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Gender Norms and Relative Earnings within Households – Evidence from South Korea

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Abstract.

Bertrand et al. (2015) and Hederos and Stenberg (2019) examined the distribution of the wife's share of household income declines sharply at the point where she starts to earn more than her husband to see whether the decline is due to a gender identity norm stating that a wife should not earn more than her husband. I closely replicate these papers and investigate whether the distribution of the wife's share of household income declines sharply at the point where the wife's income starts to surpass her husband's income in South Korea using administrative survey data. It is the first time to replicate Bertrand et al. (2015) paper in Asian country. I use the McCrary (2008) discontinuity test. I find that the distribution declines discontinuously by 24.4 percent at the cut-off and it's statistically significant and there is a large spike in the distribution of the wife's share of household income at the point where spouses earn exactly the same money. Excluding the equal-earning spouses from the sample, the remaining drop is 16.7 percent and it is statistically significant, thus the point mass of equal earning couples cannot account for all of the estimated discontinuities.

Keywords: Gender identity norms, spouse's relative earnings, South Korea

JEL: D10, J12, J16

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1 Motivation

I had a chance to learn about the paper “Gender identity and relative income within households - evidence from Sweden” by Hederros and Stenberg (2019, hereafter HS) in Gender Economics course. They examined the distribution of the wife’s share of household income declines sharply at the point where her income starts to surpass her husband’s income to see whether the decline is due to a gender identity norm prescribing that a wife should not earn more than her husband. They closely followed the paper Bertrand et al. (2015, hereafter BKP), which is about investigating the effects of gender identity by using administrative data, household income distribution between husband and wife. BKP show that the distribution of the wife’s share of household earnings drops sharply at the point where the wife starts to make more money than her husband, arguing that this drop is best explained by a gender identity norm especially called breadwinner norm. They also show that the social norm “a man should earn more than his wife” has impact on the distribution of relative earnings within households, the patterns of marriage and divorce, women’s labor supply, and the share of domestic chores between husbands and wives. I was fascinated by these papers trying to unravel the impact of norms from the impact of other causes since empirical studies of how norms affect economic outcome is scarce. I was interested in replicating these papers on South Korea setting in the first place. It is also the first time to replicate BKP paper in Asian country.

While previous empirical literatures focused on Western countries such as Sweden and the United States, the rapid increase in women’s labor market opportunities is not limited to these countries. In developed Asian countries such as Korea, a much faster change has occurred. At the same time, in South Korea, the marriage and fertility rates of educated women have declined significantly (Bertrand et al. 2015). The interaction between economic gain and intergenerational transmission of gender attitudes might play an important role in these changes (Hwang 2012).

By definition, breadwinner norm would be practically irrelevant in a world where a woman could never make more money than man. Thus, the relative gains of women's labor market opportunities over the last half century have made this breadwinner norm further relevant (Bertrand et al. 2015). These economic developments were particularly important since they happened quickly contrary to the slow-moving social norms and concepts of gender.

Korea is one of the top-performing OECD countries in reading literacy, mathematics and sciences with the average student scoring about 519, compared with the OECD average of 493, ranking 9th in the world (PISA 2018). The country has one of the world's highest-educated workforces among OECD countries (OECD 2016). However, stemming from deep-rooted patriarchal ideologies and practices, gender inequality in South Korea is consistently ranked among the highest in the world. Gender inequality has improved in healthcare and education, but it is still prevalent especially in South Korea's economy and politics (World Economic Forum 2017). According to World Economic Forum, Global Gender Gap Index 2020, South Korea ranked 108 out of 153 countries. However, people who are educated are more inclined to have preference for gender equality. According to the World Values Survey, people with low levels of education are more likely to agree with the statement that a woman should earn less than her husband because otherwise it is problematic. Therefore, questions were raised about why South Korea is falling behind in gender equality despite its high achievement in education in the country and how this mixed complex social environment affects household income between wife and husband.

According to World Values Survey which is cross-national dataset on human beliefs and values, people in South Korea follow the gender norm more than Swedish and American do.

Table 1. Survey question: Men should have more right to a job than women

South Korea						
	1989-1993	1994-1998	1999-2004	2005-2009	2010-2014	2017-2020
<i>Agree</i>	42%	43%	38%	36%	32%	53%
<i>Disagree</i>	28%	24%	26%	26%	23%	20%
<i>Neither</i>	29%	33%	33%	37%	45%	27%
<i>No answer</i>	1%	0%	-	0%	0%	-
<i>Don't know</i>	-	0%	3%	-	-	-
(N)	1,251	1,249	1,200	1,200	1,200	1,245

Sweden						
	1989-1993	1994-1998	1999-2004	2005-2009	2010-2014	2017-2020
<i>Agree</i>	8%	8%	2%	2%	2%	3%
<i>Disagree</i>	45%	90%	93%	93%	93%	94%
<i>Neither</i>	45%	-	4%	2%	5%	3%
<i>No answer</i>	-	-	-	1%	0%	0%
<i>Don't know</i>	2%	2%	0%	2%	0%	0%
(N)	2,094	1,009	2,028	2,177	1,206	1,19

United States						
	1989-1993	1994-1998	1999-2004	2005-2009	2010-2014	2017-2020
<i>Agree</i>	24%	19%	10%	7%	6%	5%
<i>Disagree</i>	69%	69%	81%	66%	69%	78%
<i>Neither</i>	5%	11%	8%	27%	24%	17%
<i>Missing; Unknown</i>	-	-	-	1%	-	-
<i>No answer</i>	0%	-	-	0%	1%	0%
<i>Don't know</i>	2%	1%	1%	-	-	-
(N)	1,839	1,542	1,200	1,249	2,232	2,596

Table 2. Survey question: Problem if women have more income than husband

	South Korea		United States		Sweden
	2010-2014	2017-2020	2010-2014	2017-2020	2010-2014
<i>Agree</i>	17%	33%	6%	5%	11% [○]
<i>Neither</i>	51%	35%	24%	17%	16%
<i>Disagree</i>	31%	32%	69%	78%	70%
<i>No answer</i>	1%	-	1%	0%	0%
<i>Don't know</i>	-	-	-	-	3%
(N)	1,200	1,245	2,232	2,596	1,206

Regarding the survey question that men should have more right to a job than women, from 1994 to 2014, the percentage of Korean who agree to this question steadily decreased from 43% to 32%. Unlike before, the percentage increased to 53% during 2017-2020. On the other hand, the percentage of Swedish who agree to this question was 2% from 1999 to 2014 and slightly increased to 3% during 2017-2020. The percentage of American who agree to this question has been in between that of Korean and Swedish. From 1989 to 2020, the percentage of American who agree with this statement constantly decreased from 24% to 5%.

Regarding the survey question that it is a problem if women have more income than husband, the percentage of Korean who agree with this question increased from 17% to 33% from 2010-2014 to 2017-2020. On the other hand, that number is much smaller in U.S. From 2010-2014 to 2017-2020, the percentage of American who agree with the question decreased from 6% to 5%. Sweden has a result only during 2010-2014 and 11 percent of Swedish agree with the question.

During 2017-2020, 94% of Swedish disagree with the statement that men should have more right to a job than women and 78% of American disagree, while only 20% of Korean disagree with the idea. During 2010-2014, 70% of Swedish disagree with the idea that it's a problem if women have more income than husband and 69% of American disagree, while only 31% of Korean disagree with that idea. Therefore, I expect the scale of discontinuity drop to be larger in South Korea than that of Sweden and U.S.

2 Research question

Compared to other countries like Sweden and U.S., do couples in South Korea conform to a norm stating that a wife should not earn more money than her husband? If so, what are the consequences? Individuals define their own identities with social categories. Identity is an individual perception of self and it becomes a part of utility function via social categories (Akerlof and Kranton 2000). According to Akerlof and Kranton, it is expensive to deviate from the standard behavior of one's social category. Identity economics is a concept that people make economic choices based not just on financial incentives, but also on their identity (Akerlof and Kranton 2010). While keeping financial incentives constant, people avoid behaviors that conflict with their self-concept (Akerlof and Kranton 2010). The authors show the importance of identity in economics by showing how predictions of the classic principal-agent problem change when considering the identity of the agent. For example, gender identity has an impact on who marries whom.

Social norms are rules of conduct supported by a combination of empirical and normative expectations (Bicchieri 2006). Individuals have a conditional preference for following social norms, provided that they maintain the right expectations (Bicchieri and Mercier 2014). Over the past century, gender norms have changed slowly in Korean society, primarily as the younger birth cohorts gradually replace the older ones over time. As the number of college-educated women increased, it has meant that their gender roles are different from those of their mothers and grandmothers. Many college-educated women create independent career plans for themselves and challenge the right of their parents when choosing a spouse (Savada and Shaw 1992).

Effective contraceptive techniques, labor-saving devices, improved childcare facilities and very low infant mortality allow women to have full-time jobs and children with or without a husband (ILO 2020). Traditional pro-fertility norms are no longer needed and are being turned into personal-choice norms, where people can choose their own behavior (Inglehart 2018). Economic developments by either new opportunities opening up or existing ones ending can lead to drastic changes in gender roles, which, in turn, can lead to changes in gender norms. However, there is often a time lag between changes in a given norm and changes in the practices that such a norm drives. For example, women are often employed in workplaces before norms about labor equality are integrated (ODI 2015). According to the surveys above, there are lots of Korean who have not adopted a new gender norm and still believe the breadwinner norm. Breadwinner norm works in two ways; through marital sorting and post-marriage behavior (Rosenberg 2020). Via marital sorting, woman gets married with a partner who earns more than herself and man gets married with a partner who earns less than himself. This is related to literatures on couple formation. Via their behavior after having married, wives minimize their workforce commitments, such as reducing work hours, limiting their investment in career development, or leaving workforce entirely.

