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IZA DP No. 12977

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ABSTRACT

Rethinking Specialisation and the Sexual Division of Labour in the 21st Century*

This paper aims to shed new light on explanations for the sexual division of labour, within a broader examination of within-household specialisation. We propose a set of indices which we believe are the first direct within-couple measures of specialisation. We use these to present a rich descriptive profile of specialisation. Absolute advantage in market work has only a small role in behaviour for heterosexual couples, and no role at all for same-sex couples. In contrast, sex-based specialisation is much greater. We consider whether the patterns in the data are consistent with a formal Beckerian model of comparative advantage. A woman would need to be 109 times more productive in market work than her male partner before reaching expected parity in domestic work, and this is likely biased downwards due to endogeneity of relative wages related to earlier time use decisions.

JEL Classification: D13, J16

Keywords: sexual division of labour, family economics, specialisation, gender, time use

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1. Introduction

The sexual division of labour, by which men specialise in market work (MW) and women specialise in domestic work (DW) has been studied through various lenses. The canonical economic explanation is biologically-determined comparative advantage within heterosexual couples (Becker 1991). According to this theory, women's innate ability to bear, deliver and feed children with their own milk, leads them to specialise in DW, whilst men focus on MW (Becker, 1991). Becker (1991) argues that even small differences in sex-based biological determinism can lead to large differences in comparative advantage, due to gendered differences in human capital investments from very early in the life course. The sexual division of labour is also consistent, however, with other explanations. In particular, alternate models emphasise the role of gendered cultural norms (Akerlof and Kranton, 2000; Bertrand et al., 2015).

The family economics literature has long dispensed with the unitary framework of household behaviour which underpins Beckerian models. Instead, distinct preferences of family members are emphasised in cooperative and non-cooperative bargaining models (see for example the discussion in Lundberg and Pollak, 1996).[2] Nevertheless, despite the claims of some, bargaining models do not provide an alternative explanation for the sexual division of labour. Comparative advantage and gender norms remain the two competing theoretical paradigms for understanding this phenomenon.[3]

[2] This literature has focused primarily on implications for within-household distribution of consumption. In contrast, there is scant empirical literature on the efficiency of within-household allocation of productive time (Udry 1996 is an exception). And indeed, many bargaining models retain an assumption of efficient allocation of resources (Lundberg and Pollak, 1996). Nevertheless, in the words of Lundberg and Pollak (2003), 'one of the casualties of this paradigm shift from unitary to non-unitary models is the presumption that families are efficient.' This is because time-use allocations not only affect current domestic production, but also future bargaining power, for example through human capital implications, and so they may not lead to productive efficiency (Lunderg and Pollak, 2003).

[3] The sociological tradition provides an alternative explanation for women's higher housework contributions: 'exchange theory', which emphasises power and dependence. This explanation proposes that women do more housework than men because they have lower economic power, as measured by relative earnings (Bittman et al., 2003). This model, however, does not explain why women do more housework instead of more market work as a consequence of economic power imbalance. Indeed hours of market

In this paper, we aim to shed new light on these explanations for the sexual division of labour, within a broader examination of within-household specialisation. We begin with presenting a rich descriptive profile of specialisation. To this end, we propose a set of three new household-level Specialisation Indices. To our knowledge, specialisation has not previously been measured using time-use inputs from both the labour-market and household spheres for both couple members. [4] Our first specialisation index (SI_1) measures the extent to which one member of the couple does most of the MW, whilst the other member does most of the DW. This index is hence sex-neutral, and blind also to absolute advantage in the market (AAM). It therefore allows us to explore the extent of within-household specialisation, without imposing any assumptions on its determinants. The second index (SI_2) is a measure of sex-based specialisation - relevant only for heterosexual couples. It takes its maximum value when the male partner does all of the MW and none of the DW. The third index (SI_3) measures the extent to which couples specialise in a way which conforms with AAM. It takes its maximum value when the spouse with the higher hourly wage does all of the MW, while the other member does all of the DW.

Using these indices, we quantify the extent of specialisation within heterosexual couples and within same-sex couples. We show that patterns of specialisation are diverse. We then study the extent to which specialisation conforms with sex-norms and with AAM. We also explore the role of children and intentions to have children. And we seek to explain differences in specialisation between couple types using simple regression models. The data we draw upon are from Australia's Household, Income and Labour Dynamics (HILDA) panel survey. HILDA is ideally suited for

work are usually treated as exogenous. Therefore, it does not provide an explanation for specialisation or the sexual division of labour, *per se*.

[4] Whilst many studies discuss specialisation, few explicitly seek to measure it. Of those that do, most use labour-market proxies "as signals of household specialisation" (Jepsen & Jepsen, 2015, p. 110), rather than measuring specialisation in its own right. See also Hersch & Stratton (2000), Antecol & Steinberger (2013), Giddings et al. (2014) & Jepsen & Jepsen (2015). Such proxies are problematic because working more labour-market hours than one's spouse does not necessarily imply doing less hours in domestic labour, or vice versa (Bittman et al., 2003; Bertrand et al., 2015). Conversely, others have attempted to measure household specialisation using only measures of time in domestic work, ignoring market work (Stratton, 2005; Bonke et al. 2008; Nottmeyer, 2011). Other papers, such as Black et al. (2007) and Juhn & McCue (2017), seek to circumnavigate these issues altogether by providing a descriptive analysis of specialisation. Whilst useful in their discussion of the connection between human capital accumulation and specialisation, their capacity to quantify the extent of specialisation occurring across households is limited.

this analysis given the set of time use variables it collects, as well as its panel dimension, which greatly helps to reduce missing wage data, which is crucial to the analysis.

Our results suggest that AAM is only a small factor in specialisation for heterosexual couples and plays no role at all for same-sex couples. In comparison, sex-based specialisation is much larger. We show, however, that sex-based specialisation has declined over recent decades. We also show that married heterosexual couples specialise considerably more than same-sex couples, with unmarried heterosexual couples in between. Almost all of these differences, however, are explained by the presence of children and fertility expectations. In contrast, the similar differences in AAM-based specialisation are largely unexplained by observed characteristics. This reaffirms the possibility that the (already small) role of AAM for heterosexual couples is overestimated, potentially confounded by gendered human capital accumulation.[5]

We then adopt a more structural approach to consider whether a Beckerian model of comparative advantage can explain these patterns of time allocation. There are considerable theoretical and empirical challenges which impede this task. However, we show that a woman would need to be more than 100 times productive in market work than her male partner before reaching expected parity in domestic work. Even amongst couples without children, expected wage parity occurs only when the woman's wage is 12.6 times higher than her husbands'. It seems very unlikely this is due to offsetting differences in domestic work productivity. By default, these results seem to reflect gender norms.

The remainder of the paper is structured as follows. Section 2 describes the three specialisation indices in detail and Section 3 discusses data. Section 4 presents a rich descriptive profile of specialisation. In Section 5 we describe the extent of sex-based specialisation and AAM-based specialisation in detail. Section 6 explores the relationships between specialisation and couple

[5] As we discuss in Section 7, AAM is likely endogenous, but the direction of resulting bias is favourable. AAM is a function of human capital, which in turn reflects choices about time use allocation made in earlier periods of life – through labour supply, and through education. In a similar vein, Becker's theory of sex-based specialisation describes a process of gendered human capital accumulation throughout the life course. This implies that AAM may be a consequence of earlier sex-based specialisation. Both of these factors suggest that our static analysis should overestimate the importance of AAM as an independent determinant of specialisation decisions.

characteristics. Section 7 outlines and test the predictions of a Beckerian model of specialisation and comparative advantage. Section 8 concludes.

2. Measuring Specialisation and the Role of Absolute Advantage

In Section 7, we propose a formal structural model of time allocation. For now, consider only a couple's time allocation choice set. Each couple member (j) allocates their time to MW, DW and leisure (L) subject to the time constraint (normalised to 1):

$$MW_j + DW_j + L_j = 1, \quad j \in (1,2)$$

A Within-Household Specialisation Index

Our first goal is to construct an index which summarises the extent to which members of a couple are specialising in their division of labour. This index should take its maximum value when one spouse does all of the household's market work: $MW_1 > 0$; $MW_2 = 0$, while their partner does all of the domestic work $DW_1 = 0$; $DW_2 > 0$. And the index should take its minimum value if a spouse's share of household market work equals their share of domestic work: $\frac{MW_1}{MW_1 + MW_2} = \frac{DW_1}{DW_1 + DW_2}$. This would occur if, for example, MW and DW are both shared equally by the members of the couple, but also if one member contributes none of their time in work of either type. In both of those cases, the household is not specialising.

With these principles in mind, we propose our first specialisation index, SI_1. We believe this to be the first direct measure of within-household specialisation, given that it combines time-use inputs from MW and DW for both couple members. Blind to sex, comparative advantage and its components, the index simply informs us whether couples are specialising in their division of labour.

$$SI_1 = \left| \frac{MW_1}{MW_1 + MW_2} - \frac{DW_1}{DW_1 + DW_2} \right| \quad (1)$$

The first term on the RHS is the share of couple's market work performed by person 1. The second term is the share of the couple's domestic work performed by the same person. The index

takes its highest value (1) if one spouse does all of the MW and none of the DW, or vice versa.[6] As desired, it takes its lowest value if their share of household market work is equal to their share of domestic work.[7]

The intuition of SI_1 can be expressed graphically, as in Figure (1). Here the horizontal (vertical) axis represents share of domestic (market) work performed by person 1. Each point represents a

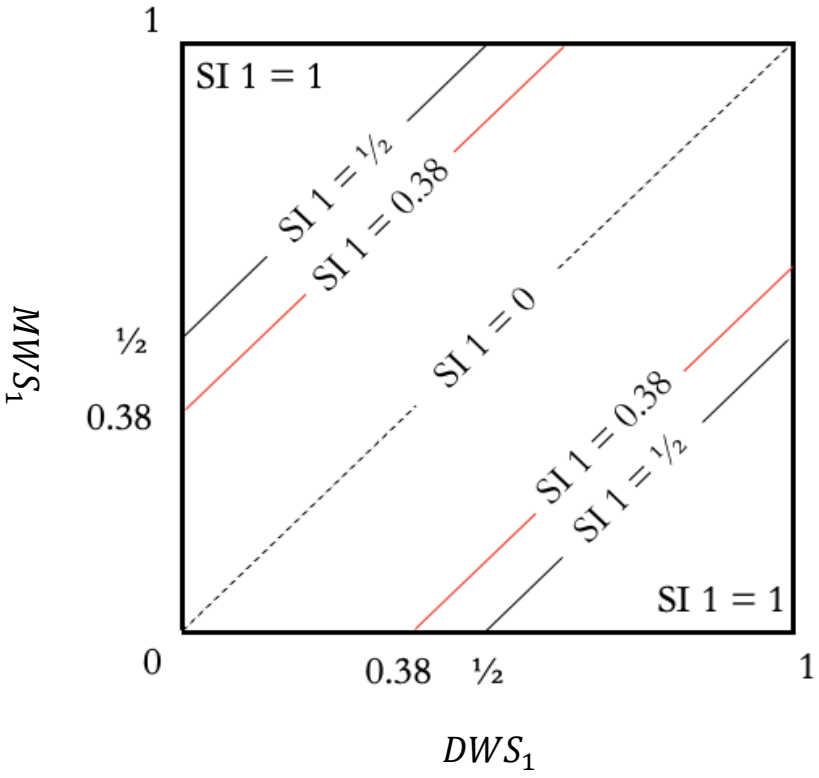


Figure 1: Map of specialisation

couple's possible time allocation combinations. The index takes the value of one at points at the top left corner and the bottom right corner of the graph (complete specialisation), and zero on the dotted diagonal line (no specialisation). In our sample, the mean of SI_1 is 0.38, the locus for which

[6] It is straightforward to show that the choice of which couple member to label as person 1 is arbitrary and the index takes the same value regardless:

$$\left|\frac{MW_1}{MW_1+MW_2}-\frac{DW_1}{DW_1+DW_2}\right| = \left|\left(1-\frac{MW_1}{MW_1+MW_2}\right)-\left(1-\frac{DW_1}{DW_1+DW_2}\right)\right| = \left|\frac{MW_2}{MW_1+MW_2}-\frac{DW_2}{DW_1+DW_2}\right|$$

[7] Leisure time (L) does not feature directly in the index. The index is not intended to measure fairness of time allocation. However as mentioned above, as L approaches one for one member of the couple (whilst remaining unchanged for the other member), the index will approach zero, since the other member of the couple would be doing the majority of both types of labour.

is depicted by red lines in Figure 1. Some examples of points on this locus are (0.38, 0), (0.5, 0.12) and (0.5, 0.88).

