13973.63) \\ 2.73 \\ (1.19) \end{array}$	$5853.44 \\ (6944.82) \\ 2.66 \\ (1.18)$	$21825.86 \\ (20733.87) \\ 2.89 \\ (1.10)$	$ \begin{array}{r} 21831.02 \\ (23999.36) \\ 2.72 \\ (1.04) \end{array} $		
Income Household size No. of children	$\begin{array}{c} 8250.97 \\ (13973.63) \\ 2.73 \\ (1.19) \\ 4.03 \end{array}$	$5853.44 \\ (6944.82) \\ 2.66 \\ (1.18) \\ 3.98$	$21825.86 \\ (20733.87) \\ 2.89 \\ (1.10) \\ 3.18$	$ \begin{array}{r} 21831.02 \\ (23999.36) \\ 2.72 \\ (1.04) \\ 3.16 \end{array} $		
Income Household size No. of children	$\begin{array}{c} 8250.97 \\ (13973.63) \\ 2.73 \\ (1.19) \\ 4.03 \\ (1.59) \end{array}$	$5853.44 \\ (6944.82) \\ 2.66 \\ (1.18) \\ 3.98 \\ (1.55)$	$\begin{array}{c} 21825.86 \\ (20733.87) \\ 2.89 \\ (1.10) \\ 3.18 \\ (1.26) \end{array}$	$\begin{array}{r} 21831.02 \\ (23999.36) \\ 2.72 \\ (1.04) \\ 3.16 \\ (1.25) \end{array}$		
Income Household size No. of children Education	$\begin{array}{c} 8250.97 \\ (13973.63) \\ 2.73 \\ (1.19) \\ 4.03 \\ (1.59) \\ 2.58 \end{array}$	$5853.44 \\ (6944.82) \\ 2.66 \\ (1.18) \\ 3.98 \\ (1.55) \\ 2.59$	$\begin{array}{c} 21825.86 \\ (20733.87) \\ 2.89 \\ (1.10) \\ 3.18 \\ (1.26) \\ 3.37 \end{array}$	$\begin{array}{r} 21831.02 \\ (23999.36) \\ 2.72 \\ (1.04) \\ 3.16 \\ (1.25) \\ 3.40 \end{array}$		
Income Household size No. of children Education	$\begin{array}{c} 8250.97\\(13973.63)\\2.73\\(1.19)\\4.03\\(1.59)\\2.58\\(1.14)\end{array}$	5853.44 (6944.82) 2.66 (1.18) 3.98 (1.55) 2.59 (1.16)	$\begin{array}{c} 21825.86 \\ (20733.87) \\ 2.89 \\ (1.10) \\ 3.18 \\ (1.26) \\ 3.37 \\ (1.18) \end{array}$	$\begin{array}{c} 21831.02 \\ (23999.36) \\ 2.72 \\ (1.04) \\ 3.16 \\ (1.25) \\ 3.40 \\ (1.21) \end{array}$		
Income Household size No. of children Education Caregiving	$\begin{array}{c} 8250.97\\(13973.63)\\2.73\\(1.19)\\4.03\\(1.59)\\2.58\\(1.14)\\0.1281\end{array}$	5853.44 (6944.82) 2.66 (1.18) 3.98 (1.55) 2.59 (1.16) 0.085	$\begin{array}{c} 21825.86 \\ (20733.87) \\ 2.89 \\ (1.10) \\ 3.18 \\ (1.26) \\ 3.37 \\ (1.18) \\ 0.1278 \end{array}$	$\begin{array}{c} 21831.02 \\ (23999.36) \\ 2.72 \\ (1.04) \\ 3.16 \\ (1.25) \\ 3.40 \\ (1.21) \\ 0.088 \end{array}$		
Income Household size No. of children Education Caregiving	$\begin{array}{c} 8250.97\\(13973.63)\\2.73\\(1.19)\\4.03\\(1.59)\\2.58\\(1.14)\\0.1281\\(0.3345)\end{array}$	5853.44 (6944.82) 2.66 (1.18) 3.98 (1.55) 2.59 (1.16) 0.085 (0.279)	$\begin{array}{c} 21825.86\\ (20733.87)\\ 2.89\\ (1.10)\\ 3.18\\ (1.26)\\ 3.37\\ (1.18)\\ 0.1278\\ (0.3341)\end{array}$	$\begin{array}{c} 21831.02\\ (23999.36)\\ 2.72\\ (1.04)\\ 3.16\\ (1.25)\\ 3.40\\ (1.21)\\ 0.088\\ (0.284)\end{array}$		
Income Household size No. of children Education Caregiving Health problem	$\begin{array}{c} 8250.97\\(13973.63)\\2.73\\(1.19)\\4.03\\(1.59)\\2.58\\(1.14)\\0.1281\\(0.3345)\\0.85\end{array}$	5853.44 (6944.82) 2.66 (1.18) 3.98 (1.55) 2.59 (1.16) 0.085 (0.279) 0.87	$\begin{array}{c} 21825.86\\ (20733.87)\\ 2.89\\ (1.10)\\ 3.18\\ (1.26)\\ 3.37\\ (1.18)\\ 0.1278\\ (0.3341)\\ 0.75\end{array}$	$\begin{array}{c} 21831.02\\ (23999.36)\\ 2.72\\ (1.04)\\ 3.16\\ (1.25)\\ 3.40\\ (1.21)\\ 0.088\\ (0.284)\\ 0.78\end{array}$		