There is similar argument on marital sorting regarding age – husband is normally older than his wife. Age gap is usually explained by either the rational choice model or the analysis of demographic trends in a society (Esteve et al. 2009). The rational choice model suggests that people search for partners who can support for them in their life as breadwinners; women prefer older men because men traditionally earn more as they age (Palós and Cortina 2009).

Closely following Hederos and Stenberg (2019), I investigate whether the distribution of the wife's share of household income declines considerably at the point where the wife begins to earn more than her husband in South Korea using administrative survey data. In addition, I will show if there is a surge in the distribution of the wife's share of household income at the cut-off where spouses make exactly the same income. Finally, I will investigate if there is a similar drop in South Korea data and if the drop is attributed to a gender identity norm stipulating that a wife's income should not exceed that of her husband.

3 Main contribution

My paper builds upon their original contribution and other studies in this literature in these ways; It is the first time to replicate BKP paper in Asian country. Other studies in this literature were only conducted in Western countries – US, Sweden, Germany, Finland and Switzerland, which can be called as WEIRD countries (Western, Educated, Industrialized, Rich and Democratic) which are unrepresentative of humans as a species. To the best of my knowledge, there has been no research conducted for specific replication of BKP paper in South Korea. Moreover, most of papers regarding gender wage gap in South Korea have been focused on difference between male and female sexes, not specifically between wife and husband within the household.

4 Background setting in South Korea

Confucianism is a socio-political philosophy and belief system that has influenced on South Korean society for a long time (Sleziak 2013). Confucianism is a philosophy that emphasizes the importance of a social classes to create a harmonious social balance (Rošker 2013). This hierarchical structure is explained through the Five Relationships, a main teaching in Confucianism that prescribes the main basic relationships between people as follows; ruler and ruled, father and son, husband and wife, elder brother and younger brother and friend and friend (Hwang 1999). The roles in each relationship also stipulated, for example, for husband and wife, the individual duties of the wife are staying at home, raising children and doing the chores while the husband supporting for the family as the breadwinner (Levi and Nicolas 2013).

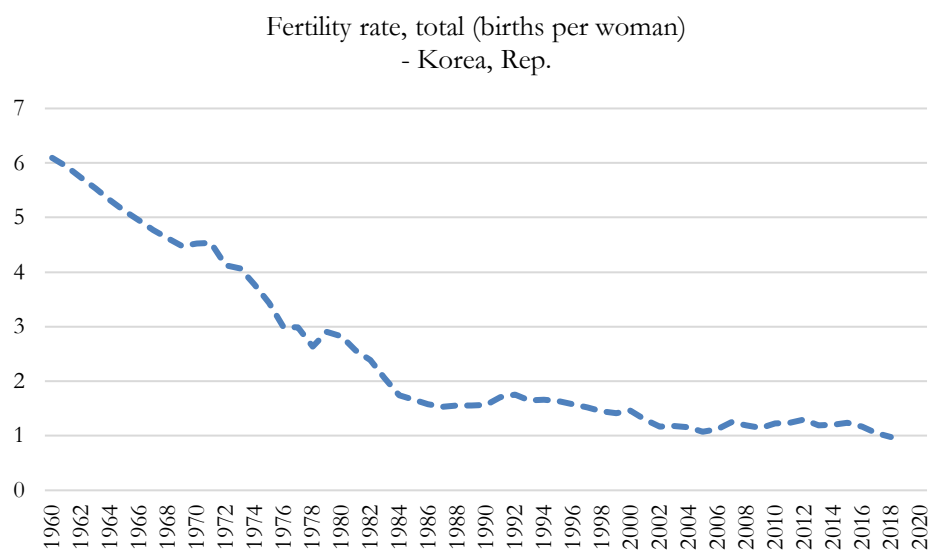
South Korea evolved into a dynamic, industrial society. Until 1990, standards of education and public health were high, most people lived in urban areas, and complex social hierarchies similar to those in Western countries or Japan had emerged (Savada and Shaw 1992). Rapid economic growth has brought major changes in values and human relationships. However, there was also continuity with the past. Confucian and neo-Confucian thoughts and institutions that flourished during the Choson Dynasty (1392-1910), continued to have a significant influence in 1990 (Levi 2013). The influence of Confucianism was most pronounced in the enormous value placed on education, a key factor in the development of Korean economy (Baker 2011). The persistence of hierarchical, often authoritarian, way of human interaction reflected the neo-Confucianism's emphasis on inequality (Savada and Shaw 1992).

Since the early 2000s, Korea has developed a comprehensive system of public and private formal childcare and kindergarten support for infants and their parents (OECD 2019). In Korea, there are conflicts between modern attitudes, traditional family expectations and dominant social and workplace practices, while at the same time, there are problems with job-insecurity, low wages, housing and education costs and all these factors affect willingness and first childbearing timing

decisions among young people (OECD 2019). Since the early 2000s, a wide range of measures have been implemented, including relatively generous parental leave eligibility to prevent declining fertility rates (OECD, 2019).

The 2010s witnessed social progress. Higher educational levels of the younger generation continued to rise as they jumped into social life. By the end of the decade, South Korea attained one of the highest levels of education in the world, with the age group 25-34 being the highest in the world (The Korea Herald, 2019). However, Korea's total fertility rate is the lowest in the OECD.

Figure 1. Korea's total fertility rate 1960-2020



Data source: Korean Statistical Information Service, United Nations World Population Prospects

The fertility rate fell below 1.3 children per woman in the 2000s and 2010s. It was 0.98 in 2018, the lowest in the world, and fell to 0.84 in 2020 (Statistics Korea 2021). Since the 2000s, the government has been working by providing financial incentives to couples to have more children and improving social services for mothers in order to increase the birth rate (The Korea Herald

2019). Despite the government's recent efforts, it has a minor impact on the fertility rates as they do not address the root cause of the decline (The Korea Herald 2019).

From 1960 until 2010, South Korea has switched from a poor rural society to a rich urban society (Kim 1998). The pace of the change largely divided Korea by generation. Older generations are rooted in a rural past so that they are hardly understood by generations in the current family formation (The Korea Herald 2021). The generational divide accounts for differences in gender attitudes. Older generations, rooted in the rural past, view women primarily as wives, mothers, and homemaker (Chung 1994). Although gender-essentialist worldview is prevalent, successive governments, including the current one, have adopted the pro-natalist policies (The Korea Herald 2021). The pro-natalist approach focuses on helping women to give birth and take care of their children. It is packed with forward-looking social welfare, but it is especially directed at women and characterized as a conservative and patriarchal approach (Brown et al. 2005).

The situation is exacerbated by structures built up by older generations that strengthen gender essentialism. South Korea's economy is dominated by massive, mostly family-run business companies and institutions that are dominated by men who work long hours (Jung 2004). South Korea has the third highest percentage of male workers who work long hours a week among OECD countries. Similarly, Korean men ranked second from the bottom for their daily time spent on unpaid work, including housework, shopping, and childcare (Miranda 2011). According to the OECD, Korean men only spend 49 minutes a day working unpaid while Korean women spent 215 minutes.

How likely do I think that before marriage a woman earns more than her husband in South Korea? Compared to other OECD countries, South Korea has a large gender gaps in terms of earnings, labor market participation, and representation in politics. The gender wage gap in Korea is the highest in the OECD: female workers in Korea earn only 63% of what male workers earn. Only 56.2% of women in Korea are employed and many women quit their jobs when they have

children (OECD 2017). The Federation of Korean Trade Unions (FKTU) stated that the widening wage gap is primarily due to the need for female workers to take time off to have children and take care of their families. In the country's top 50 conglomerates, female workers still earn less than their male counterparts in general because they are traditionally more likely to take care of their children than men (The Korea Herald 2019).

The professional gender inequality in South Korea is unusually high among developed countries. This type of inequality can be seen in statistics about the wage gap, employment rates, occupational segregation, and parental leave in South Korea (World Economic Forum 2017). In 2017, the OECD ranked Korea in the lowest of all OECD countries for gender pay gap, which is a position that has not improved since the OECD first published this ranking in 2000 (OECD 2017). The gender wage gap in Korea has been called "the worst among the industrialized countries." with female workers earning 65% of what their male counterparts make (USA Today 2015). Korea also hit the lowest for the eighth consecutive year on the glass-ceiling index released by The Economist in 2020. The glass-ceiling index, which measures where women have the best chance of equal treatment at work, was combined by the country's performance on nine indicators: wage gap, labor force participation, representation in senior jobs, paid maternity leave, etc. (The Economist 2016).