Two more Specialisation Indices

Whilst SI_1 measures the extent of specialisation, it does not help to determine whether such specialisation conforms with sex-norms or with absolute advantage in either sector. We propose two more specialisation indices for this purpose. Both are based on the first index, but with minor tweaks.

The second specialisation index (SI_2) measures whether couples divide their labour in a direction which conforms with sex norms (which may in turn reflect AAD). Specifically, it measures whether heterosexual couples[8] divide their labour such that the female partner specialises in domestic work and the male partner in the labour-market, as per equation (2).

The third specialisation index (SI_3) measures whether couples specialise to conform with AAM. This infers the couple divides their labour such that the couple member with the higher hourly wage does most of the MW, whilst their partner does most of the DW, as per equation (3).

$$SI_2 = \frac{DW_F}{DW_F + DW_M} - \frac{MW_F}{MW_F + MW_M} \quad (2)$$

$$SI_3 = \frac{MW_H}{MW_H + MW_L} - \frac{DW_H}{DW_H + DW_L} \quad (3)$$

SI_2 is hence equal to the female's share of DW minus her share of MW. SI_3 is defined as the share of MW done by the person with the higher hourly wage, minus their share of DW.

Unlike SI_1, these two indices range from -1 to 1. A score of 1 implies the couple is fully specialised in a way that conforms with sex norms (in the case of for SI_2) or with AAM (in the case of SI_3). In the case of SI_2, this implies that the female is doing all of the DW and none of the MW. For SI_3, it implies that the couple member with the higher hourly wage does all of the MW and none of

[8] This index is relevant for heterosexual couples only. Gay and lesbian families, by virtue of being the same-sex, cannot divide their labour in this way.

the DW. A score of -1 also implies complete specialisation, but in the opposite direction predicted by sex or absolute advantage. For SI_2, this is when the female partner does all of the MW and none of the DW. For SI_3, it implies the partner with the lower hourly wage completes all of the MW and none of the DW. For a score of zero, the interpretation is analogous to the first index, that is, there is no specialisation occurring in the household.

The second and third specialisation indices therefore incorporate elements of SI_1, this being the extent to which couples specialise, but they also impose a direction in which specialisation confirms with a particular prediction. For these reasons, SI_1 is not directly comparable to the other two indices, however, SI_2 and SI_3 may be compared to each other to determine whether sex or AAM plays a greater role in within-family time-allocation.

3. Data

The data used in this study is drawn from Release 17 of the Household, Income and Labour Dynamics Australia (HILDA) Survey. HILDA collects data on a broad range of socio-economic factors, with a focus on household structure and characteristics, employment and income. A nationally representative longitudinal dataset, the survey began in 2001 and re-interviews participants annually.

HILDA has a rare combination of features which make it ideal for our purposes. It includes time-use data on both MW and DW for both members of couples. Secondly, it identifies same-sex couples, and their sample is large enough for meaningful analysis. Thirdly, it is a longitudinal survey, which greatly reduces potential sample selection bias from missing wage information, as well as measurement error in hourly wages, which are constructed from self-reported earnings and hours.[9] We elaborate on these issues below.

Key Variables

Our time-use data are drawn from HILDA's Self-Completion Questionnaire, on which respondents record how much time they typically spend in a range of activities per week, such as

[9] To our knowledge, there is no dataset available for the US which has all of these features.

childcare, paid work, housework and household errands. Commonly referred to as stylised estimates, such data are regarded as inferior to time diary data for some purposes. But we argue that they may actually be more suitable for our purposes than diary data.[10]

Relative hourly wages between couple members are our measure of AAM. A person's hourly wage in each wave is derived as the ratio of weekly earnings to self-reported hours worked. It is hence subject to measurement issues, with at least three associated threats to validity. The first threat is potential sample-selection bias – couples who completely specialise have one person that does not participate in any market work. But as a result, we do not observe an hourly wage for one member of such couples, and so those couples would be excluded from the SI_3 analysis sample. However, the panel structure of HILDA goes a long way towards addressing this issue. Rather than relying on contemporaneous hourly wages, we instead use a within-person moving-average across waves. Specifically, for each person at time *t*, we use their median non-missing wage across a five-year window: from *t-2* to *t+2*. This substantially reduces the sample loss due to missing wage data – an additional 7,311 couple-wave observations are included under this approach (as opposed to relying only on contemporaneous wage data), reflecting an additional 16% of the full SI_1 sample.[11]Taking this median value also arguably addresses the second threat to validity associated with measurement error, which is the possibility of noisy observations from misreported earnings or hours – which would lead to attenuation bias. If the wage is relatively stable over time but is reported with error, the 5-year moving-median wage may be a better measure. The third threat to

[10] In particular, stylised estimates have been shown to introduce systematic bias. For example, studies have consistently found that stylised estimates of housework time exceed diary estimates (Marini & Shelton, 1993; Baxter & Bittman, 1995; Bianchi, Milkie, & Sayer, 2000; Juster, Ono & Stafford, 2003). To the extent that this paper is focused on the variation between couples in time-allocation decisions, within the family home, such systematic biases are not relevant. Further, an array of studies comparing the differences between stylised and diary estimates often find a similar degree of variation between different groups (Baxter & Bittman, 1995; Robinson, 1985; Marina & Shelton, 1993). Stylised estimates are in fact likely to be more accurate for our study. Diary information is usually collected over the course of one or two days. Time use on those days may be accurately recorded, but they may nevertheless provide a noisy signal of individuals' 'typical' time use allocations - in which we are interested.

[11] Couple-year observations are dropped if either couple member's hourly wage is missing. Amongst those dropped in our preferred approach, the majority had at least one partner who was self-employed (77%), while 43% included at least one partner who was not currently working. Appendix 5 shows sensitivity of key results to different approaches to deal with missing wage observations.

validity is perhaps more subtle. It is the possibility that measurement error in hours of paid work mechanically leads to downward bias in SI_3. To illustrate, consider an individual who underreports hours worked. This person has an upwardly biased wage, and as a consequence is more likely to be coded as having a higher wage than their partner. But this person's share of paid work is also biased downwards and, consequently, so is SI_3. Fortunately, in every wave, HILDA collects time in paid work twice – once in the interviewer-administered Person Questionnaire, and again in the time-diary section of the subsequent Self-Completion Questionnaire. We use the first of these to construct the hourly wage, and the second of these to construct each specialisation index. Whilst this does not eliminate the issue completely (since reporting error may be correlated between the two reports), it likely reduces its importance.

We also take further steps to deal with measurement error in wages. We drop extreme outliers – hourly wages below AUD \$1.90 and over AUD \$211[12]. We also test the sensitivity of the results to excluding observations where the hourly wage difference is relatively small: less than 5%, 10% and 50%.

These and all other variables are described in more detail in Appendix 2.

Sample Construction and Descriptive Statistics

We selected couple-year observations from waves 2 to 17,[13] where both members were aged 18-64. Couple-year observations were also excluded if either member did not return a self-completion questionnaire. Couple-year observations where either partner had missing data for all of the time-use variables were excluded. In cases where only some time-use variables were missing, these were set to zero.[14]

[12] These are the top and bottom 0.1% of the hourly wage observations after applying the moving average. In total, 100 couple wave observations were excluded as a result.

[13] We drop Wave 1 because the stylised time-use variables in the first wave differ from subsequent waves. In the first wave, time-use is measured in hours (as opposed to hours and minutes in later waves) and there is no variable for paid employment.

[14] This occurred frequently, for example, when individuals without children were asked how much time they spent caring for their children.

After dropping a small number of couple-wave observations whose sampling weights are set to zero,[15] our primary estimation samples consist of 45,337 couple-year observations for SI_1, 44,697 for SI_2 (since it uses heterosexual households only) and 22,375 for SI_3. The smaller sample for SI_3 is from to the loss of waves (waves 2, 16 and 17) due to the moving-average approach to constructing the wage (as described above), missing wage information, and the restriction to couples whose members' hourly wages differ by at least 5%. We show the results of sensitivity testing to this last restriction.

Table 1 displays the means for the variables used in the analysis for the full SI_1 sample. The majority of couples are married and different-sex, with the average couple age at just under 43 years old. Additionally, almost half the couples in our sample have a dependent child under the age of 15 living in the household, and less than a quarter have a child between the ages of 0 to 4. On average, couples in our sample spend approximately 61 hours each week on domestic work, and 72 hours in paid employment collectively.

Perhaps the most important element of Table 1 is that the mean of SI_2 is 0.278, much higher than the mean of SI_3 (0.114). These means are directly comparable, and they imply that specialisation conforms much more to sex-roles than it does with absolute advantage in the market – a theme that we explore in subsequent analysis.

Table 2 displays the correlations between the three specialisation indices. SI_1 and SI_2 are strongly positively correlated, with a coefficient of 0.618. The correlations between SI_3 and each of the other two indices are relatively weak, at around 0.3. This suggests that household specialisation overall conforms strongly with sex-roles, much less so with AAM.

Table 3 shows the proportions of couples who have positive values of SI_2 and SI_3, respectively – that is, couples who specialise consistently with sex and with AAM. The results show that approximately 78% of couples specialise consistently with sex, while just 62% specialise consistently with AAM.

[15] 223 couple-wave observations were dropped whose sampling weights were set to zero, including 186 married, 35 unmarried and 2 gay couple-wave observations.

Table 1: Descriptive statistics

Variable	*Mean*	*SD*	*N*
Married Heterosexual	0.812	(0.391)	45,337
Unmarried Heterosexual	0.176	(0.381)	45,337
Gay	0.006	(0.075)	45,337
Lesbian	0.006	(0.077)	45,337
SI 1	0.383	(0.270)	45,337
SI 2	0.278	(0.379)	44,697
SI 3	0.114	(0.387)	22,375
Couple Age	42.570	(10.452)	45,337
Couple Duration	16.190	(11.202)	44,567
Children Aged 0-4	0.239	(0.426)	45,337
Children Aged 5-9	0.215	(0.411)	45,337
Children Aged 10-14	0.210	(0.407)	45,337
Children < 15	0.485	(0.500)	45,337
Likely to Have [More] Children	3.653	(4.043)	27,945
Desires [More] Children	4.204	(4.045)	28,007
Log Relative Wage	0.389	(0.347)	24,817
Time-Use			
Market Work	72.185	(25.787)	45,337
Paid Employment	64.868	(23.463)	45,337
Commuting	7.317	(5.810)	45,337
Domestic Work	60.690	(38.034)	45,337
Housework	23.396	(13.789)	45,337
Household Errands	9.001	(6.898)	45,337
Childcare	20.386	(27.734)	45,337
Outdoor Tasks	7.907	(7.946)	45,337

Table 2: Correlations between the specialisation indices

	SI_1	SI_2	SI_3
SI_1	1.000		
SI_2	0.618	1.000	
SI_3	0.317	0.333	1.000
N	22,067		

Table 3: Couples specialising according to AA

	Mean	*SD*	*N*
$SI_2 > 0$	0.776	(0.417)	44,697
$SI_3 > 0$	0.620	(0.485)	22,375

4. A Descriptive Profile of Specialisation

In this section we provide a descriptive profile of specialisation, drawing only on SI_1. Therefore, we do not comment on absolute advantage or its role in the division of labour here. Rather, we explore the sources of heterogeneity in the extent of specialisation across a range of families, and changes over time.