Table 5. Summary statistics of selected variables for the elderly 60+ by pension receipt status and time Couple pensioner means that at least one spouse receives pension. All money values are in 2008 KRW (in thousand). Standard deviations are in parentheses. Source: Author's calculation using a sample of the elderly aged 60 and above from the Korean Retirement and Income Study. Table 5 provides summary statistics of other control variables for the elderly aged 60 and above by their pension status and time periods. The income shown in Table 5 includes labor income, property income, and public and private pensions except for the Basic Old Age Pension. Household size represents the number of people living together. The caregiving variable is a dummy indicating whether the respondent provided care for their grandchildren. The income of pensioners decreased, whereas the income of non-pensioners increased or stayed the same. Other than income, there is little difference in individual characteristics between pensioners and non-pensioners.

3.5.2 Regression Results

Pensioners are at the bottom 60% of the income and property distribution of the elderly population aged 65 or above, so I use age thresholds and income distribution for identification. Regarding the income thresholds, the Korean government establishes and announces the baseline level of income and property to be eligible for the Basic Old Age Pension annually. According to the baseline in 2008, I construct the recognized income threshold and divide the elderly into two groups, bottom 60% and top 40%. To control for age differences in private transfers, it would be reasonable to make 70 the cut-off age. To determine the age threshold of couples, I consider "couple-age" as the maximum of the two spouses' ages. Thus, a couple aged 60 or above implies that the couple has at least one spouse aged 60 or above. A couple with at least one pensioner is considered to be a pensioner couple. Table 6 and 7 provide summary statistics by age thresholds, pension status, and time (before and after the introduction of national BOAP) for the single elderly and elderly couples respectively.

Age and	Time	Stats	Income	Household	No. of	Education	Health	Caregiving
Pension				size	children		Problem	
70+.	Pre	Mean	2413	2.3812	4.2046	1.5859	0.7272	0.0543
Pensioner		SD	8209.8	1.6833	2.0475	0.8169	0.4457	0.2268
	Post	Mean	1350^{-7}	22704	41328	1594	0.7613	0.020
	1 050	SD	2411.3	1.6207	2.0691	0.8242	0.4266	0.1889
	- D	<u>N</u>	717	821	821	821	821	514
70+	Pre	Mean	6713	2.3706	3.7079	2.2079	0.7135 0.4524	0.05 0.2187
pensioner		N	166	170	178	178	$178^{-0.4334}$	140
Peneronor	Post	Mean	9284.2	2.3034	3.6685	2.2393	0.7022	0.0345
		ŞD	20969	1.6968	1.7999	1.2593	0.4586	0.1833
		<u>N</u>	169	178	178	178	178	116
65-69 Dongionor	Pre	Mean	4195.4	2.1165 1.5161	3.6368	1.8726	0.6651 0.4721	0.1647 0.272
rensioner		N	204	206	$212^{1.0023}$	$212^{0.0000}$	212	170
	Post	Mean	$25\overline{9}7.5$	2.1085	3.5802	1.8741	0.75	0.0897
		ŞD	2992.5	1.6299	1.646	0.8909	0.434	0.2867
65-69	Pro	Mean	<u> </u>	$\frac{212}{24253}$	$\frac{212}{31600}$	$\frac{212}{2.4483}$	$\frac{212}{0.6322}$	0 1549
Non	110	SD	9773	1.7496	1.524	1.2918	0.485	0.3644
pensioner	_	Ň	77	87	87	87	87	71
	Post	Mean	10040	2.2414	3.092	2.454	0.7701	0.1515
		SD N	$\frac{12232}{76}$	1.7380 87	1.4835 87	1.3001	0.4232 87	0.3013
60-64	Pre	Mean	4086.2	1 9542	2 8667	2 2074	0.7111	0.1579
Bottom	110	SD	5306.5	1.1493	1.5052	0.9932	0.4549	0.3666
60%		Ň	130	131	135	135	135	95
	Post	Mean	4233.9	1.8074	2.8519	2.2052	0.7333	0.129
		N	4005.8	135	1.0250 135	135	$0.4459 \\ 135$	0.3371
60-64	Pre	Mean	22743	2.2195	2.9268	2.6098	0.6341	0.1429
Top 60%		SD	51839	1.3325	1.1487	1.2625	0.4877	0.355
		N	40	41	41	41	41	35
	Post	SD	$\frac{21984}{13286}$	$\frac{2.1403}{1.3521}$	2.8293 1.243	$\frac{2.0317}{1.3058}$	0.6098 0.4930	$0.1765 \\ 0.387$
		Ň	36	41	41	41	41	$34^{-1.001}$