According to the World Bank data, the female labor force participation rate in South Korea in 2019 was 53.77 percent. This rate was lower than the average rate of female labor force participation in OECD countries. Gender occupational segregation means women are concentrated in low-paid jobs, which has been considered as one of the possible causes of gender inequality in the labor market (Gauchat et al. 2012). Men and women have a tendency to work in different industries. Women across the world are overrepresented in services and men are in construction and manufacturing sector (OECD 2002). In South Korea, contrary to the high percentages of male for high school graduates and university graduates and higher, the female

percentages were much lower at 39.58% and 27.62%, respectively (Patterson and Benuyenah 2021). Female education's low figures correspond with the high number of females in services and sales (22.68%) and clerks (16.47%) from 1997 to 2008 (Patterson and Benuyenah 2021). Korean women suffer from the same inter-occupational gap, a phenomenon that women were over-represented in low-paid jobs while seriously under-represented in high-paid ones, however, it seems that they are more affected by lower wages compared to male workers in the same job, a phenomenon known as the intra-occupation gender gap (Yoosik and Kazuo 2019).

However, drastic changes of gains in women's labor market opportunities have taken place in Korea. The marriage and fertility rates of educated women have declined significantly (Ma 2016). The interaction between economic growth and intergenerational changes in gender attitudes might have acted on these developments (Hwang 2012). While more and more women work outside the house, the dominant conception, particularly for the college-educated middle class, is that the husband is the "outside person," the main source of financial support; the wife is the "inside person," whose main responsibility is maintenance of the family (IBP 2012). Therefore, women still tend to leave the workforce when they get married. Perhaps the most important responsibility of a married women is getting involved in their children's education (Savada and Shaw 1992).

According to the 2005–2008 World Value Survey, the percentage of people who disagreed with the statement that “When jobs are scarce, men should have more right to a job than women” is 66.4% in the U.S., but only 44.2% in Hong Kong, 17.9% in Japan, 26.4% in Korea, and 36% in Taiwan. The sample size for each country is U.S. 1238, Hong Kong 1225, Japan 1042, Korea 1197, and Taiwan 1226. When it comes to saying “it is more important for a wife to help her husband's career than to have one herself,” 70.4% of Americans disagreed (General Social Survey), whereas less than half of respondents disagreed in Asia—22.9% in Japan, 35% in Korea, and 31.2% in Taiwan (East Asian Social Survey). The sample size for each country is U.S. 13,748, Japan 2130, Korea 1605, and Taiwan 2102.

5 Literature Review

Akerlof and Kranton (2000) proposed a model in which one's identity directly enters the utility function. Under this model, one's own identity can influence economic outcomes as it assumes that utility decreases if one is deviating from expected behavior for one's social category. Brecht et al. (2019) found that women strongly favor potential partners with higher education, but they found no evidence for men. Preferring a highly educated potential partner has to do with evolutionary psychology. In other words, man's reproductive capacity can be assessed by his potential to provide financially for future offspring, which is signalled by among others his education level. Bursztyn et al. (2017) suggested that single women avoid behaviors that would benefit their careers because of concerns about experiencing disadvantage at the marriage market. Their results show that marriage market signalling can be an additional explanation for gender differences in the labor market. Marriage market signalling has to do with explanations surrounding norms of gender identity. Views on traditional gender roles, in which the man is the main breadwinner and the woman the housewife, seem to be formed during adolescence and have been found to be heavily influenced by religious ideology (Thornton et al. 1983; Vella 1994; Guiso et al. 2003; Algan and Cahuc 2004). In general, it is the wife who minimizes their workforce commitments, by reducing working hours, limiting their investment in career development, or leaving the workforce entirely (Becker and Moen 1999).

A distorted marriage market equilibrium where most husbands out-earn their wives would be formed by a tendency for positive assortative marriage combined with the gender gap in earnings, even without the breadwinner norm that might affect these outcomes (Binder and Lam 2018). There are mechanisms that might affect the distribution of relative earnings (e.g. equalization of earnings); gender norm, financial or legal incentives, rounding, etc. There are two hypotheses. One is the norm of gender identity and the other is income equalization or convergence in co-working couples (Binder and Lam 2018). Income equalization in this context means earnings of

husband and wife become the same for several reasons. One reason is that couples may report identical income to the survey when there are fiscal incentives to do so. Another is that there are several factors to lead to income convergence in couples where both work in the same company (Zinovyeva and Tverdostup 2020). Binder and Lam (2018) found that distributions of spouse income gap do not provide any identifying evidence for the male breadwinner norm and that the discontinuity in this distribution reflects a point mass of equal-earning couples as wives start earning more than their husbands. A point mass of equal-earning couples might reflect a country's institutional framework, such as collective agreements, minimum wages, or a progressive income tax schedule with individual taxation, which provides incentives for spouses earn exactly 50 percent each.

Bertrand et al. (2015) analyse the impact of breadwinner norm on socioeconomic outcomes by showing that the distribution of the share of income earned by the wife declines considerably to the right of 0.5, where the wife's income surpasses the husband's income. In addition, this gender identity norm affects marriage formation, the wife's participation in the labor force, the wife's income conditional on working, marital satisfaction, likelihood of divorce, and the share of domestic chores. They verify that wives who would earn more than their husbands are more likely to quit their job and to earn less than their potential earnings conditional on working. Couples where the wife earns more than her husband are more likely to get divorced. Their results show that wife's share of domestic chores is higher when she earns more than her husband, supposedly in order to compensate her traditional role and reinforce gender identity.

The discontinuity in BKP's paper, which can be found in a decline in the graph, is because standard models of the marriage market, including agents optimizing continuous utility functions, should not produce a discontinuous equilibrium distribution. Such a finding suggests the existence of a utility penalty that applies only if the wife out-earns her husband. Their finding of a significant decline in the density function to the right of 0.50, together with the existence of the bunching of

equal earning couples, might suggest that couples manipulate their income on the margin in order to follow such a social norm (Binder and Lam 2018).

There were several researches on BKP's replication. Hederos and Stenberg (2019) base their main analysis on Swedish register data. They argue that the equal-earning couples should be removed from the sample before testing. After exclusion of the equal-earning spouses, they argue that the remaining drop is between 3.5 and 5.4 percent and they are statistically significant ($p < 0.05$) only when applying the default bandwidth. Exploiting the richness of their data, they show that about two thirds of equal-earning spouses are self-employed. They show that the discontinuity at which the wife starts earning more than her husband is primarily driven by spouses who earn the same incomes and that these spouses are less likely to have the same incomes because of gender norms. Wieber and Holst (2015) replicated BKP's to verify some parts of their paper on Germany and they also found that the distribution of the share of income earned by the wife fell sharply to the right of 0.50. Their results from fixed effects regression confirm that gender identity has impact on the labor supply of full-time working women, but only in Western Germany. Zinovyeva and Tverdostup (2020) replicated BKP's as well but they provided alternative explanation for their discontinuity independent of the gender identity norm. They used data from Finland and found that the discontinuity arises as a result of income equalization and convergence of earnings in co-working couples. By drawing on prior work by BKP's, Roth and Slotwinski (2019) introduced erroneous reporting in the survey data as an additional explanation about the debate on what causes the discontinuity in the distribution of women's income at the cut-off where the woman out-earns her partner. Specifically, they combined surveyed and administrative information for the same individual using a unique dataset available in Switzerland.

Pierce et al. (2012) also implemented a regression discontinuity design, but this time to show that men whose wives earn more than himself are more likely to use erectile dysfunction drugs than their male traditional counterparts who out-earn his wife. The authors argue that the

husband's share of income which is less than his wife may lead to psychological distress that affects partners' mental and physical health. Rosenberg (2020) also reexamined the breadwinner norm by investigating the relationship between the probability that a wife out-earns her husband and her participation in labor market. Her results suggest that breadwinner norm affects at the margin of marital sorting rather than on couples' behavior after marriage. The key finding of this paper is that whether wives become more likely to earn more than their husbands actually has little effect on their subsequent labor supply, conditional on having entered marriage. Mansury and Baek (2019) examined the gender income gap in South Korea using households as the unit of analysis. However, they focus on male-headed households and female-headed households and examine the multidimensional nature of gender inequalities, including discriminatory access to economic resources and opportunities. They found out that that Korean male-headed households earned 30% higher income on average than female-headed households.

6 Empirical approach

In this work, I examine if the Korean distribution exhibits a discontinuous drop at the point where the wife's income starts to exceed her husband's income.

McCrary (2008) introduced the concept of manipulation testing in the context of regression discontinuity (RD) designs. The key idea of manipulation testing in this context is that if there is no systematic manipulation of the unit's index around the cutoff, the density of units should be continuous near this cutoff value. Therefore, the existence of such discontinuity is usually accounted for as empirical evidence of self-selection or nonrandom sorting of units into control and treatment status. McCrary's test standard includes an algorithm that automatically selects a bin size for the histogram and a bandwidth within which to apply the local linear smoother to the histogram. In a regression discontinuity design, standard sufficient conditions for identification are

continuity of the conditional expectation of counterfactual results in the running variable. These continuity assumptions may not be plausible if agents can manipulate the running variable.

I assume X_i of N subjects indexed by $i = 1, \dots, N$. It is a random sample of size n from the random variable X using the cumulative distribution function (c.d.f.) and probability density function (p.d.f.) given by $F(x) = P(S \leq x)$ and $f(x) = \frac{dF(x)}{dx}$, respectively. The random variable X_i represents the score, index, or running variable for unit i in the sample. The key design feature in RD is that units have an observable running variable, score or index, and are assigned to treatment whenever this variable exceeds a known cutoff. An empirical study in RD designs attempts to compare the response of units just below the cutoff (control group) to the response of units just above (treatment group) in order to learn about the treatment effects of interest. Each unit is assigned to control or treatment depending on whether its observed score exceeds a known cutoff indicated by $\bar{x}$.

unit i assigned to control group if $X_i < \bar{x}$

unit i assigned to treatment group if $X_i \geq \bar{x}$

where the cutoff point x is known and it is assumed that enough observations are available for each group.