The extent of specialisation has declined over the survey period. Figure 2 shows the mean of SI_1 by survey wave, depicting a gradual decrease from 2002 to 2017. At its highest, the mean of SI_1 is 0.42 in wave 3 and decreases by 14% to 0.36 in wave 17.

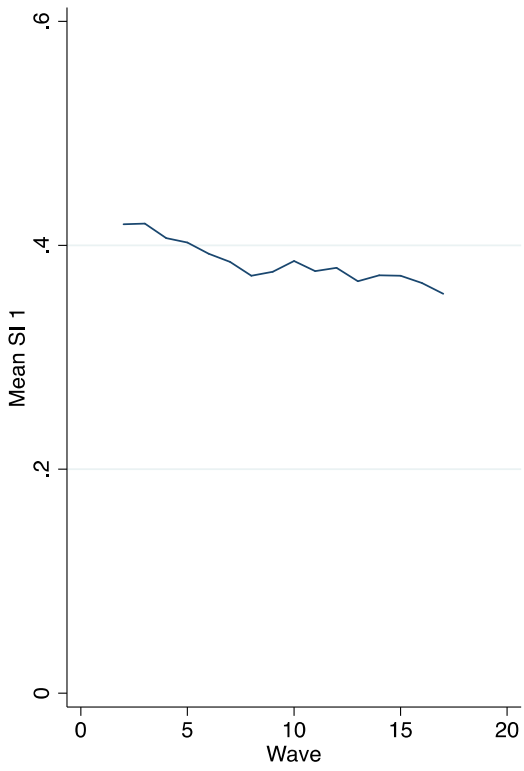


Figure 2: Mean SI_1 over time

To unpick this decline further, we now consider MW and DW separately, looking at the components of specialisation independently. Specifically, we are interested in whether the SI_1 trend is driven by more equal allocation of time in market work, or in domestic work, or perhaps in changes in the average quantity of work performed in each sector.

Define the 'concentration' of market work as:

$$MWC = \left| \frac{MW_1 - MW_2}{MW_1 + MW_2} \right| \quad (4)$$

MWC ranges from zero to 1. It takes its maximum value of 1 if one person does all of the market work and its minimum value of zero if both members do the same amount of market work.

Similarly for domestic work concentration:

$$DWC = \left| \frac{DW_1 - DW_2}{DW_1 + DW_2} \right| \quad (5)$$

The overall sample mean of MWC is 0.48. Drawing on (4), this suggests that one person does 74% of the market work in an average household at a given point in time. The mean of DWC is 0.38, implying that one person does 69% of the housework in an average household. Figure 3 shows that the mean MWC and DWC have both declined over time. However the decline has been twice as large for MWC. This suggests that the overall decline for specialisation (Figure 2) may be driven more by increasingly equal participation in market work, rather than in domestic work.

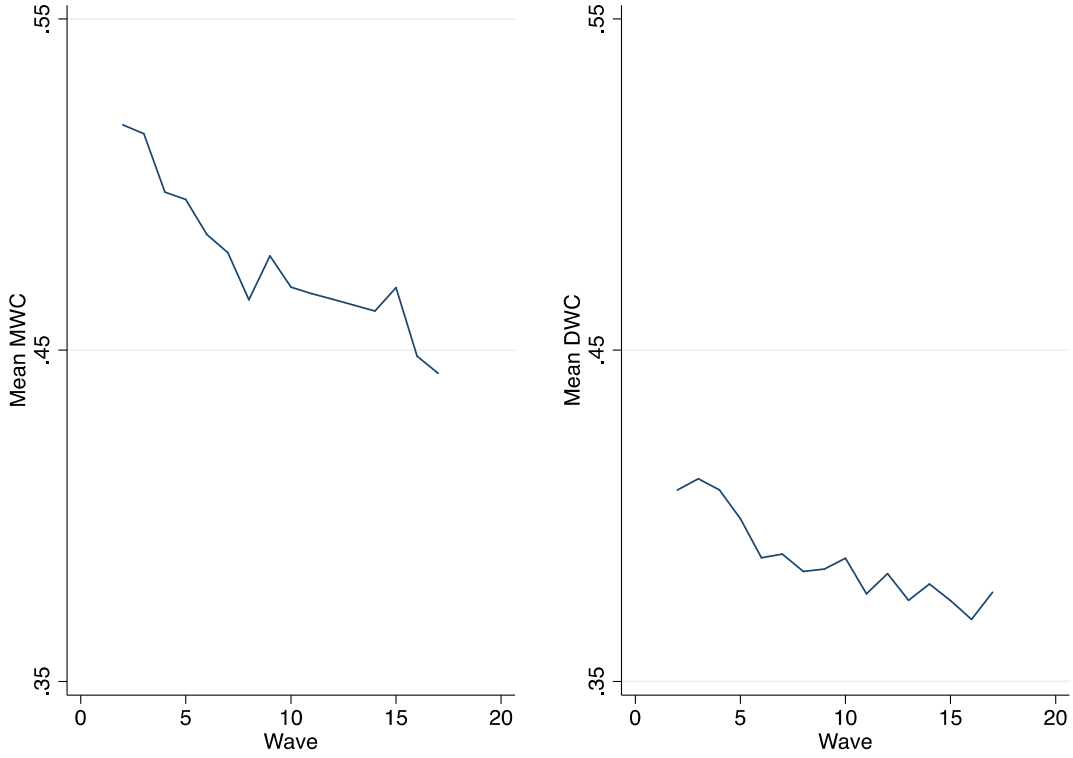


Figure 3

A: Market work concentration **B: Domestic work concentration**

The decline in specialisation could also reflect a decrease in demand for domestic labour. The development of labour-saving technologies and emergence of affordable service industries has reduced time spent in domestic production and offers a market alternative to specialised homemakers (Stevenson & Wolfers, 2007). Figure 4 shows the number of hours spent by couples in paid work and housework, on average, from 2002 to 2017. Paid work hours increased over time, reaching almost 74 hours in wave 17. Interestingly, however, the data show no discernible trend in mean domestic work hours. At a finer grain of detail, the data show some decline in mean time spend in 'housework', and in 'outdoor tasks', offset by slight increases in time spent on 'errands' and 'childcare'.

Time spent in paid work is greater than time in domestic work, and the gap has increased over time. Consistent with this, both couple members participate in paid work in a growing share of couples. An average of 1.7 members per couple were employed in 2017, up from 1.6 in 2002. It is therefore unsurprising that MWC has also declined.

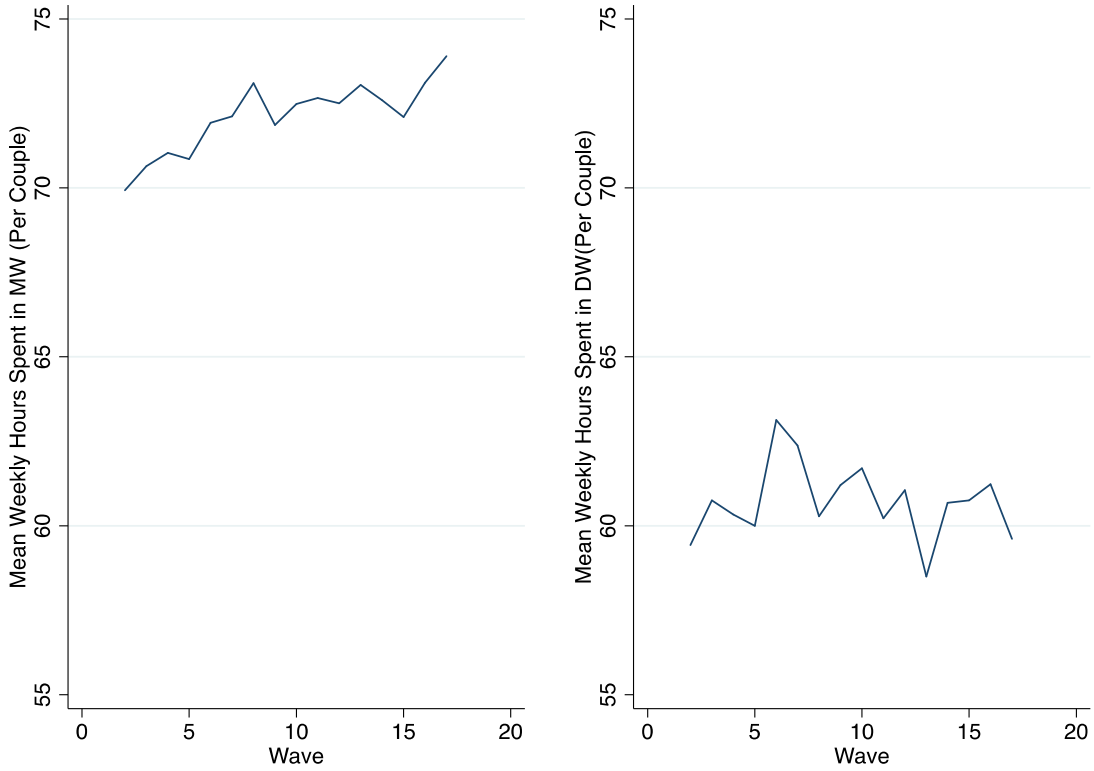


Figure 4: Mean weekly hours spent working, per couple

A: Market work **B: Domestic work**

Specialisation and the Arrival of Children

Children are a key theme in most discussions on specialisation. Children are often cited as the greatest determinant of a heterosexual couple's division of labour (Lundberg & Rose, 2000; Bonke et al., 2008; Dalmia & Sicilian, 2008) and recent studies have shown children also play a role in how same-sex families divide their labour (Antecol & Steinberger, 2013; Giddings et al., 2014; Martell & Roncolato, 2016).

As Giddings et al. (2014) suggest, since children are "usually a deliberate choice on the part of the parents, especially same-sex couples, it is potentially misleading to consider children as exogenous to household's time allocation decisions" (p. 529). For similar reasons, it is problematic to treat changes in time use allocations before and after the arrival of children as causal.

Whilst acknowledging these issues, Figure 5 shows the mean of SI_1 before and after children. As expected, the arrival of children is associated with a very sharp increase in specialisation, from 0.31 in the year prior to the birth/adoption of the child up to 0.60 at its arrival. As we move further away from the year of birth/adoption, specialisation declines gradually. However, within a ten-year window, specialisation does not decline to the point that it equals its pre-child levels. This decrease in specialisation following the arrival of the child is intuitive; as the child grows and becomes more self-sufficient, there is less demand for a full-time caregiver. Further, in the years

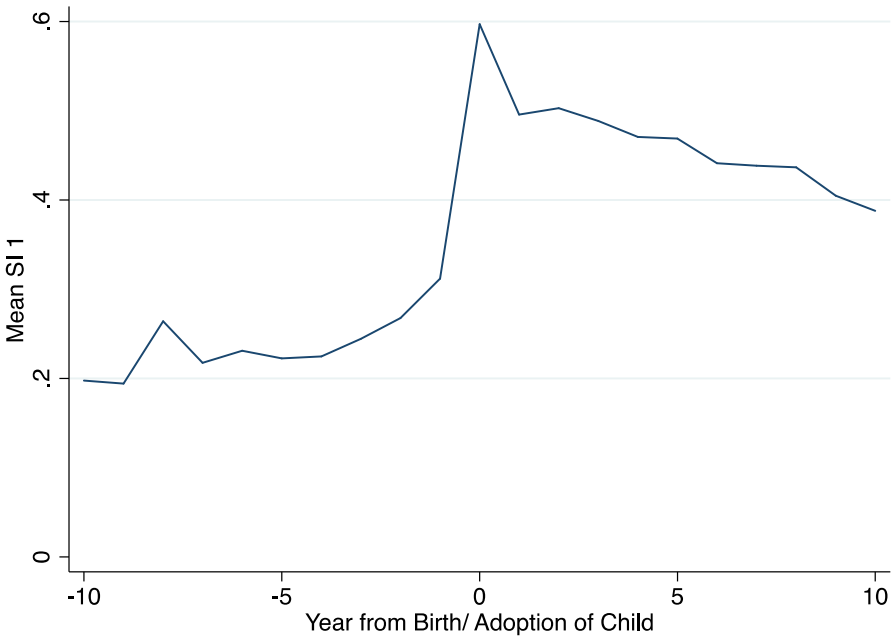


Figure 5: Specialisation before and after children

prior to the arrival of the first child, specialisation increases marginally, from 0.2 ten years preceding to 0.31 one year before the arrival. It is possible this small incline reflects the fertility intentions of the parents, as families prepare for the arrival of their child.