Table 6. Summary statistics for the single elderly aged 60+ by pension receipt status and time, All money values are in 2008 KRW (in thousand). Source: Author's calculation using a sample of the elderly aged 60 and above from the Korean Retirement and Income Study.

Age and	Time	Stats	Income	Household	No. of	Education	Health	Caregiving
Pension				size	children		Problem	
70+.	Pre	Mean	6768	2.6857	4.3534	2.5071	0.8604	0.0991
Pensioner		ŞD	14929	1.2307	1.6082	1.1579	0.3469	0.2992
	Post	Moon	4501 Q	26431	42702	$2000 \\ 25231$	0.8817	0.0654
	1 050	SD	5153.4	1.209	1.5707	1.1837	0.3233	0.2474
		Ñ	431	566	566	566	566	566
70+	Pre	Mean	14787	2.5846	3.8901	3.4506	0.8461	0.0544
Non		SD	13100	1.1749	1.3649	1.3334	0.3614	0.2273
pensioner	Post	Moon	$\frac{200}{17074}$	25385	275	273	0.8718	239 0.037
	1 050	SD	28796	1.1534	1.3236	1.3691	0.3349	0.1882
		Ñ	251	273	273	273	273	273
<u>6</u> 5-69	Pre	Mean	10502	2.7955	3.4015	2.6894	0.8258	0.1839
Pensioner		ŞD	8723.1	1.1252	1.3586	1.1005	0.3800	0.3882
	Post	Moon	203 8456 7	$204 \\ 26705$	$\frac{204}{34120}$	$2604 \\ 26080$	0.8447	0.1212
	1 050	SD	8283.5	$\frac{2.0705}{1.1241}$	1.3453	$\frac{2.0989}{1.1084}$	0.3629	0.1270
		Ň	192	264	264	263	264	264
65-69	Pre	Mean	21631	2.8317	3.151	3.3993	0.7819	0.1573
Non		SD	19037	1.0488	1.1462	1.1393	0.4137	0.3648 248
pensioner	Post	Mean	20920	2 6644	31275	3 4238	0.7987	0 0940
	1 050	SD	18453	1.0058	1.1593	1.175	0.4017	$0.29\overline{2}3$
		Ň	266	298	298	298	298	298
60-64	Pre	Mean	18626	3.096	2.7607	3.0853	0.7017	0.1827
Bottom		SD	12259	1.0506	1.0348	1.0127	0.4582	0.3874
60%	Dogt	N Moon	289	302	305 2.7541	305 31080	$305 \\ 0.7442$	197 0 1 2 7 0
	1 050	SD	9013 5	0.9955	10364	1.0275	0.1442 0.4370	$0.1279 \\ 0.3345$
		Ň	301	305	305	305	305	305
60-64	Pre	Mean	44367	3.1429	2.7313	3.791	0.6267	0.12
Top 60%		SD	33869	1.0161	1.0561	1.1508	0.4854	0.3272
	Dogt	N	123	133	134	2 2000	$134 \\ 0.6567$	0 0806
	FOSU	SD	32534	$2.0204 \\ 0.9055$	$\frac{2.7104}{1.0663}$	3.0090 1 1763	0.0307 0.4766	0.0890
		Ň	90 ⁻ 90 ⁻	134	134	133	134	134

Table 7. Summary statistics for elderly couples aged 60+ by pension
receipt status and time, Couple pensioner means that at least one spouse
receives pension. All money values are in 2008 KRW (in thousand). Source:
Author's calculation using a sample of the elderly aged 60 and above from the
Korean Retirement and Income Study.