I follow McCrary(2008) and estimate the discontinuity in the density as

$$\hat{\theta} \equiv \ln \lim_{s \downarrow c} \hat{f}(s) - \ln \lim_{s \uparrow c} \hat{f}(s) \equiv \ln \hat{f}^+ - \ln \hat{f}^-$$

where c is the point of potential discontinuity and $\hat{f}^+$ and $\hat{f}^-$ indicate the densities just to the right and left of this point. Under standard non-parametric regularity conditions, $\hat{\theta}$ is consistent and asymptotically normal.

In the certain case of RD designs, manipulation tests can be used for sharp RD designs (where treatment assignment and treatment status match) and for fuzzy RD designs (where treatment assignment and treatment status are different). In the latter case, the test applies to the intention-to-treat mechanism because units can choose control or treatment status beyond the hard-thresholding rule for treatment assignment (that is, assigned to control group if $X_i < \bar{x}$ and assigned to treatment group if $X_i \geq \bar{x}$). A manipulation test in this context is a hypothesis test on the continuity of the density $f(x)$ at the cutoff point $\bar{x}$. It is the testing problem that I am interested in

$$H_o : \lim_{x \uparrow \bar{x}} f(x) = \lim_{x \downarrow \bar{x}} f(x) \text{ versus } H_a : \lim_{x \uparrow \bar{x}} f(x) \neq \lim_{x \downarrow \bar{x}} f(x)$$

A decisive factor is the choice of bandwidth h , which determines which observations near the cutoff $\bar{x}$ are used for estimation and inference. Nonparametric manipulation tests using local-polynomial density estimators are useful for falsification of RD designs and for empirical studies analyzing whether units are self-selected into a specific group or treatment status.

In my study, chances are couples self-select into husband out-earning their wife by manipulating the value of the running variable which is household income and will determine treatment assignment. Because of this, there are slightly too few couples just above the means test threshold, and slightly too many couples just below.

6-1 Data

My analyses are based on annual household survey data of married couples in South Korea from the years 1990-2016, encompassing 61,222 opposite-sex couples. The data stem from Household Income and Expenditure Survey (HIES), which is administered by Statistics Korea, and covers Korean population. It has information about income of household heads and their spouses.

This is an annual survey on household income and expenditures to provide basic data necessary to formulate household welfare-related policies. Target population is ordinary households of one or more members living in districts across the country including urban and rural area. The gender of the household head based on the highest contribution to household income. All data on income are average monthly amounts per household, and they are nominal amounts including inflation. In addition to earnings, there is detailed information on other labor market outcomes, demographic characteristics and education. Data collection method is an interview by surveyors. The concept of head of household used in this survey is characterized by main income earner. To set up my main analysis sample, I closely follow HS and restrict the sample to married couples in which both spouses have positive annual labor earnings. This leaves me with 61,222 couple-level observations from the years 1990-2016 before dropping couples who do not earn positive income and who do not work and not the age between 18-65 (working-age individuals). After dropping, 33,006 couples are remained.

According to Statistics Korea document, in a nutshell, they use 27,011 enumeration districts which are 10% of entire districts in South Korea as sampling frame. One district consists of about 60 households. Among 27,011 districts, they sampled 999 districts. Then they sampled 10 households by each district, resulting in 8,700 households being surveyed. Therefore, the sample size was around 7,500 households every year. Answers are not pre-coded on data collection forms but are coded by the interviewers (data collectors). Same couples are surveyed for 3 years in a row. The panel keeps in the sample for 3 years unless it drops out of the panel by moving out or becoming ineligible. As the survey randomly assigned household serial numbers, I couldn't restrict my main analysis sample to include only the observation from the first year the couple appears in the registers since it was impossible to identify unique couples across years. As such, robustness check is required and I did the robustness check in the later part by splitting the data using observations every three years to test the stability of my results.

6-2 Bandwidth selection and sensitivity

McCrary (2008) noted that the selection of bandwidth is important for good performance of $\hat{\theta}$. A bigger bandwidth (h) results in a shorter and wider “bump” that spreads out farther from the center and assigns more probability to the neighboring values. A small h results in a small standard deviation, and the kernel places most of the probability on the datum. This is used when the sample size is large and the data are tightly packed. A large h results in a large standard deviation, and the kernel spreads more of the probability from the datum to its neighbouring values. This is used when the sample size is small and the data are sparse. I use two smaller bandwidths which are equal to one half and one quarter of the default bandwidth. Reducing the bandwidth allows me to explore the sensitivity of my results to the spike. This is because the smaller the bandwidths, the more weight is given to couples with the same income.

McCrary (2008) recommends using a smaller bandwidth than the automatically-selected one (around half the size) to perform robust asymptotic inference. I take into account the automatically selected bandwidth, which in this case is around 0.06; and then bandwidths of 0.03 (one half) and 0.015 (one quarter). The last bandwidth may be too narrow for optimal statistical inference, but using successively smaller bandwidths allows me to discover the sensitivity of the test to the point mass (which gets more and more dominant as the bandwidth decreases).

The intuition for optimal bandwidth choice is to set up the objective of minimizing the (mean squared) error between the estimated treatment effect and actual treatment effect. Stata commands could automatically give bandwidth choice. Even though it is important to focus on results for the optimal bandwidth, it is also important to test for different bandwidth with using optimal bandwidth as a starting point.

6-3 Results

Like Hederos and Stenberg (2019) did, I will examine whether the distribution of wives' earnings shares exhibits a spike at the point where couples have exactly equal earnings and remove the equal-earning couples from the sample. I use the McCrary (2008) discontinuity test. In a first step, I show the descriptive statistics of my main analysis sample and the cross-sectional samples in Table 3.

Table 3. Descriptive statistics

Sample	Main		2006 cross-section		2011 cross-section		2016 cross-section	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Log income wife	13.53	1.10	13.47	1.12	13.75	1.01	14.05	0.92
Log income husband	14.32	1.09	14.25	1.17	14.54	0.98	14.76	0.82
Log income diff.	19.24	0.01	19.24	0.01	19.24	0.01	19.24	0.01
Wife's share of income	0.34	0.21	0.35	0.21	0.34	0.20	0.36	0.19
Wife out-earns husband	0.18	0.39	0.18	0.39	0.18	0.39	0.19	0.39
Age wife	41.34	9.15	40.70	8.33	42.60	9.12	45.17	9.94
Age husband	44.35	9.60	43.70	8.88	45.65	9.57	47.99	10.30
Age diff.	-3.00	3.04	-3.01	2.93	-3.05	3.15	-2.82	3.31
Education wife	3.27	1.26	3.20	1.22	3.39	1.25	3.64	1.25
Education husb.	3.60	1.32	3.54	1.30	3.70	1.31	3.86	1.32
Education diff.	-0.33	0.92	-0.34	0.89	-0.30	0.96	-0.22	0.94
N	31,212		1,897		1,863		1,442	

Notes: The main analysis sample includes couple observations in the registers between 1990 and 2016. The spousal differences are defined as the wife's characteristic minus the husband's characteristic. Education variable means 1 if the individual has completed elementary school, 2 = middle school, 3 = high school, 4 = two to three years college, 5 = undergraduate.

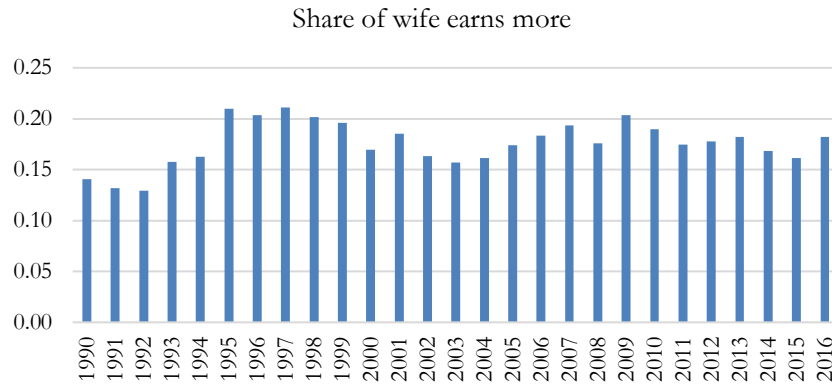
Main analysis dataset is pooled cross-sectional data from 1960 to 2016. Wife's share of income shows that it has been below 0.5 during 2006, 2011, 2016 cross-sectional and pooled cross-sectional data. The reason why I separate cross-sectional data during 2006, 2011, 2016 in summary statistics is to better understand why the distribution of the wife's share of household earnings has a spike at the point where spouses have equal earnings every five year in most recent years. In my main analysis sample, wives earn, on average, 34 percent (Compared with 38 percent in Swedish sample analyzed by HS) of total household labor earnings. The average wife is about three years

younger than her husband. Between 2011 and 2016, wives' average share of household earnings increased from 34 to 36 percent.