Specialisation in Same-Sex and Heterosexual Households

Figures 6 shows the means of SI_1 across a range of couple types: married heterosexual, unmarried heterosexual, gay and lesbian. Heterosexual couples are separated into married and unmarried couples to allow for the fact that marriage has been shown to encourage specialisation and financial pooling due to its contractual nature (Badgett, 2001).[16]

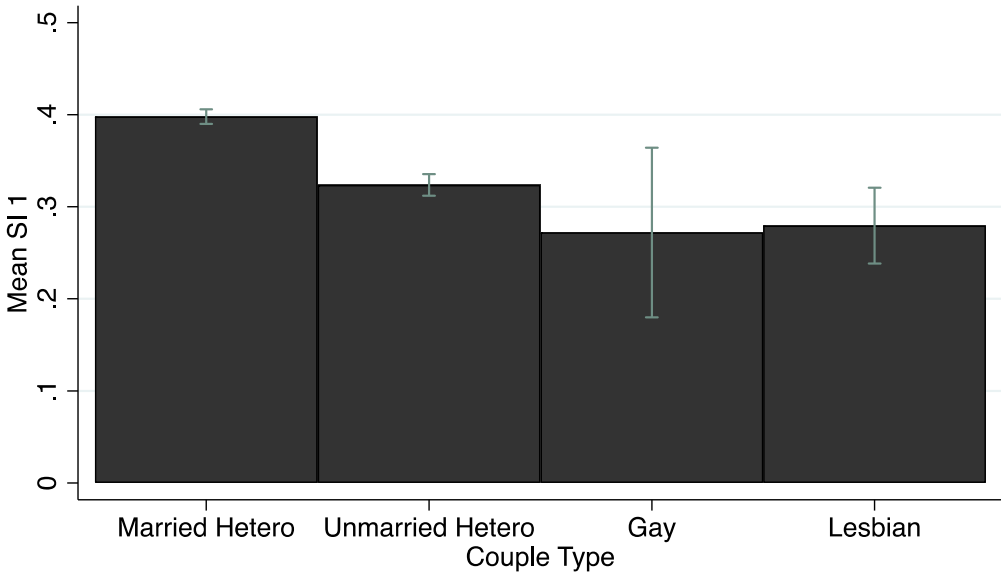


Figure 6: Mean of SI_1 by couple type

This figure shows that specialisation is prevalent across all couple types. But married heterosexual couples specialise much more than same-sex couples, with unmarried heterosexual couples midway between. There are a number of possible explanations for this. Firstly, since marriage protects the couple member specialising in the home via alimony or child support, this may enable married heterosexual couples to specialise more than unmarried heterosexual couples (Stevenson

[16] Whilst Australia enacted legislation in December 2017 allowing same-sex marriage, this would only apply to the most recent wave of the HILDA survey. Further, as HILDA survey data is generally collected in September each year, it is unlikely any same-sex couples identified as married in wave 17 would be legally recognised as such at the time. Less than 4% of all gay couple wave observations and 2% of lesbian couple wave observations identified as married in the data. Of these, only six same-sex couple wave observations were drawn from wave 17 survey data.

& Wolfers, 2007). Secondly, the differences may reflect differences in the prevalence of child rearing across couple types. Whilst advances in reproductive technologies have enabled same-sex couples to more easily rear children, particularly for lesbian couples via a sperm donor, our data indicates that same-sex families still have far fewer children than comparable heterosexual families (see Appendix 1). Finally, differences in preferences may also explain some of the variation observed between same-sex and heterosexual families. For example, gay households are much more likely to outsource household tasks compared to heterosexual families (Goldberg, 2013). We further explore the possible explanations for these couple-differences in Section 6, using simple regression models.

5. What Drives Specialisation?

We are interested in what drives within-couple specialisation, and especially whether it is consistent with comparative advantage. We cannot test that directly since comparative advantage is not measurable. But we can study the extent to which specialisation is consistent with sex – which, to some unknown extent, is an indicator of AAD, but also a function of social norms. And we can also test whether specialisation is consistent with absolute advantage in market work, as measured by relative wages. In this section, we explore this through a descriptive analysis of SI_2 and SI_3 respectively.

To commence, Figure 7 explores the distribution of sex-based specialisation. This heat-plot shows the bivariate density for the share of DW and MW undertaken by the female member of the heterosexual couples in our sample. It shows two dominant patterns of behaviour. Much of the data lies towards the middle of the plot, where the female partner undertakes between 30% and 55% of the total market work, and between 40% and 80% of the total domestic work. The highest density within this region is very close to a 50/50 split in both MW and DW, but this is only slightly higher than the surrounding region. By far the highest density occurs at the bottom right-hand side corner of the graph, where the female partner undertakes 80% of the DW and none of the MW. This shows that there are a large portion of heterosexual couples in the sample which

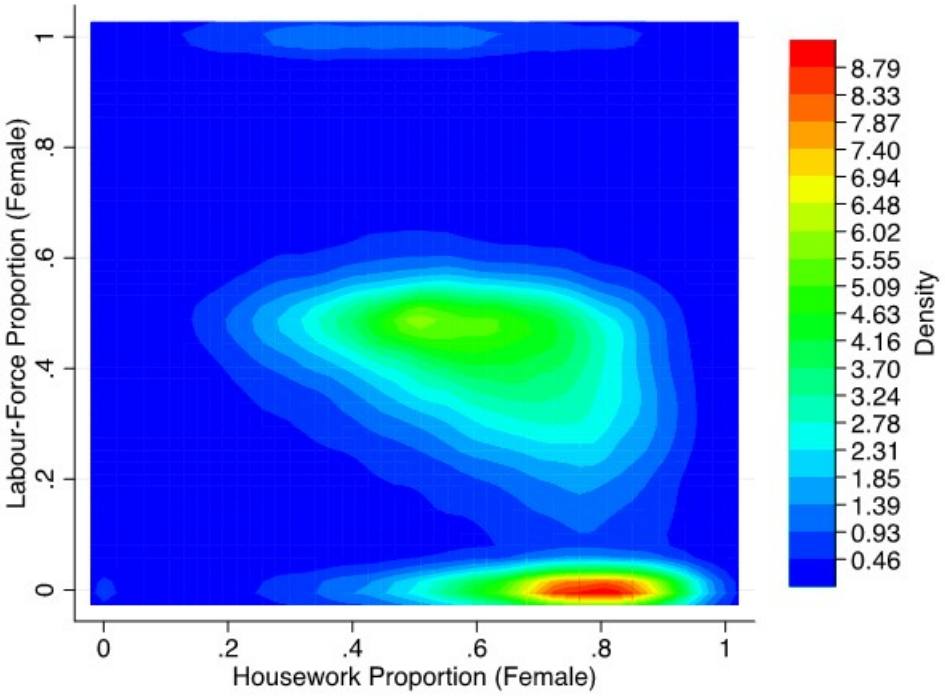


Figure 7: Density Plot SI_2

exhibit a sexualised division of labour. There are very few observations in which the female does all of the MW (at the top of the Figure). In those cases, however, females also do close to half of the DW[17].

Similarly, Figure 8 is a density plot of the proportion of paid work and housework undertaken by the partner with the higher hourly wage. It captures whether couples are specialising in the direction predicted by AAM. In some ways, this density plot is similar to the previous, with a large collection in the centre of the plot and another in the direction predicted by absolute advantage. However, it is much more symmetric around the diagonal – with the density only slightly higher towards the north-west of the region compared to the south-east. Those couples conforming most strongly with AAM are in the north-west corner of Figure 8, where the member with the higher hourly wage undertakes most of the market work and only a small proportion of housework. But there is also considerable mass in the south-east corner, where the partner with the higher hourly wage undertakes very little of the market work and most of the housework, contrary to AAM.

[17] Bittman et al. (2003) and Bertrand et al. (2015) find that married heterosexual women tend to contribute more to the household when their income exceeds that of their husband's, in order to compensate for deviating from prescribed social norms.

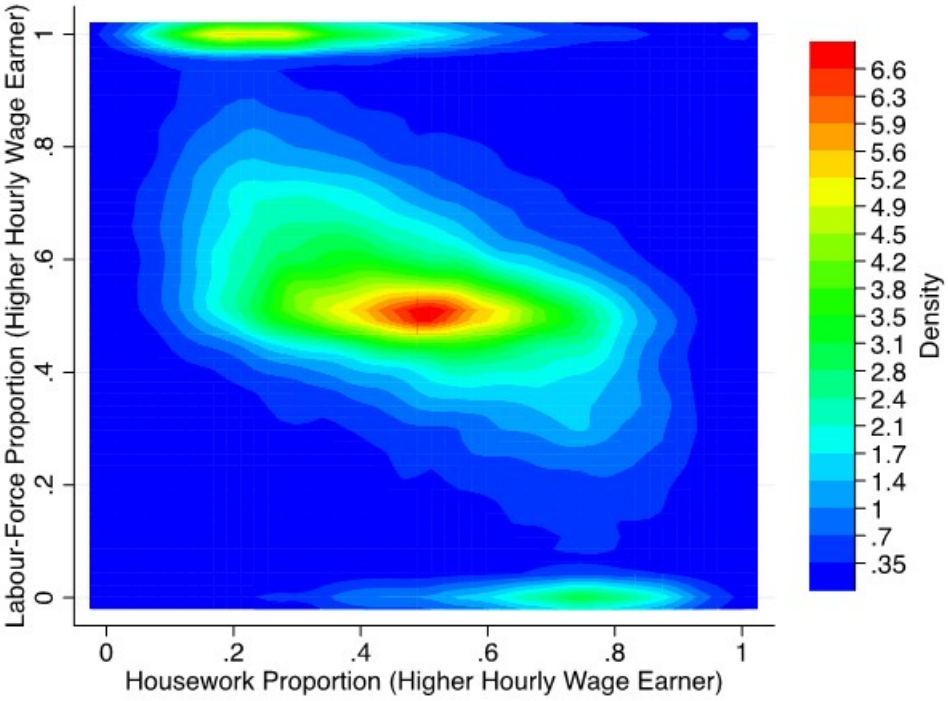


Figure 8: Density Plot SI_3

These density plots highlight a great diversity in how couples allocate their time. For some, allocations conform with sex-roles, as well as with AAM. But many other couples make choices which are opposed to AAM in particular. Finally, many other households allocate their time relatively equally in both spheres, and hence do not specialise at all.

Sex-based and AAM-based Specialisation Over Time

We have shown that specialisation overall has decreased over time. Here we see whether this is also the case for sex-based and AAM-based specialisation. Panel A of Figure 9 shows that sex-based specialisation has indeed declined, from 0.32 in wave 2 to 0.24 in wave 17, consistent with the trend for SI_1. On the other hand, Panel B shows that specialisation according to AAM has remained relatively constant. This suggests that declining specialisation is driven by a reduction in sex-based specialisation.