I explore various regression models. First, I simply compare the changes in private transfers between pensioners (treatment group) and non-pensioners (control group). Second, for a more robust analysis, I take more restricted treatment and control groups for DID analysis. In the previous model the control group of non-pensioners includes both the poor elderly aged 60-64 and the rich elderly aged 65 and above. This income difference between the members of the countrol group (all non-pensioners) may contaminate the estimates. Aside from the pension receipt status, there should be no difference in the trend of private transfers between treatment and control groups. People just above or below the 65 threshold may have little difference if they belong to the same income group. I consider pensioners aged 65-69 as a treatment group and individuals 60-64 years old at the bottom 60% of income distribution as a control group. Regarding couples, the control group includes couples with at least one spouse aged 60-65 at the bottom 60% of income distribution.

Table 8 and 9 report DID regression estimates for single individuals and couples respectively. For regression models (1) and (2), the dependent variable is private transfers from children, and for models (3) and (4), the dependent variable is net private transfers. For models (1) and (3), the treatment group is simply pensioners; the control group is non-pensioners aged 60 and above. For models (2) and (4), the treatment group includes pensioners aged 65-69; the control group includes elderly 60-64 years old at the bottom 60% of income distribution. *Post* is a dummy variable indicating the period before or after the pension and *Pensioner* is also a dummy variable indicating pension receipt status. The interpretation of coefficients is as follows: the coefficient of *Post* is the mean change before and after the pension for the control group; the coefficient of *Pensioner* is the difference in private transfers between the treatment group and the control group before the pension; and finally the coefficient of interest is for the interaction between the Post and Pension dummy, which is interpreted as the effect of the pension relative to the control group.

In all the models of Table 8, the coefficient of Post*Pensioner is large and statistically significant. Being a pensioner leads to 334,000 KRW more in private transfers from children in model (1) and 163,000 KRW more in net private transfers in model (3) relative to non-pensioners aged 60 and above after the pension compared to before. Since the pension amount is 996,000 KRW on average, pensioners receive 0.3 more per KRW in private transfers (model 1) and 0.16 more per KRW in net transfers (model 3). There is no evidence of crowding out in this case. The positive effect of the pension is even higher in models (2) and (4) in which the treatment and the control groups are pensioners aged 65-69 and individuals 60-64 years old at the bottom 60% of income distribution. Coresidence may be negatively correlated with private transfers because living together with children itself includes in-kind supports. The coefficient on coresidence is negative and significant when the control group is a low income group aged 60-64 as expected, but not significant when the control group is all non-pensioners. Women tend to live longer and are more dependent on their children's support. The coefficient of female is large and significant in models (1) and (3), but not in (2) and (4). Caregiving for grandchildren is not significant. In the survey, few elderly reported that they provide caregiving activity. In Table 5 the fraction of the single elderly providing care for their grandchildren is less for pensioners than non-pensioners. Other control variables have expected sign: parents with health problem receive more transfers; the more children the higher the transfers.

The results for couples in Table 9 are different from the single elderly. Pensioner couples receive 74,000 KRW more in transfers from their children relative to non-

	(1)	(2)	(3)	(4)
Dep. Var	Transfers from	m Children	Net transfers f	rom children
Control group	Non-pensioner	Bottom 60%	Non-pensioner	Bottom 60%
	60 +	60-64	60 +	60-64
Post	-983.40***	-1227.68***	-701.78***	-1195.89***
	(11.37)	(21.25)	(13.18)	(23.94)
Pensioner	-427.28***	-932.17***	-142.79	-1025.29***
	(130.54)	(126.92)	(101.34)	(102.45)
Post*Pensioner	334.63***	572.53***	162.91^{*}	633.77***
	(80.43)	(105.75)	(84.20)	(109.89)
Income	-0.01***	-0.03	-0.02***	-0.04
	(0.00)	(0.02)	(0.00)	(0.03)
Coreside	-231.17	-421.90***	-80.67	-356.34**
	(226.33)	(122.69)	(296.03)	(148.03)
Caregiving for	-34.47	267.46	118.91	230.03
grandchildren	(569.59)	(440.64)	(445.27)	(402.72)
Female	954.71**	918.49	839.86**	895.86
	(439.23)	(596.93)	(402.87)	(621.71)
Health problem	344.52^{***}	411.58***	321.83^{**}	446.94***
	(94.59)	(71.73)	(149.44)	(90.39)
No. of children	282.09***	291.00^{***}	259.39^{**}	272.56^{**}
	(93.95)	(106.16)	(107.65)	(117.34)
Household size	-201.79***	-196.42***	-243.60***	-206.71***
	(21.45)	(50.84)	(19.13)	(53.63)
Education	566.56^{***}	621.08***	511.20***	593.18^{***}
	(84.47)	(68.96)	(101.16)	(69.15)
Constant	556.74^{***}	1013.28***	381.77^{***}	1012.14^{***}
	(79.33)	(268.55)	(124.85)	(321.08)
Observations	1907	1491	1905	1490