There is a difference between spouses' education. Education variable shows that as the number increases, it means that the individual has completed higher education. Husband's level of education has been higher than that of wife in the main analysis and all the years in cross-sectional analysis. Between 2006 and 2016, the spousal differences in education decreased from 34 to 22 percent. In my main analysis sample, 18 percent of wives earn more than their husband. Compared to that, 21 percent of wives earn more than their husband in Swedish data and 18.3 percentage in U.S. data. The fraction of wives out-earning their husband stayed the same as 18 percent between 2006 and 2011 and slightly increased from 18 to 19 percent in 2016.

Figure 2 shows that the fraction of wives who out-earn their husband has changed over time between 1990 to 2016. However, most of the time, it has been between 0.15 and 0.2.

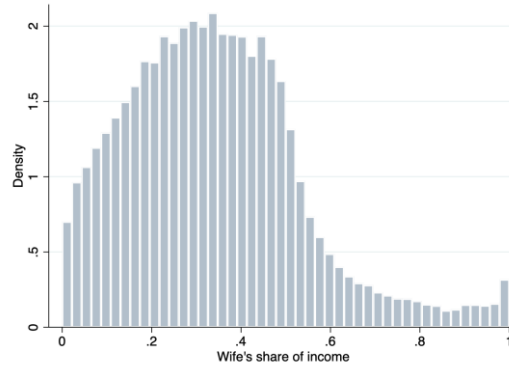
Figure 2. The fraction of wives out-earning their husband



Source: Household Income and Expenditure Survey (HIES), which is administered by Statistics Korea, 1990-2016

I define wife's share of income as $\frac{wifeIncome_i}{wifeIncome_i + husbIncome_i}$, where i indexes the couple, and $wifeIncome_i$ and $husbIncome_i$ are the total labor and self-employment income of the wife and the husband, respectively. I denote by w_{ijt} wife i 's share of household labor earnings in couple j in year t , where $0 < w_{ijt} < 1$.

Figure 3. Histogram of the share of income earned by the wife in Korea, 1990-2016

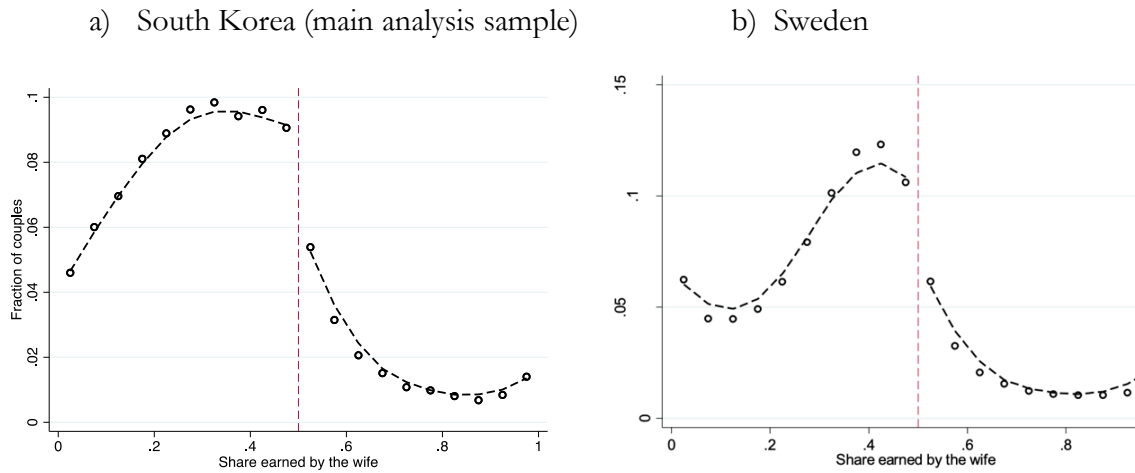


Notes: N = 33,006

In the next step, Figure 3 shows histogram, graphical presentation of the distribution of relative income. Figure 3 shows the distribution of couples according to the wife's share of household labor earnings in a sample of couples where both spouses are employed and have positive earnings. Like in the results of BKP, the histogram shows a sharp decline of the distribution of relative income at the 50 percent benchmark.

Figure 4 depicts the frequency distribution of wife's share of income grouped in 20 bins, along with a lowess (locally weighted scatterplot smoothing) estimate of the distribution on each side of $w_{ijt} = \frac{1}{2}$.

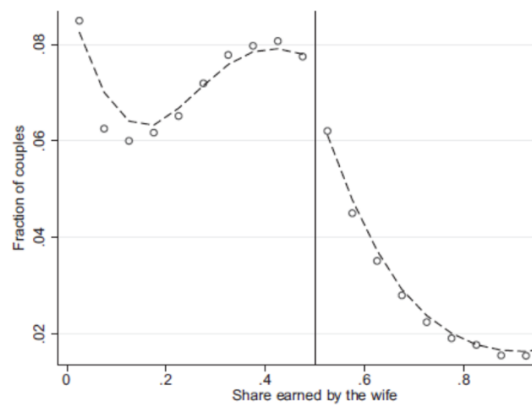
**Figure 4. Distribution of the share of total household labor earnings earned by the wife,
20 bins.**



Notes: The main analysis sample includes couple observations between 1990 and 2016. The sample includes married couples in which both spouses have positive incomes and are between 18 and 65 years of age. Each dot is the fraction of couples in a 0.05 relative earnings bin. The dashed vertical line indicates the relative income share = 0.50. The dashed line is the lowest smoother applied to the distribution allowing for a break at 0.50.

Notes: The main analysis sample includes one observation per couple (from the first year that the couple appears in the registers between 1990 and 2011). The sample includes married couples in which both spouses have positive incomes and are between 18 and 65 years of age. Each dot is the fraction of couples in a 0.05 relative earnings bin. The dashed vertical line indicates the relative income share = 0.50. The dashed line is the lowest smoother applied to the distribution allowing for a break at 0.50.

c) U.S.



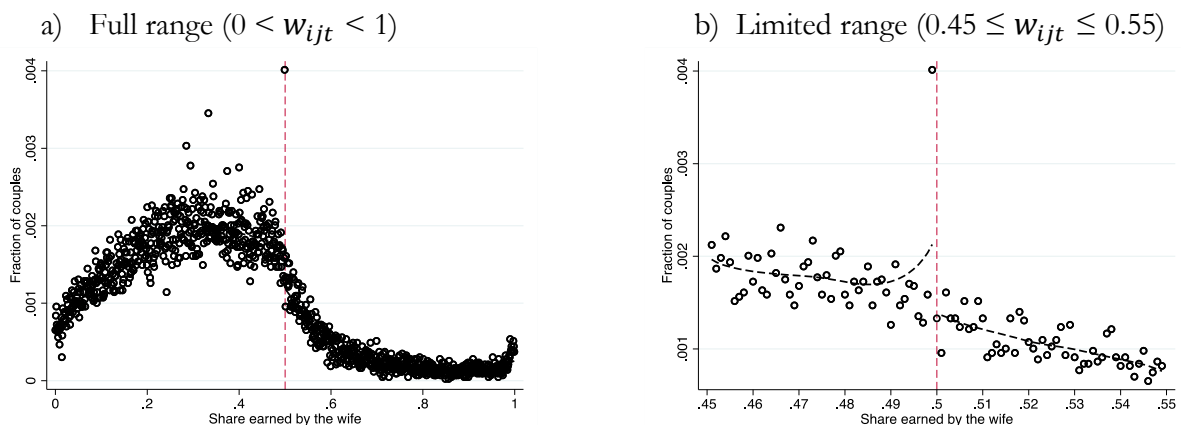
Notes: The data are from the 1990 to 2004 SIPP/SSA/IRS gold standard files. Figure reprinted from Bertrand, M., Pan, J. and Kamenica, E, Gender Identity and Relative Income Within Households, Quarterly Journal of Economics, 2015, 130(2), p. 571-614, by permission of Oxford University Press.

Figure 4 (a) depicts the frequency distribution of the wife's share of household labor earnings in my main analysis sample, grouped in 20 bins. The y-axis is the frequency of couples

corresponding to that earning ratio. This figure corresponds to Figure 1 in HS paper which is based on data from LISA database from 1990 to 2011. To make comparison easier, I show HS's figure in Figure 4 (b) and BKP's figure in Figure 4 (c). The Korean and Swedish distributions are overall similar. The most notable differences between the Korean and Swedish distributions are that the fraction of wives earning almost as much as their husband is higher in Sweden. I can find that the highest frequency of earning ratios are around where wife earns about the 35 percent of the household income in Korean data, which is lower percentage compared to Swedish data. The highest frequency of earning ratios of Swedish data are around where wife earns about 40 percent of the household income. The most notable differences in U.S. distributions are that the fraction of wives with a very low share of household earnings is higher in the U.S. compared to Korean and Swedish data. The fraction of wives earning almost as much as their husband is the highest in Sweden and it is higher in Korea than U.S.

The key question is whether the distribution of wives' earnings shares exhibits a spike at the point where couples have exactly equal earnings. Before I proceed to identify this, I investigate the distribution of relative earnings in more detail.

Figure 5. Distribution of the share of total household labor earnings earned by the wife, 1000 bins.



Notes: The main analysis sample includes couple observations in the registers between 1990 and 2016. The sample includes married couples in which both spouses have positive incomes and are between 18 and 65 years of age. Each dot is the fraction of couples in a 0.001 relative income bin. The dashed vertical line is the lowess smoother applied to the distribution allowing for a break at 0.50.