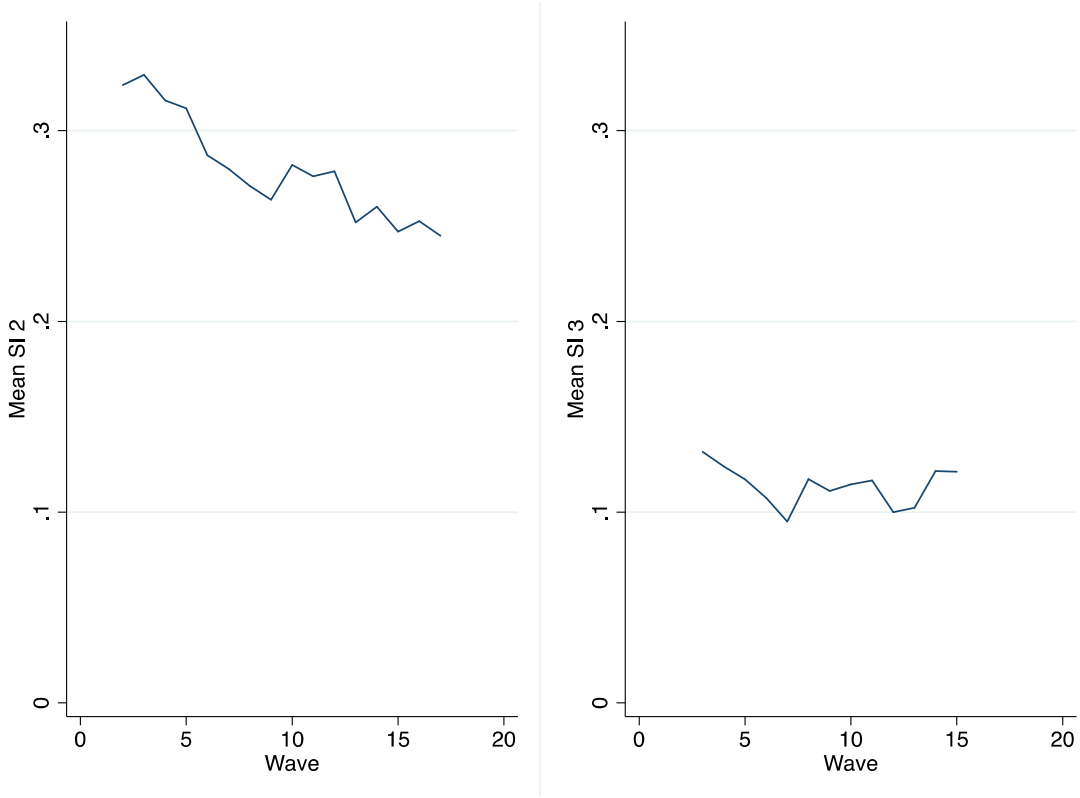


Figure 9

Panel A: Mean SI_2 by wave **Panel B: Mean SI_3 by wave**

To explore these trends further, Figure 10 shows the female labour-force and housework proportions by wave, enabling us to determine whether the decline in specialisation according to sex is driven by females undertaking more of the market work share or less of the housework share.[18] Over time, the proportion of housework undertaken by the female partner has decreased somewhat, and their market work has also increased. This change in female labour supply has been well-documented in academic literature and can be attributed to a number of key economic developments commencing in the latter half of the twentieth century.

[18] By construction, the male proportions of MW and DW are mirror-images of Figure 10.

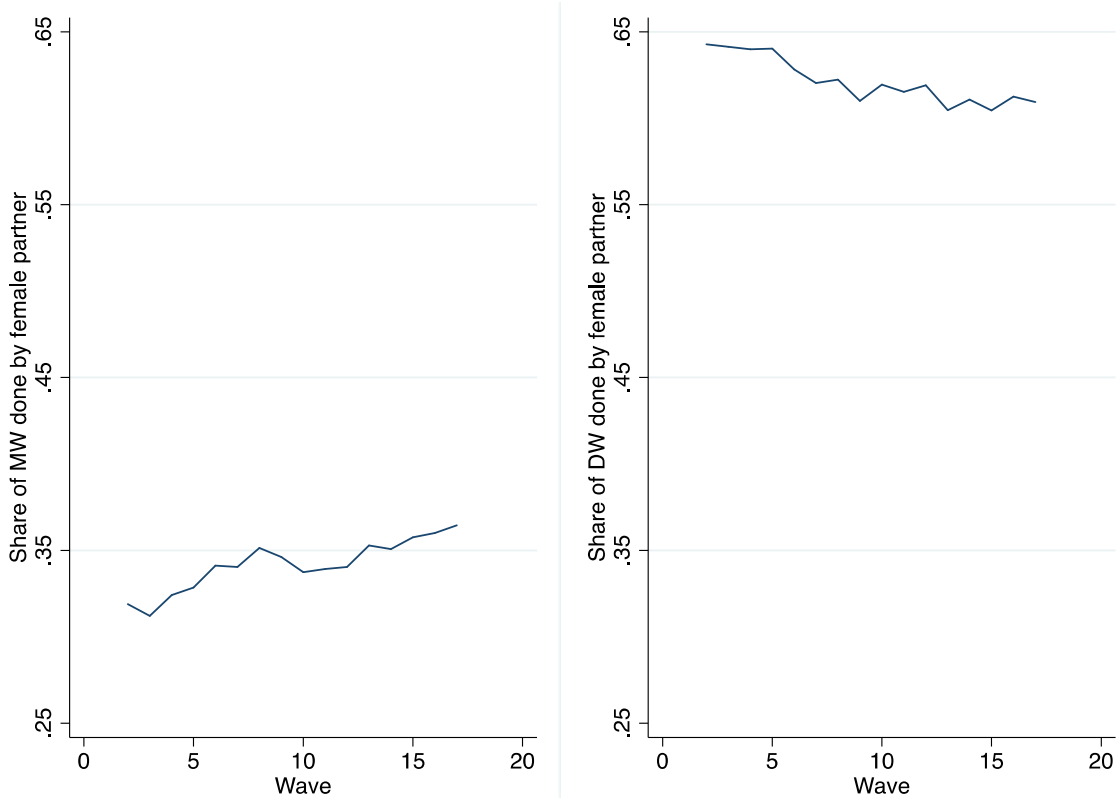


Figure 10: Share of work done by female partner

Panel A: Market Work **Panel B: Domestic Work**

Figure 11 shows the same trends for the partner with the higher hourly wage. Here the trends are much weaker. This rigidity over time mimics the broader trend for SI3. The role of AAM and couple's time allocation decisions appear to be small, but stable over time.

Even though the role of AAM in household specialisation appears to be small, it may still be overstated. Relative wages may be a consequence of gender norms, manifested through discrimination against women in market work, differential human capital accumulation in the labour-market, and primary female responsibility for the care of children. Thus, productivity differences in the labour-market may reflect, to some extent, the fulfilment of gender expectations associated with one's sex.

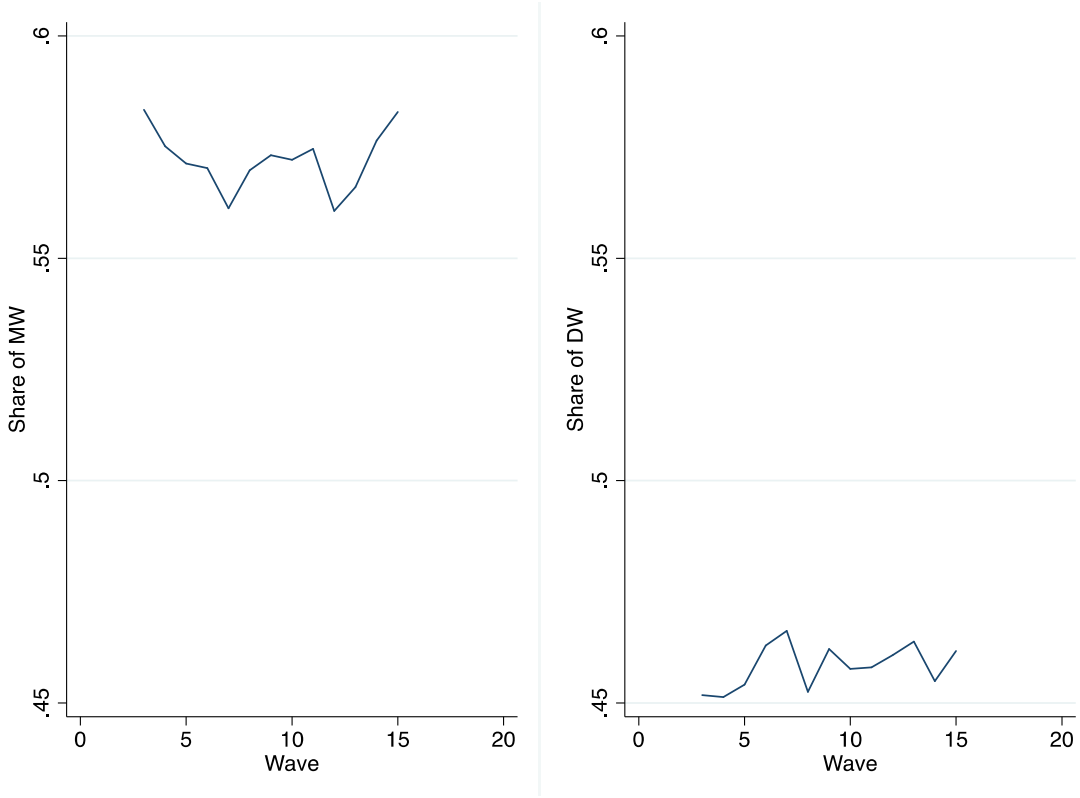


Figure 11: Share of work done by partner with the higher hourly wage

Panel A: Market Work **Panel B: Domestic Work**

To explore this idea further, Figure 12 shows the mean of SI3 over time, this time by gender of the couple member that has a higher hourly wage. In Panel A, the mean value is always negative, implying that specialisation is not consistent with AAM if the female has the higher wage. However, the extent of this specialisation 'away from her absolute advantage in market work' has declined considerably over time. Nevertheless, this result again points to gender being the primary driver of household time allocation decisions.

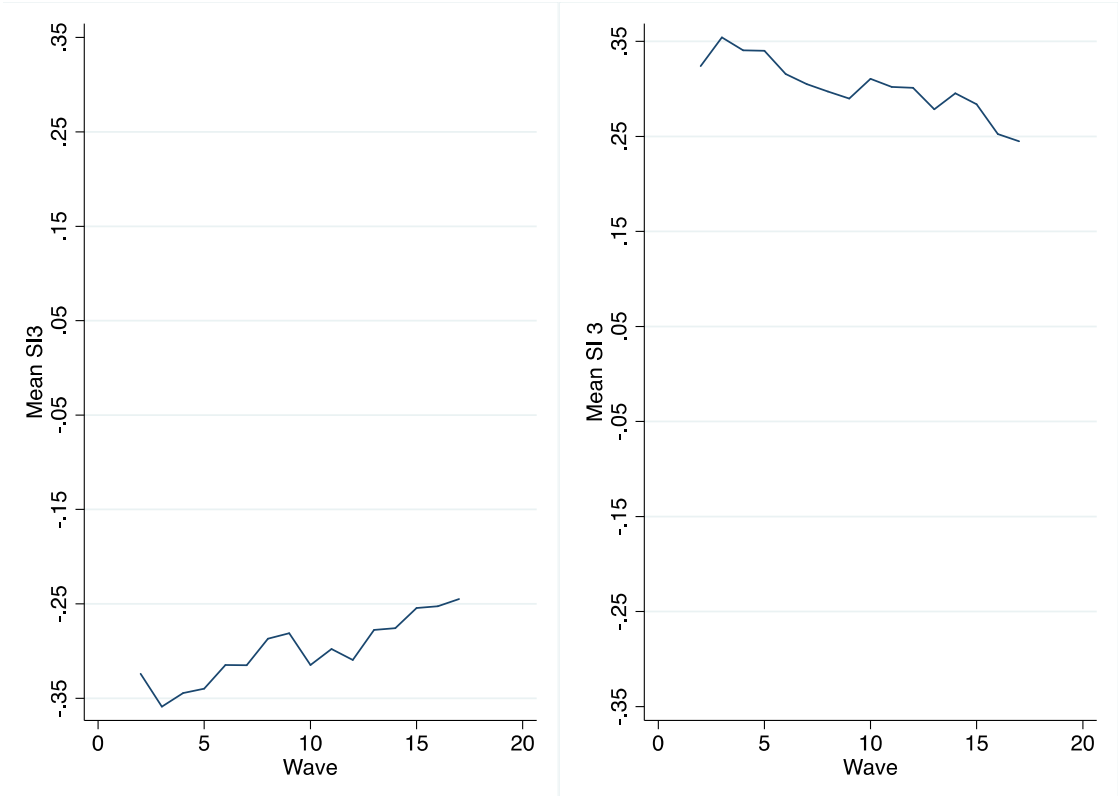


Figure 12: Mean SI_3 by sex of member with higher hourly wage

Panel A: Female **Panel B: Male**

Sex, Absolute Advantage and the Arrival of Children

We have shown previously that children seem to have a very big role in inducing specialisation overall. We now show corresponding results for sex-based specialisation (Figure 13) and AAM-based specialisation (Figure 14). Figure 13 shows a large jump in specialisation on the basis of sex at the year of the birth/ adoption of a child, largely mirroring the overall trend in SI_1. In contrast, Figure 14 shows no such discontinuity. The arrival of children – a huge positive shock in the demand for domestic labour induces sex-based specialisation, which seems to have little to do with AAM.