Table 8. DID regression results for the single elderlyAll money valuesare in 2008 KRW (in thousand). Cluster-robust standard errors in parentheses.*p < .10, **p < .05, ***p < .01

	(1)	(2)	(3)	(4)
Dep. Var	Transfers from	m Children	Net transfers f	rom children
Control group	Non-pensioner	Bottom 60%	Non-pensioner	Bottom 60%
	60 +	60-64	60 +	60-64
Post	-111.87***	-278.28***	186.87***	113.22**
	(32.84)	(56.42)	(39.67)	(46.46)
Pensioner	504.64^{**}	145.30	697.51^{**}	603.81^{*}
	(203.62)	(275.41)	(311.85)	(359.02)
Post*Pensioner	74.06***	220.59^{***}	-186.58^{***}	-125.71^{*}
	(15.20)	(15.60)	(62.79)	(67.02)
Income	-0.03***	-0.04***	-0.07***	-0.07***
	(0.01)	(0.01)	(0.01)	(0.02)
Coreside	37.87	286.69	144.39	366.83
	(406.77)	(384.31)	(449.87)	(504.68)
Caregiving for	611.66^{*}	304.51	846.96*	356.15^{*}
grandchildren	(328.34)	(209.20)	(459.91)	(186.44)
Health Problem	402.83***	419.02***	480.38^{***}	457.02***
	(83.09)	(121.36)	(13.08)	(52.18)
No. of children	396.93^{***}	459.54^{***}	321.45^{***}	351.06^{***}
	(45.76)	(152.96)	(59.84)	(124.35)
Household size	41.91	-128.80*	-39.35	-175.30**
	(177.12)	(68.16)	(149.87)	(68.58)
Education	588.98^{***}	755.55***	476.94^{*}	786.14***
	(179.99)	(91.06)	(250.73)	(56.73)
Constant	-723.81***	-596.08	-445.65	-894.05
	(113.49)	(480.82)	(302.20)	(597.71)
Observations	2897	1782	2893	1778

Table 9. DID regression results for elderly couplesAll money values arein 2008 KRW (in thousand).Cluster-robust standard errors in parentheses.*p < .10, **p < .05, ***p < .01

pensioners (model 1), but they receive 186,000 KRW less in net transfers (model 3). Similar results apply to the restricted treatment and control groups (model 2 and 4). Since couples' average pension amount is 1,620,000 KRW, our estimate of the per KRW crowding out effect is -0.11 in net private transfers (model 3). The effects of observable characteristics are similar to those of the single elderly. Household size and coresidence are statistically more significant for the single elderly than for elderly couples.

Crowding out occurs for couple pensioners but not for single pensioners. What does this result tell us? As Tables 3-5 show, single pension recipients, on average, are considerably poorer and more dependent on private transfers than couple pensioners. This reflects the female elderly population being much larger than the male. The result can be explained by people becoming more generous when they are the only one to help someone in need compared to the case when there are others who can help. If your mother were alone, you would be more likely to help her out than you would if your father were still alive. The altruism literature ignores the fact that many generous acts cannot be explained by the additive form of other regarding preferences model. The standard altruism model predicts greater crowding out of private transfers for single pensioners than for couple pensioners as a result of public pensions. In fact, the results show the opposite, supporting other hypotheses such as filial norms and demonstration effects.

3.6 Conclusion

This exploration of the possible crowding out effect of the Basic Old Age Pension in Korea employed the Difference in Difference (DID) method. The DID estimates show mixed results: crowding out did not take place for the single elderly, while for elderly couples an additional unit of pension income was offset by a 0.11 reduction in net private transfers from adult children. These results should be interpreted with caution due to several limitations of the analysis. It encompasses only two relatively recent periods, and lack of longer period data makes it difficult to accurately measure possible time trend effects. Further, the Basic Old Age Pension is not strictly a randomized experiment because being eligible for the pension is not random; the treatment group and control group are systemically different regarding their income. However, private transfers do not affect pension eligibility; thus, reverse causality is less likely to work.

Still, the results offer important insights into the impact of public pension transfers on private transfers. A considerable proportion of the elderly population, especially women without a spouse, do not experience the crowding out effect, and among those who do, the size of the effect is relatively small. The results demonstrate a redistribution effect of the Basic Old Age Pension targeting the poor elderly in Korea.

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