In Figure 5 (a), I show the frequency distribution of the wife's share of household earnings grouped in 1 000 bins, instead of 20 bins as in Figure 4 (a). The overall distribution is smooth except for a very pronounced spike (outlier) in the center of the distribution. The spike appears because couples bunch at the point where spouses have exactly equal earnings. In Figure 5 (b), I zoom in on couples in which the wife earns between 45 and 55 percent of household earnings. The spike at the point where spouses have equal earnings is then even more obvious from outlier. In my main analysis sample, spouses have equal earnings in 0.14 percent ($N = 45$) of all couples. The fraction of couples earning same income is 0.28 percent in Swedish sample (HS) and 0.21 percent in the U.S. sample (BKP), therefore, Korean sample has lower percentage regarding same income couples than Swedish and U.S. sample. Next, McCrary test (2008) is used in a second stage as a formal test of discontinuity in the percentage of income earned by the wife.

Table 4. McCrary test (2008) for the share of income earned by the wife in Korea

Sample	Cut-off	(1)	p-value	(2)	p-value	(3)	p-value	N
		$\hat{\theta}$		$\hat{\theta}$		$\hat{\theta}$		
Main	0,50001	-0,244	0,000	-0,274	0,000	-0,429	0,000	33006
2006 cs	0,50001	-0,105	0,642	-0,002	0,994	0,070	0,868	1870
2011 cs	0,50001	-0,014	0,948	-0,090	0,773	-0,015	0,972	1809
2016 cs	0,50001	-0,270	0,312	-0,309	0,431	-0,229	0,689	1357
Bandwidth		0,06		0,03		0,015		

The main analysis sample includes couple observations in the registers between 1990 and 2016. The bandwidth in column 1 is the bandwidth that is automatically selected in the McCrary (2008) test. The bandwidths in columns 2 and 3 correspond to one half and one quarter of this bandwidth.

BKP acknowledge in footnote 7 of their paper that the presence of the point mass presents a challenge and they tested for a discontinuity just to the right of 0.50 to circumvent this problem. Therefore, I tested for a discontinuity at 0.50001, just to the right of 0.5—consistent with testing for a gender norm that the wife should not earn firmly more than her husband. Table 4 reports the discontinuity estimates, which equal the estimated log increase in the height of the density function when moving from just to the left of the supposed benchmark to just to the right. A negative number thus indicates a sharp decline and a positive number indicates a sharp gain. I use default bandwidth which is automatically selected in the McCrary (2008) test and use a simple

undersmoothing method which is to take a reference bandwidth and to divide it by 2 (Hall 1992). Using the default bandwidth (0.06), I find that the distribution drops discontinuously by 24.4 percent at the cut-off and it's statistically significant ($p < 0.01$) in the main analysis. The drop for Sweden analyzed by HS was 20.9 percent and for the U.S. analyzed by BKP was 12.3 percent using the default bandwidth. Using the narrower bandwidths (0.03 and 0.015), the discontinuity drop in my main sample is between 27.4 and 42.9 percent and they are both statistically significant ($p < 0.01$). As the bandwidth shrinks, the estimate of the sharp decline increases in magnitude. This suggests that the point estimates are susceptible to the existence of the point mass. I show the drops in my cross-sectional samples for year 2006, 2011 and 2016 in rows 2-4 of table 4. All of the estimates are not statistically significant, however, all the estimates indicate negative number when using the default bandwidth. I find that the Korean distribution of the wife's share of household labor income declines considerably by between 24.4 and 42.9 percent at the point where the wife starts to out-earn her husband. This finding, which combines a significant decrease in the density function to the right of 0.50 and the presence of the bunching where spouses earn exactly the same, might imply that Korean couples manipulate their income on the margin to stick to such a social norm.

Table 5. Survey question: man is breadwinner and woman is homemaker. 2004-2019

	2004	2009	2014	2019
	Mean	Mean	Mean	Mean
Man breadwinner, woman homemaker	2.60	2.67	2.79	2.99
N	63268	40526	53976	52182

Source: Time use survey, Statistics Korea from 2004 to 2019

Table 5 is from Time use survey for households in Statistics Korea from 2004 to 2019. The question was if they agree with the statement that "man is breadwinner and woman is homemaker". Each number means 1 indicates "strongly agree" 2 "agree" 3 "disagree" and 4 "strongly disagree".

The number is increasing over time from 2.6 to 2.99 between 2004 and 2019, which means more people disagree with the breadwinner norm in South Korea.

I conclude that even though more people disagree with the breadwinner norm in Korea, the distribution of the wife's share of household income declines relatively more where the wife starts to earn more than her husband compared to Sweden and the U.S. Now I look into what extent the decline is driven by the equal-income spouses.

6-4 Is the discontinuous drop driven by the equal-earning couples?

I conduct a simple test to investigate if the discontinuity is driven by equal-earning couples. I drop all-equal earning spouses (N=45) and test if there is still a discontinuity. I keep the point mass of equal earning couples and test for a discontinuity at 0.5 and 0.500001 and drop the point mass and test for a discontinuity exactly at 0.50001.

Table 6. McCrary test for discontinuity in the distribution of the wife's share of total household labor earnings after excluding the equal-earning couples

Sample	Cut-off	(1)		(2)		(3)		N
		$\hat{\theta}$	p-value	$\hat{\theta}$	p-value	$\hat{\theta}$	p-value	
Main	0,5	-0,078	0,161	0,027	0,725	0,081	0,447	33006
Main	0,50001	-0,244	0,000	-0,274	0,000	-0,429	0,000	33006
Main, dropping equal earners	0,50001	-0,167	0,003	-0,130	0,107	-0,190	0,096	32961
Bandwidth		0,06		0,03		0,015		

Notes: Sample of spousal earnings data taken from the Household Income and Expenditure Survey (HIES). The first reported bandwidth and bin size correspond to those automatically selected by the McCrary (2008) test algorithm. McCrary (2008) recommends using a small bandwidth than the automatically selected one, as is done in the second thru fourth rows. Point estimates report the change in log height of the density function as one travels from just left of the supposed breakpoint to just right of it.

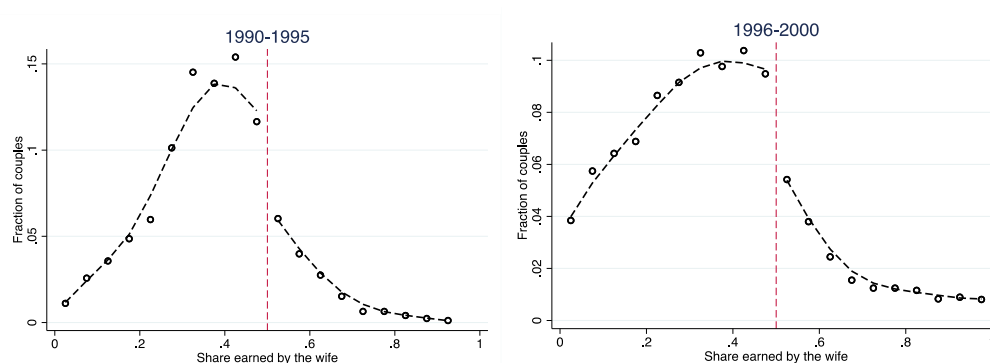
Excluding the equal-earning spouses from the sample, the remaining drop is 16.7 percent applying the default bandwidths (0.06) and it is statistically significant ($p < 0.01$). Using the narrower bandwidths, the drop is 13 and 19 percent but they are not statistically significant. There is the

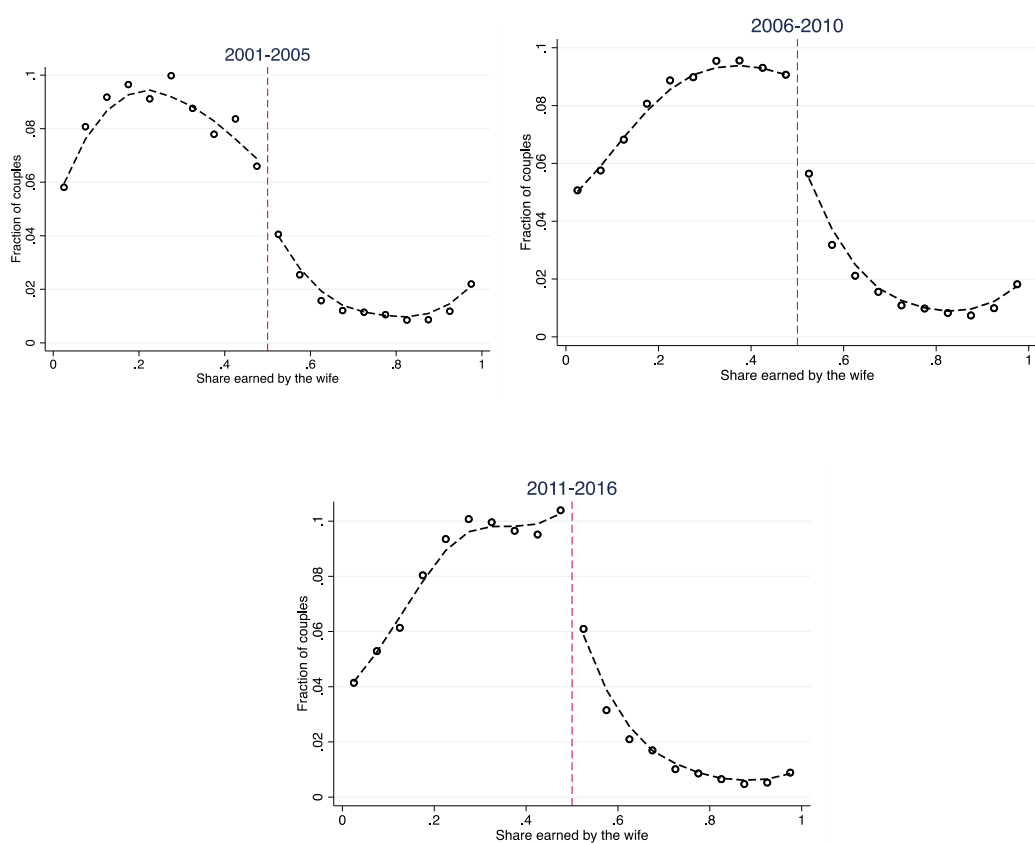
existence of a small share of couples earning exactly the same incomes. This produces a point mass in the distribution of the wives' relative income at exactly 0.5. Results show that the point mass of equal-earning couples is somewhat responsible for this discontinuity, in other words, omitting these couples eliminates some part of the estimated discontinuities. The result shows that equal earners account for 31.6 percentage of the discontinuity. However, the point mass of equal earning couples cannot account for all of the estimated discontinuities since the remaining drop is 16.7 percent and it is statistically significant. The size of equal-earning spouses is relatively small ($N=45$) and I couldn't find any common trait about them from the information on other labor market outcomes, demographic characteristics and education.