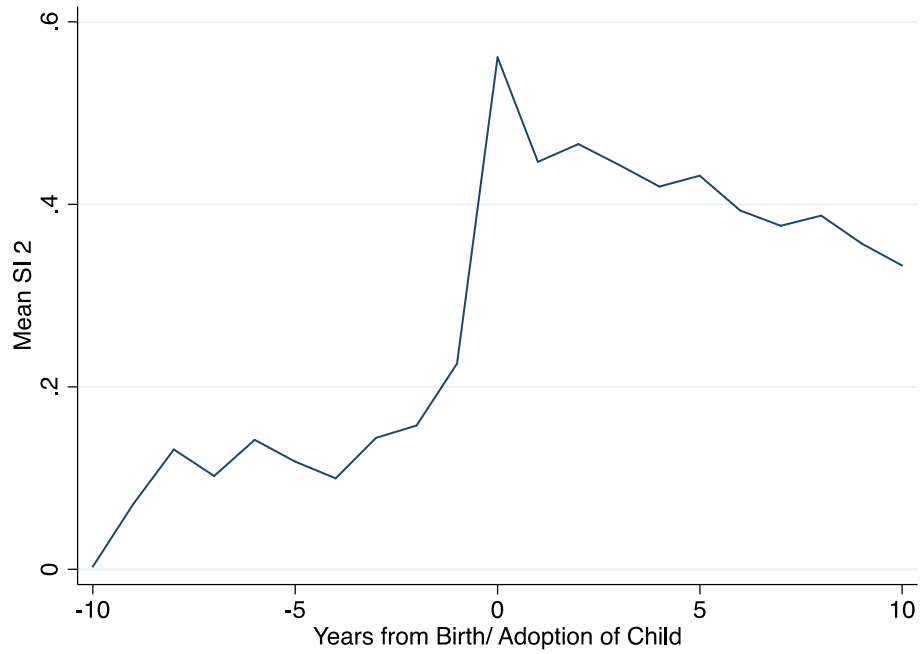


Figure 13: Specialisation according to sex norms before and after children

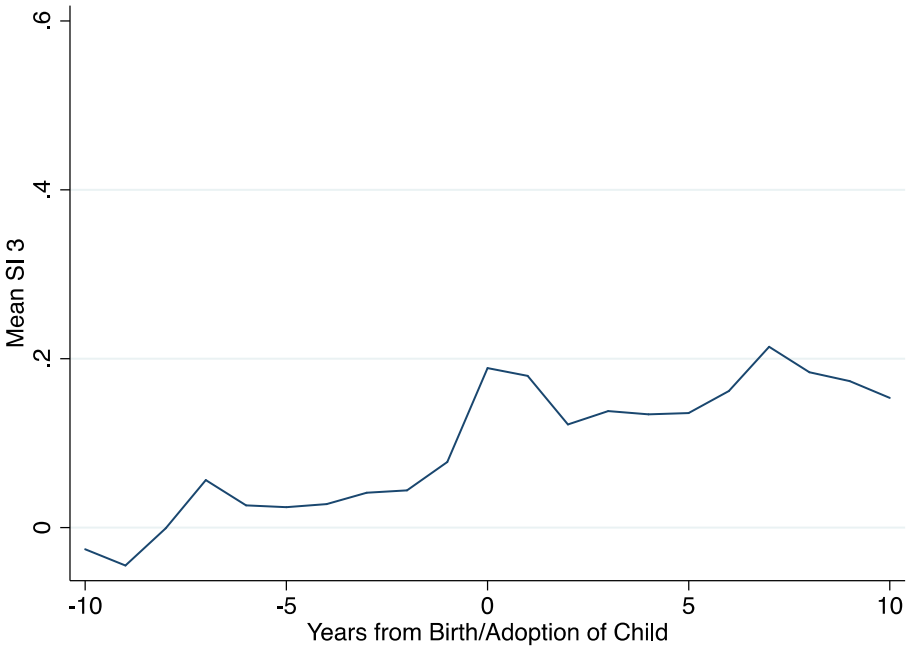


Figure 14: Specialisation according to AAM before and after children

Sex, Absolute Advantage and Couple Type

Figure 15 shows the mean of SI_2 over time for married and unmarried heterosexual couples, respectively.[19] Married heterosexual households specialise considerably more according by sex compared to unmarried heterosexual households. However, this has declined over time for both groups, consistent with the overall trends for SI_2, as well as for SI_1. In Section 6, we examine the potential explanations for this difference between married and unmarried couples.

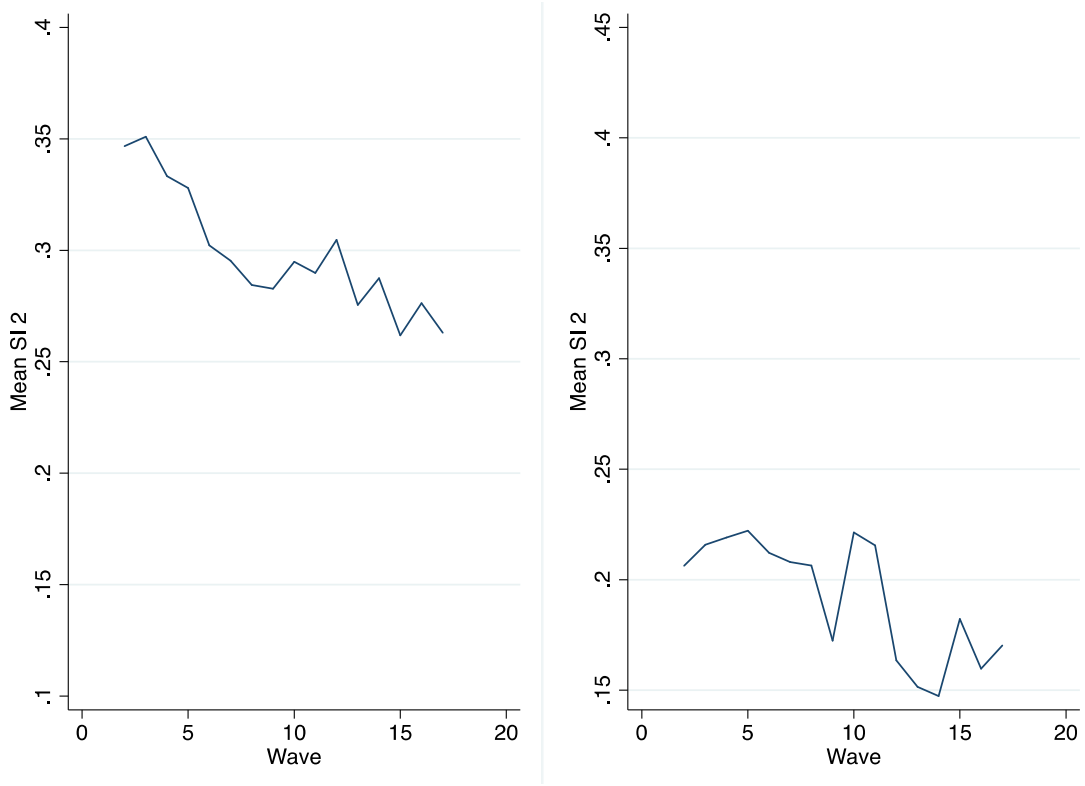


Figure 15: Mean SI_2 for heterosexual couples

Panel A: Married **Panel B: Unmarried**

Figure 16 shows the mean for SI_3 for each couple type.[20] The most striking results are for same-sex couples. For them, there is no evidence at all of specialisation consistent with AAM. This in turn suggests that comparative advantage is irrelevant in their time allocation decisions, since sex plays no role. An alternate explanation is that productivity in market work is very strongly correlated with (unmeasured) productivity in domestic work. This would imply that AAM is

[19] SI_2 is undefined by same-sex couples.

[20] The mean of SI_3 by wave shows no strong trend, and is quite noisy for same-sex couples due to their relatively small samples.

unrelated to comparative advantage, which seems unlikely. Either way, the results suggest that the theory of comparative advantage does not at all explain the time allocation decisions made by same sex couples. This in turn raises the question as to whether, or why, this theory would only hold for heterosexual couples. Turning to heterosexual couples, their means for SI3 are also much lower than they are for SI2, confirming that sex plays a much larger role than AAM. As noted before, for heterosexual couples, AAM may to some extent be a consequence of gender norms, rather than an independent driver of specialisation.

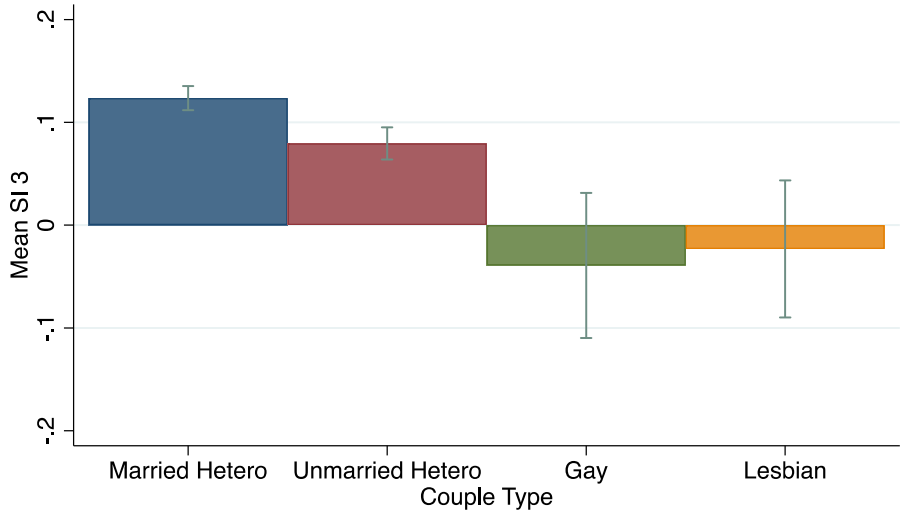


Figure 16: Mean SI_3 by couple type

A threat to the validity of this analysis is that wage differences may only be small for some couples. For such couples, the relationship between AAM and comparative advantage may be weak. In the main analysis, we have already addressed this partially by only considering couples whose wages differ by at least 5%. We can test the sensitivity of the results to stronger restrictions. Table 4 shows the results when the restriction is extended to 10%, 20% and 50%. The most important results are qualitatively similar for any of these restrictions. In particular, there is no evidence of specialisation by AAM for same sex couples. For heterosexual couples, the mean of SI_3 increases as the exclusion threshold is raised. Amongst heterosexual couples whose wage differs by at least 50%, mean SI_3 is 0.25 for married couples and 0.18 for unmarried couples. Nevertheless, we again note that for heterosexual couples, AAM may be an outcome of gender norms rather than an independent driver of specialisation. It is for this reason that the results for homosexual couples are particularly insightful. For them at least, comparative advantage does not seem to explain time allocation decisions at all.