6-5 Trend over time analysis in Korea – Rapidly changed society compared to Sweden

I examine how the distribution of couples with regard to the wife's share of household labor earnings has evolved over time during 1990-2016. I divide the sample into every five year. As Figure 6 shows, the decline in the distribution at equal earnings is present in every period. This discontinuity is located right at the point at which a wife would outearn her partner.

Figure 6. Distribution of the share of total household labor earnings earned by the wife – trend over time





Notes: The main analysis sample includes couple observations between 1990 and 2016. The sample includes married couples in which both spouses have positive incomes and are between 18 and 65 years of age. Each dot is the fraction of couples in a 0.05 relative earnings bin. The dashed vertical line indicates the relative income share = 0.50. The dashed line is the lowest smoother applied to the distribution allowing for a break at 0.50.

The size of the discontinuity seems to have shrunk in the past 15 years from 1990 to 2005 but it seems to have got bigger again since 2006. Next, McCrary test (2008) is used to estimate the discontinuity in the percentage of income earned by the wife.

Table 7. McCrary test (2008) for the share of income earned by the wife in Korea – trend over time

Sample	Cut-off	(1)	p-value	(2)	p-value	(3)	p-value	N
		$\hat{\theta}$		$\hat{\theta}$		$\hat{\theta}$		
Main	0,50001	-0,244	0,000	-0,274	0,000	-0,429	0,000	33006
90-95	0,50001	-0,351	0,145	-0,297	0,373	-0,344	0,442	1708
96-00	0,50001	-0,319	0,026	-0,314	0,111	-0,412	0,159	4578
01-05	0,50001	0,016	0,909	0,067	0,730	0,124	0,644	7866
06-10	0,50001	-0,229	0,032	-0,237	0,108	-0,410	0,043	9175
11-16	0,50001	-0,324	0,001	-0,367	0,007	-0,372	0,049	9679
Bandwidth		0,06		0,03		0,015		

The main analysis sample includes couple observations in the registers between 1990 and 2016. The bandwidth in column 1 is the bandwidth that is automatically selected in the McCrary (2008) test. The bandwidths in columns 2 and 3 correspond to one half and one quarter of this bandwidth.

McCrary test (2008) also shows similar pattern with figures above. In table 7, I show the results with the cut-off at 0.50001. Using the default bandwidth (0.06), this drop has decreased over time, from 35.1 percentage in 1990-1995 and 31.9 percentage ($p < 0.05$) in 1996-2000 to 22.9 percentage ($p < 0.05$) in 2006-2010. However, in 2001-2005, the estimate is positive, therefore it doesn't indicate the drop but it is not statistically significant. The drop in the distribution has increased again from 22.9 percentage ($p < 0.05$) in 2006-2010 to 32.4 percentage ($p < 0.01$) in 2011-2016.

In my additional analysis samples, I show figures of discontinuity and run the McCrary test separately for the following groups: Older and younger couples, higher education and lower education couples.

6-6 Older and younger couples

I start to present the percentage of wives marrying husbands of particular age. I restrict the sample to couples where the wife is between 22 and 51 years of age. Husband's age is three years older than his wife based on descriptive statistics.

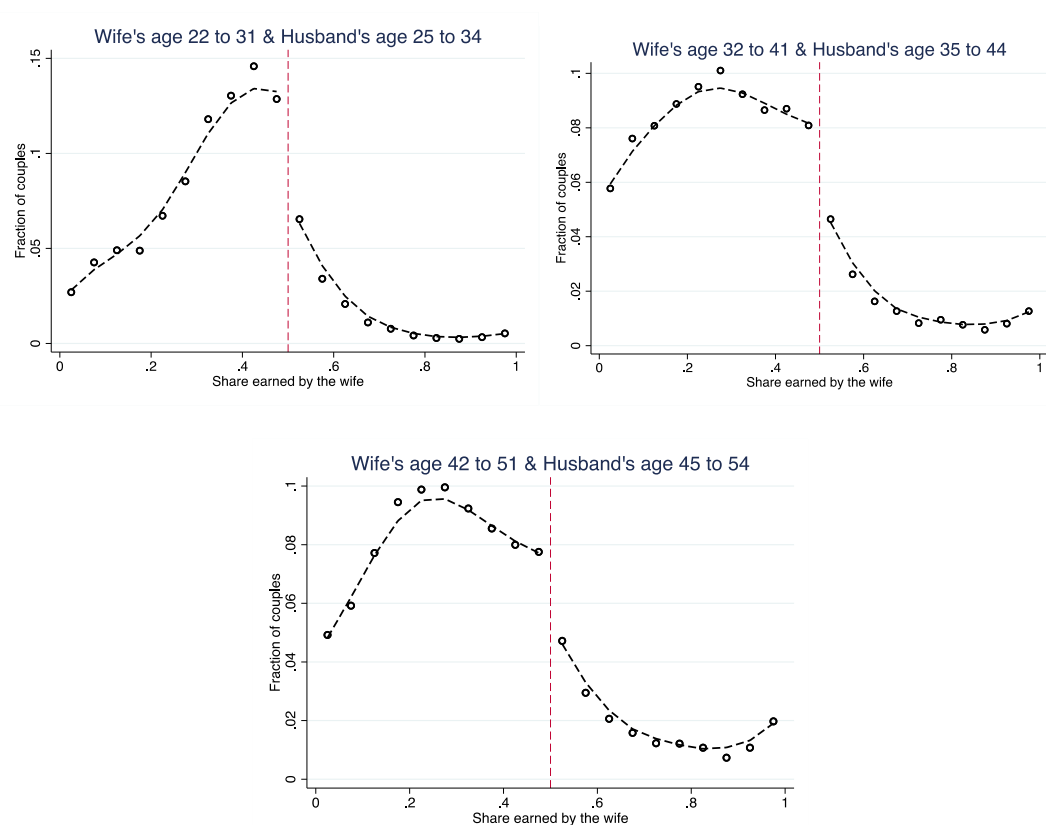
Table 8. Percentage of wives marrying husbands of particular age

	Husband's age		
Wife's age	25 to 34	35 to 44	45 to 54
22 to 31	0,137	0,025	0,011
32 to 41	0,041	0,293	0,045
42 to 51	0,001	0,042	0,239

Source: Household Income and Expenditure Survey (HIES), which is administered by Statistics Korea, 1990-2016

I divide couples into three groups – older couples (wife’s age 42 to 51 and husband’s age 45 to 54), the middle couples (wife’s age 32 to 41 and husband’s age 35 to 44) and younger couples (wife’s age 22 to 31 and husband’s age 25 to 34). I expect the younger couples to be less conservative than older couples, therefore, the discontinuity to be smaller for younger couples and larger for older couples.

Figure 7. Distribution of the share of total household labor earnings earned by the wife – different age groups



Notes: The main analysis sample includes couple observations between 1990 and 2016. The sample includes married couples in which both spouses have positive incomes and are between 18 and 65 years of age. Each dot is the fraction of couples in a 0.05 relative earnings bin. The dashed vertical line indicates the relative income share = 0.50. The dashed line is the lowest smoother applied to the distribution allowing for a break at 0.50.

Table 9. McCrary test (2008) for the share of income earned by the wife – Sample by age

Sample	Cut-off	(1)		(2)		(3)		N
		$\hat{\theta}$	p-value	$\hat{\theta}$	p-value	$\hat{\theta}$	p-value	
Wife's age 22 to 31 Husband's age 25 to 34	0,50001	-0,213	0,132	-0,251	0,197	-0,231	0,394	4525
Wife's age 32 to 41 Husband's age 35 to 44	0,50001	-0,284	0,008	-0,231	0,118	-0,175	0,410	9768
Wife's age 42 to 51 Husband's age 45 to 54	0,50001	-0,251	0,040	-0,262	0,119	-0,330	0,143	7904
Bandwidth		0,06		0,03		0,015		

The main analysis sample includes couple observations in the registers between 1990 and 2016. The bandwidth in column 1 is the bandwidth that is automatically selected in the McCrary (2008) test. The bandwidths in columns 2 and 3 correspond to one half and one quarter of this bandwidth.

With the standard bandwidth and bin size, I estimate that the density function declines for younger couples (wife's age 22 to 31 and husband's age 25 to 34) by 21.3 percentage across the threshold and it is not statistically significant but my sample for the young couples is substantially smaller here. For older couples (wife's age 42 to 51 and husband's age 45 to 54) it is a 25.1 percentage drop and it is statistically significant ($p < 0.05$). However, the middle couples (wife's age 32 to 41 and husband's age 35 to 44) show larger estimate than older couples, 28.4 percentage and it is statistically significant ($p < 0.01$). This result doesn't align with my expectation that the effect of gender norm is large for older couple and thus the estimate of discontinuity would be bigger for them. Therefore, at least this finding doesn't show the evidence that Korean couples follow the breadwinner norm from the distribution of the share of total household labor earnings earned by the wife.

6-7 Couples with different educational levels

According to the World Values Survey, people with low levels of education are more likely to agree with a statement that women must earn less than their husbands to avoid problems. I

analyze the effect of gender norm according to the educational levels of couples. First, I present the percentage of wives marrying husbands of particular education in Table 10.

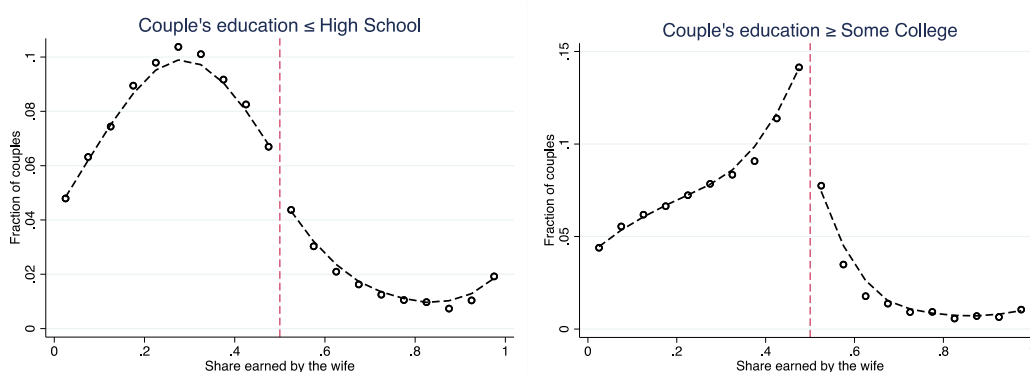
Table 10. Percentage of wives marrying husbands of particular education

Wife's education	Husband's education	
	$\leq$ High School	$\geq$ Some College
$\leq$ High School	0,512	0,152
$\geq$ Some College	0,099	0,321

Source: Household Income and Expenditure Survey (HIES), which is administered by Statistics Korea, 1990-2016

I expect couples with higher education to be less conservative - I should expect the discontinuity to be greater among less-educated couples. I define less-educated couples as couples who completed high school or less and more-educated couples who completed college or more.

Figure 8. Distribution of the share of total household labor earnings earned by the wife – different education levels



Notes: The data is from the 1990 to 2016 Household Income and Expenditure Survey (HIES). The sample includes all married couples where both the husband and wife earn positive income and are between 18 and 65 years of age. Each dot is the fraction of couples in a 0.05 relative income bin. The vertical line indicates the relative income share = 0.5. The dashed line is the lowess smoother applied to the distribution allowing for a break at 0.5.

Table 11. McCrary test (2008) for the share of income earned by the wife – different education levels

Sample	Cut-off	(1)		(2)		(3)		N
		$\hat{\theta}$	p-value	$\hat{\theta}$	p-value	$\hat{\theta}$	p-value	
Couple's education ≤ High School	0,50001	-0,247	0,009	-0,301	0,024	-0,571	0,003	15603
Couple's education ≥ Some College	0,50001	-0,293	0,000	-0,199	0,088	-0,113	0,474	8944
Bandwidth		0,06		0,03		0,015		

The main analysis sample includes couple observations in the registers between 1990 and 2016. The bandwidth in column 1 is the bandwidth that is automatically selected in the McCrary (2008) test. The bandwidths in columns 2 and 3 correspond to one half and one quarter of this bandwidth.

Results are not consistent with my expectation regarding the gender identity norm hypothesis. The estimated drop at 0.50001 is 24.7 percentage among less-educated couples and it is statistically significant ($p < 0.01$) and it is 29.3 percentage among more-educated couples and it is statistically significant ($p < 0.01$). I find that the drop in the distribution of relative earnings is larger among more-educated couples, which is opposite to my expectation. My interpretation of these cases is that the results do not provide much evidence about social norm regarding husbands earning more than wives from relative earnings within households in Korea.

6-8 Robustness check

In the data section, I mention that same couples are surveyed for 3 years in a row. The panel keeps in the sample for 3 years unless it drops out of the panel by moving out or becoming ineligible. As the survey randomly assigned household serial numbers, I couldn't restrict my main analysis sample to include only the observation from the first year the couple appears in the registers since it was impossible to identify unique couples across years.

Therefore, I split the data to test the stability of my results by using observations every three years; 1990, 1993, 1996, 1999, 2002, 2005, 2008, 2011, and 2014. However, if samples are

overlapping it means I give some observations a greater weight, but as long as these couples are not systematically different from other couples the analysis should be plausible.

Table 12. McCrary test for discontinuity in the distribution of the wife's share of total household labor earnings (cross-section)

Sample	Cut-off	(1)	p-value	(2)	p-value	(3)	p-value	N
		$\hat{\theta}$		$\hat{\theta}$		$\hat{\theta}$		
Main	0,50001	-0,244	0,000	-0,274	0,000	-0,429	0,000	33006
1990 cs	0,50001	0,237	0,831	-0,511	0,714	-0,511	0,795	178
1993 cs	0,50001	-0,402	0,396	-0,167	0,797	-0,442	0,645	361
1996 cs	0,50001	-0,641	0,196	-0,582	0,381	-0,693	0,490	428
1999 cs	0,50001	-0,439	0,072	-0,395	0,230	-0,405	0,407	1306
2002 cs	0,50001	-0,129	0,729	-0,031	0,952	-0,134	0,860	1046
2005 cs	0,50001	-0,158	0,543	-0,324	0,387	-0,167	0,739	2084
2008 cs	0,50001	-0,305	0,209	-0,020	0,956	-0,042	0,935	1704
2011 cs	0,50001	-0,014	0,948	-0,090	0,773	-0,015	0,972	1809
2014 cs	0,50001	-0,261	0,241	-0,233	0,427	-0,325	0,408	1610
Bandwidth		0,06		0,03		0,015		

The main analysis sample includes couple observations in the registers between 1990 and 2016. The bandwidth in column 1 is the bandwidth that is automatically selected in the McCrary (2008) test. The bandwidths in columns 2 and 3 correspond to one half and one quarter of this bandwidth.

Most of estimates are negative except for 1990 cross sectional data using default bandwidth. All the estimates are negative in every cross-section sample using 0.03 and 0.015 bandwidth. However, all the estimates are not statistically significant regardless of the selection of bandwidth. Therefore at least this result shows that it is consistent with main analysis sample in terms of the existence of drop.

7 Conclusions

Compared to other countries like Sweden and U.S., do couples in South Korea comply with a norm stating that a wife should not earn more than her husband? If so, what are the consequences? I investigate whether the distribution of the wife's share of household income declines considerably at the point where the wife starts to out-earn her husband in South Korea using administrative survey data. In addition, I demonstrate if there is a surge in the distribution of the wife's share of household income at the point where spouses make exactly the same income. I conclude that even though more people disagree with the breadwinner norm in Korea, the distribution of the wife's share of household income in Korea declines relatively more at the point where the wife starts to earn more than her husband compared to Sweden and the U.S. I also conduct how the distribution of couples with regard to the wife's share of household labor earnings has evolved over time to test the stability of my results.

I find that the distribution drops discontinuously by 24.4 percent at the cut-off and it's statistically significant ($p < 0.01$) using the default bandwidth. The drop for Sweden analyzed by HS was 20.9 percent and for the U.S. analyzed by BKP was 12.3 percent using the default bandwidth. There is a spike at the point where spouses have exactly equal earnings. Excluding the equal-earning spouses from the sample, the remaining drop is 16.7 percent applying the default bandwidths (0.06) and it is statistically significant ($p < 0.01$). 31.6 percentage of the discontinuous drop is driven by the equal-earning couples and thus the point mass of equal earning couples cannot account for all of the estimated discontinuities. The size of equal-earning spouses is relatively small ($N=45$) and examination of the equal-earning spouses doesn't show any common trait about them from the information on other labor market outcomes, demographic characteristics and education.

All the heterogeneity tests that I did at the end of the analysis do not support the existence of the norm at least from the discontinuity in the distribution of the wife's share of total household labor earnings. I conclude that my finding of a significant drop in the density function to the right

of 0.50, together with a spike of equal earning couples might suggest that couples manipulate their income on the margin to abide by breadwinner norm. However, my results couldn't find any implication from equal earning couples like HS. Future research is required on how much the effect of gender norm could explain this discontinuity.

Korean wives who would earn more than their husbands might rather diminish their income to re-install traditional gender roles. One potential reason for the different results in South Korea compared to Sweden and U.S. could be differences in cultural background and the labor market composition for women.

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