Table 4: Mean of SI_3 by couple type and minimum wage gap

	Couple Type			
	Married Heterosexual	Unmarried Heterosexual	Gay	Lesbian
	A. > 5% wage gap			
Mean SI_3	0.124	0.079	-0.039	-0.023
(SE)	(0.003)	(0.005)	(0.027)	(0.026)
N 22,375	*16,284*	*5,783*	*115*	*193*
	B. > 10% wage gap			
Mean SI_3	0.135	0.091	-0.055	-0.007
(SE)	(0.003)	(0.005)	(0.028)	(0.030)
N 19,888	*14,516*	*5,018*	*97*	*157*
	C. > 20% wage gap			
Mean SI_3	0.161	0.115	-0.069	0.008
(SE)	(0.004)	(0.006)	(0.030)	(0.035)
N 4,750	11,040	*3,529*	*75*	*106*
	D. > 50% wage gap			
Mean SI_3	0.245	0.177	-0.172	-0.568
(SE)	(0.007)	(0.014)	(0.101)	(0.197)
N 3775	3,020	738	13	4

6. Correlates of Specialisation

The previous two sections have shown descriptive profiles of specialisation. Differences between couple types have been a key focus, and whether the theory of comparative advantage can explain the observed patterns of specialisation. In this section, we present further insights into specialisation through simple regression models. These models serve two purposes. Firstly, we test whether differences in specialisation between couple types can be explained by other observed characteristics. Secondly, identifying the correlates of specialisation will help to understand its drivers. We begin by showing regression results for specialisation as a whole, then for sex-based specialisation and AAM, respectively.

We estimate regressions as per the following specification:

$$SI1_{it} = \alpha + \beta_c + \gamma_t + \tau \boldsymbol{X}_{it} + \varepsilon_{it} \quad (6)$$

Where $SI1_{it}$ is the outcome variable, representing Specialisation Index 1 for couple *i* at time *t* and β_C is the variable of interest, capturing differences in specialisation across couple types *c*., with married heterosexual couples as the omitted reference group. The model includes wave fixed effects (γ_t, omitting Wave 2), while $\boldsymbol{X_{it}}$ is a vector of control variables for couple-level time-varying characteristics[21] (which are included sequentially) and ε_{it} is the error term. For all analyses, we show robust standard errors, clustered at couple level, to account for likely serial correlation.

Table 5 shows results for SI_1. The first column shows the results without including any of the X controls. These are essentially raw differences between couple types, controlling only for wave fixed effects. The differences mirror those shown in the descriptive section above. Columns 2 and 3 show that those couple-type differences are largely unexplained by simple demographic differences – namely age and couple duration.

In Column 4, we introduce a control for the presence of young children, aged 0-4. This is by far the single best predictor of specialisation. The results suggest that a young child increases SI_1 by 0.22. This is consistent with Figure 5. Furthermore, this variable appears to explain most of the difference between couple types in the extent of specialisation. It explains more than two-thirds of the difference between married and unmarried couples, and around half of the difference between married heterosexuals and gay couples, as well as. more than half of the difference between married heterosexuals and lesbian couples.

In Column 5 we also include controls for older children. They also have large and significant effects on SI_1 – albeit much smaller effects than do young children, as expected. With the inclusion of these controls, the model explains even more of the differences in specialisation between couple types, with none of the remaining couple-type differences significant at the 5% level.

Next, Column 6 includes controls for fertility intentions and expectations. These do not appear to have strong independent relationships with SI_1. Despite this, their inclusion contributes to further explaining remaining discrepancies in specialisation between couple types, and particularly for lesbian couples. This may be due to lesbian couples' high stated fertility expectations. In any case, neither fertility expectations nor desires are statistically significant.

[21] This includes age, age squared, couple duration, children, fertility intentions and log of relative wage. For a detailed description of how each control variable is constructed, see Appendix 2.

In Column 7, we also control for the absolute difference in hourly wage rates between couples. The results show a strongly significant positive relationship between the size of this gap and SI_1. But the estimated coefficient implies that an increase in relative wages by 1 log point (i.e. an increase in the ratio of hourly wages of 171%) increases specialisation by only 0.1. Ceteris paribus, SI_1 is only 0.1 units higher for a couple whose hourly wages differs by 171%, as compared to a couple whose members have the same hourly wage as each other. This seems to be a very small effect of relative wages on specialisation. We return to this theme in the analysis of SI_2 below. The inclusion of the relative wage variable does not change the couple-type coefficients greatly, and certainly not qualitatively.

Overall, it is clear that differences in the extent of specialisation between couple types are mostly explained by the presence of children, and to a lesser extent, expectations and desires around future fertility.

Table 5

Estimates from SI_1 regressions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.432***	0.577***	0.584***	0.417***	0.603***	0.548***	0.450***
	(0.006)	(0.044)	(0.045)	(0.041)	(0.043)	(0.064)	(0.065)
Unmarried Heterosexual	-0.0728***	-0.0780***	-0.0750***	-0.0236**	-0.0194*	-0.0142	-0.00859
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Gay	-0.122**	-0.122**	-0.140**	-0.0578	-0.0347	-0.0404	-0.0244
	(0.047)	(0.047)	(0.050)	(0.049)	(0.049)	(0.036)	(0.026)
Lesbian	-0.117***	-0.118***	-0.112***	-0.0565**	-0.0391*	-0.00698	0.0442
	(0.022)	(0.022)	(0.022)	(0.018)	(0.018)	(0.021)	(0.025)
Couple Age		-0.00713***	-0.00743***	-0.00664**	-0.0178***	-0.0159***	-0.0127***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)
Couple Age Squared		0.00829**	0.00800**	0.0106***	0.0247***	0.0224***	0.0161**
		(0.003)	(0.003)	(0.002)	(0.003)	(0.005)	(0.005)
Couple Duration			0.000661	0.00223***	0.00179***	0.00242***	0.00184*
			(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Children Aged 0-4				0.220***	0.221***	0.224***	0.208***
				(0.006)	(0.006)	(0.006)	(0.007)
Children Aged 5-9					0.0665***	0.0607***	0.0472***
					(0.006)	(0.006)	(0.007)
Children Aged 10-14					0.0462***	0.0487***	0.0271***
					(0.006)	(0.007)	(0.008)
Likely to Have [More] Children						-0.00121	0.0000398
						(0.002)	(0.002)
Desires [More] Children						0.00122	-0.000668
						(0.002)	(0.002)

Log Relative Wage							0.102***
							(0.010)
N	45337	45337	44567	44567	44567	27375	15118
R-sq	0.017	0.018	0.018	0.112	0.126	0.169	0.184

Notes: Standard errors in parentheses clustered on coupleID.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We now conduct a similar analysis for SI_2. The only changes we make are to exclude homosexual couples (for whom SI_2 is undefined), and to enter the age of each member (age of male and age of female) separately.

The estimated effects of children are even larger for SI_2 than for SI_1. Having a single young child is associated with an increase in SI_2 by 0.271, and the estimates for older children are also strongly significant.

However, these full set of controls do not explain all of the difference in SI_2 between married and unmarried heterosexual couples: half of the raw gap remains unexplained. We considered whether differences between couple types in gender attitudes may explain the gap, but they do not seem to.[22]

The most striking finding comes in Column 7. Here the estimated coefficient of relative wages is 0.1. This implies that if a woman's wage were to increase by one log point relative to her husband's, the extent of sex-based specialisation would go down by just 0.1. We further explore the role of AAM for sex-based specialisation in Section 7.

[22] HILDA includes questions on gender attitudes in only some waves (Waves 5, 8, 11 and 15). When the analysis is restricted to these waves, the inclusion of variables for conservative gender attitudes does not change the estimated coefficient for unmarried couples.

Table 6

Estimates from SI_2 regressions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.341***	0.131	0.142*	-0.0663	0.193**	0.398***	0.344***
	(0.009)	(0.069)	(0.070)	(0.065)	(0.069)	(0.091)	(0.095)
Unmarried Heterosexual	-0.106***	-0.124***	-0.121***	-0.0580***	-0.0533***	-0.0559***	-0.0530***
	(0.010)	(0.011)	(0.012)	(0.011)	(0.011)	(0.012)	(0.012)
Female Age		-0.0176**	-0.0180***	-0.0142**	-0.0243***	-0.0218***	-0.00655
		(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
Male Age		0.0310***	0.0309***	0.0284***	0.0229***	0.00673	-0.00604
		(0.005)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
Female Age Squared		0.0236***	0.0236***	0.0224***	0.0354***	0.0330***	0.0134
		(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.010)
Male Age Squared		-0.0419***	-0.0419***	-0.0379***	-0.0313***	-0.00954	0.00459
		(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)
Couple Duration			0.000703	0.00256**	0.00198*	0.00207*	0.00113
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Children Aged 0-4				0.271***	0.276***	0.291***	0.270***
				(0.008)	(0.009)	(0.009)	(0.010)
Children Aged 5-9					0.0747***	0.0829***	0.0638***
					(0.009)	(0.010)	(0.011)
Children Aged 10-14					0.0761***	0.0777***	0.0527***

					(0.009)	(0.010)	(0.011)
Likely to Have [More] Children						-0.000440	0.001000
						(0.003)	(0.003)
Desires [More] Children						0.00197	-0.000773
						(0.002)	(0.003)
Log Relative Wage SI2							0.100***
							(0.010)
N	44697	44697	43980	43980	43980	26975	14887
R-sq	0.016	0.035	0.035	0.107	0.120	0.173	0.185

Notes: Standard errors in parentheses clustered on coupleID.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We now estimate similar regressions for SI3 (shown in Table 7). The main insight from these results is that observable characteristics explain a smaller share of the differences in SI3 between heterosexual couples and same-sex couples, as compared to SI1. They do however, explain all of the difference between married and unmarried heterosexual couples.

To put this another way, whilst observables explain the couple-type differences in the extent of specialisation (as per SI1), they do not explain why heterosexuals are more likely to specialise consistently with AAM. The obvious explanation seems to be the role of sex in shaping AAM. As argued earlier, for heterosexual couples, AAM is likely to be influenced by gendered human capital investment. In other words, for heterosexuals, AAM is confounded by sex, while for homosexual couples AAM does not seem to play a role in time allocation decisions.

Turning to the coefficient estimates in Table 7, children and especially young children continue to have a strong effect. However, these are much smaller than for SI1 and SI2. In other words, children induce couples to specialise in a way that is consistent with sex-roles far more than they induce couples to specialise in AAM. This is perhaps unsurprising, since the presence of young children is the foundation for theories of sex-based AAD, and perhaps the origin of cultural gender-roles as well.

Table 7

Estimates from SI_3 regressions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.141***	-0.120	-0.134	-0.172*	-0.0418	-0.0213	-0.0732
	(0.012)	(0.073)	(0.075)	(0.074)	(0.079)	(0.126)	(0.124)
Unmarried Heterosexual	-0.0439***	-0.0386***	-0.0310*	-0.0151	-0.0123	-0.0000531	0.00475
	(0.010)	(0.011)	(0.013)	(0.013)	(0.013)	(0.014)	(0.014)
Gay	-0.163***	-0.180***	-0.158**	-0.133*	-0.119*	-0.0952	-0.0871
	(0.038)	(0.050)	(0.054)	(0.053)	(0.052)	(0.052)	(0.055)
Lesbian	-0.146***	-0.160***	-0.153***	-0.139**	-0.128**	-0.128*	-0.105
	(0.041)	(0.041)	(0.043)	(0.045)	(0.045)	(0.061)	(0.062)
Age (Higher Hourly Wage Earner)		0.0415***	0.0414***	0.0418***	0.0379***	0.0289***	0.0262***
		(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)
Age (Lower Hourly Wage Earner)		-0.0290***	-0.0283***	-0.0289***	-0.0328***	-0.0236**	-0.0213**
		(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)
Age squared (Higher Hourly Wage Earner)		-0.0321***	-0.0323***	-0.0321***	-0.0272***	-0.0137	-0.0125
		(0.007)	(0.007)	(0.007)	(0.007)	(0.010)	(0.010)
Age squared (Higher Hourly Wage Earner)		0.0174**	0.0160*	0.0170*	0.0220**	0.00518	0.00348
		(0.007)	(0.007)	(0.007)	(0.007)	(0.011)	(0.010)
Couple Duration			0.000981	0.00147	0.00119	0.00347**	0.00342**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Children Aged 0-4				0.0674***	0.0703***	0.0799***	0.0760***
				(0.014)	(0.014)	(0.014)	(0.014)
Children Aged 5-9					0.0424***	0.0454**	0.0428**
					(0.012)	(0.015)	(0.014)
Children Aged 10-14					0.0354***	0.0211	0.0189
					(0.011)	(0.015)	(0.014)
Likely to Have [More] Children						0.00160	0.00178

						(0.004)	(0.004)
Desires [More] Children						-0.00249	-0.00223
						(0.004)	(0.004)
Log Relative Wage SI3							0.180***
							(0.022)
N	22375	22375	22004	22004	22004	13485	13485
R-sq	0.004	0.038	0.038	0.042	0.046	0.068	0.088

Notes: Standard errors in parentheses clustered on coupleID.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7. Testing the Beckerian Model of Comparative Advantage

We have shown above that patterns of within-household specialisation appear to have little to do with absolute advantage in the market, and much to do with sex. In this section, we continue this investigation, taking a more structural approach. We specify a modified Beckerian model of time allocation and outline its predictions, and examine whether it can explain the patterns of gendered specialisation that we see in the data. There are considerable theoretical and empirical challenges involved in testing the model, which we seek to clearly discuss. Ultimately, we again see little evidence that comparative advantage plays an important role in specialisation decisions.

7.1 Predictions of a Beckerian Model

Couple i seeks to maximise domestic production for a single commodity Z_i as a function of purchased inputs (x) and domestic work time by each member of the couple (t_{mi} and t_{fi}):

$$Z_i = x_i^a t_{mi}^b t_{fi}^c \tag{7}$$

This is a Cobb-Douglas production function as per Becker (1973).[23] The parameters b and c represent relative productivity in domestic work for the male and female, respectively. These too are individual-specific, although we supress this from the notation for now.

Each couple maximises Z by choosing the amount of time each member allocates to market work and to domestic work (which we refer to collectively as work time). Leisure time is determined outside of, and has no explicit role in the model.[24] Allocations of leisure time may or may not be efficient or equitable, but this as irrelevant to assessing the role of comparative advantage as determinant of gendered specialisation. Total time in work is specific to every individual, so that

[23] In Appendix 4 we consider a more general class of CES production functions, which we draw upon when we interpret the empirical results later in this section.

[24] This is different to a standard Beckerian model, in which all time is allocated either to market work or domestic work. However, the conclusions of this section are the same if all time is assumed allocated either to market work or domestic work. We return to the role of leisure time in our discussion of equation (15) below.

for the male in couple i, work time (T_{mi}) is the sum of domestic work time (t_{mi}) and market work time (l_{mi}), and similarly for the female. These are the time constraints:

$$t_{mi} + l_{mi} = T_{mi} \tag{8}$$
$$t_{fi} + l_{fi} = T_{fi} \tag{9}$$

The production function imposes complementarity between domestic work of the male and the female (t_{mi} and t_{fi}). But there is no complementary in male and female market work (l_{mi} and l_{fi}), since x_i is equal to the couple's earnings:

$$x_i = w_{mi}l_{mi} + w_{fi}l_{fi} \tag{10}$$

In this model, an efficient time allocation maximizes Z_i subject to the time constraints in (8) and (9) and the budget constraint in (10). Substituting (8), (9) and (10) into (7), household i's problem is to maximise:

$$Z_i = [w_{mi}(T_{mi} - t_{mi}) + w_{fi}(T_{fi} - t_{fi})]^a \; {t_{mi}}^b \; {t_{fi}}^c \tag{11}$$

Taking logs:

$$\ln Z_i = a \ln[w_{mi}(T_{mi} - t_{mi}) + E_{fi}(T_{fi} - t_{fi})] + b \ln \; t_{mi} + c \ln \; t_{fi} \tag{12}$$

The first order conditions are:

$$\frac{\partial \ln Z_i}{\partial t_{mi}} = \frac{-aw_{mi}}{w_{mi}(T_{mi}-t_{mi})+w_{fi}(T_{fi}-t_{fi})} + \frac{b}{t_{mi}} = 0 \tag{13}$$
$$\frac{\partial \ln Z_i}{\partial t_{fi}} = \frac{-aw_{fi}}{w_{mi}(T_{mi}-t_{mi})+w_{fi}(T_{fi}-t_{fi})} + \frac{c}{t_{fi}} = 0 \tag{14}$$

Equations (13) and (14) imply:

$$\frac{t_{fi}}{t_{mi}} = \frac{c}{b} \Big/ \frac{w_{fi}}{w_{mi}} \tag{15}$$

which is independent of the total time each person spends working (T_{fi} and T_{mi}), confirming that the amount of leisure time each member has does not impact the models' predicted relative domestic work time allocation. Note also that the right hand side of Equation (15) is female absolute advantage in domestic work ($\frac{c}{b}$), divided by female absolute advantage in market work ($\frac{w_{fi}}{w_{mi}}$), which equals female comparative advantage in domestic work. That is,

$$\frac{t_{fi}}{t_{mi}} = \frac{AAD_i}{AAM_i} = CA_i \tag{16}$$

Finally, we take the logged version of equation (15), and allow b and c to be couple-specific, recognising that AAD is likely to vary greatly between couples:

$$\ln \frac{t_{fi}}{t_{mi}} = \ln \frac{c_i}{b_i} - \ln \frac{w_{fi}}{w_{mi}} \tag{17}$$

7.2 Testing the Beckerian Model

Testing whether the theoretical prediction above is consistent with the data is particularly challenging. We begin by listing these challenges:

a) The first major complication is that we do not observe AAD, which is the first term on the RHS of (17). Further to this, we do not know whether AAD is correlated with AAM, or the size of this correlation.

b) AAM (the second term on the RHS of 17) is likely endogenous. In particular, wages are a function of decisions in the past to invest in human capital (especially time spent in market work), and there is likely to be strong serial correlation in such time use decisions. This is especially likely to affect womens' wages and time use, since men typically work full-time for most of their working-age.

c) The Beckerian model above assumes a Cobb-Douglas production function, which imposes a substitution elasticity of 1 between male and female domestic work. This has no empirical justification. Appendix 4 shows that relaxing this assumption with a class of CES production functions yields solutions which are similar to (18), but with s (the elasticity of substitution) appearing as a coefficient to both terms on the RHS (see equation A7). Since we do not know the true elasticity of substitution, this complicates the interpretation of

both the slope and the intercept in the relationship between $\ln\frac{t_{fi}}{t_{mi}}$ and $\ln\frac{w_{fi}}{w_{mi}}$, which we examine below.

d) Finally, the presence of measurement error in the relative wage, which would bias the slope the relationship between $\ln\frac{t_{fi}}{t_{mi}}$ and $\ln\frac{w_{fi}}{w_{mi}}$ towards zero. As discussed in Section 3, there is good reason to believe that measurement error in wages is relatively minor, at least when assessed relative to the other complications listed above.

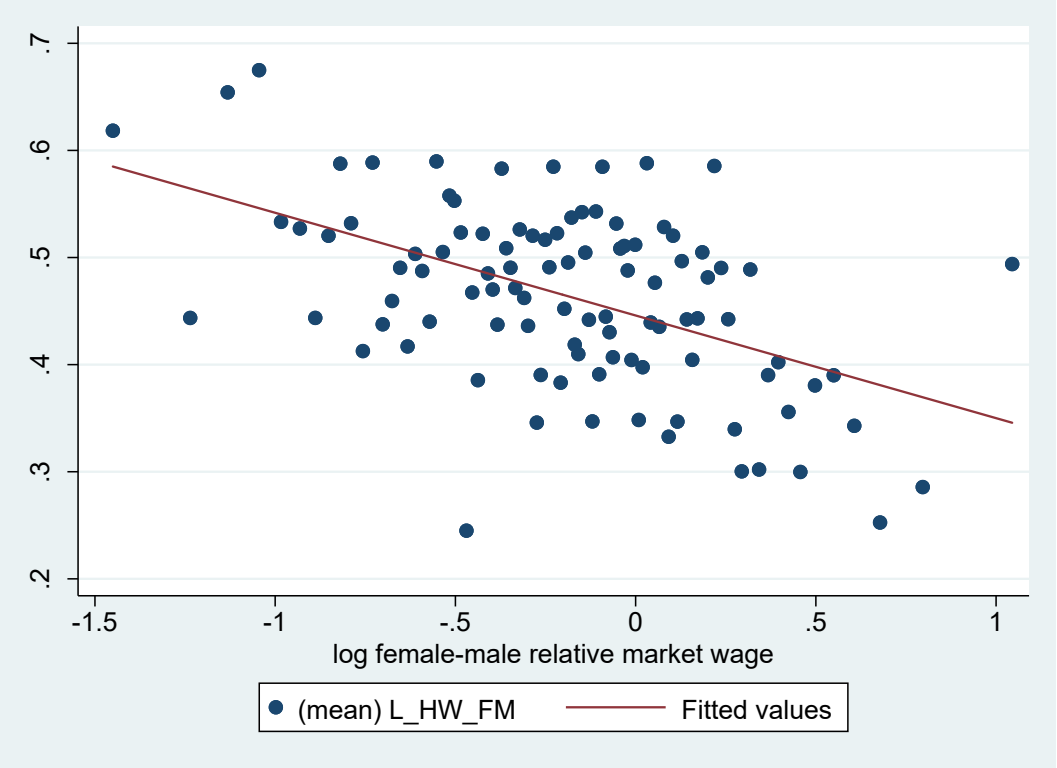


Figure 17: Log relative domestic work time by log relative wage

Keeping these major challenges in mind, Figure 17 below the actual non-parametric relationship between $\ln\frac{t_{fi}}{t_{mi}}$ and $\ln\frac{w_{fi}}{w_{mi}}$. Each point shows the mean of the former for each percentile of the latter, with a superimposed linear fit. This fit is suggestive of a negative linear relationship, which

is qualitatively consistent with the Beckerian model, and this is confirmed in regression analysis (Table 8).[25]

Table 8: Regressions of log relative domestic work time on log relative wage

	(1) No controls	(2) With controls
	A: All couples	
log (female wage / male wage)	-0.095***	-0.101***
	(0.030)	(0.029)
Constant	0.446***	0.434***
	(0.015)	(0.021)
N	24,003	23,622
	B: Couples without children	
log (female wage / male wage)	-0.115***	-0.099**
	(0.040)	(0.041)
Constant	0.291***	0.277***
	(0.020)	(0.030)
N	12917	12718

Notes: This table presents results from regression models which correspond to Figure 17, and equation (17). Control variables include quadratics in female age and male age, duration of relationship, and number of children aged 0-5, 5-9 and 10-14, respectively. Standard errors in parentheses clustered on coupleID.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

But perhaps the main feature of Figure 17 is that women do much more housework than males at every percentile of the relative wage distribution. For example, at wage parity, the fitted value is 0.446, implying that women do 56% more housework than their husbands. Even at the 99th percentile of the relative wage distribution, where women's wages are 2.4 times higher than their partners', women still do 44% more housework. It seems that no matter how large her wage advantage, a woman always has an even larger expected advantage in domestic work, if the Beckerian model holds.

[25] For this analysis, we exclude observations in the top and bottom 0.5% of the relative wage distribution. The top 0.5% of the distribution in particular is characterised by outlying high values of female/male relative housework. We believe this is because extreme values in the relative wage distribution result from measurement error rather than the actual relative wage. If however, we include those observations, the main results are even stronger. These results are available on request.

A naïve interpretation of the Beckerian model outlined above would conclude that at wage parity, women are on average 56% more productive in the home, whilst at the extreme end of relative wage advantage, women are 3.5 times as productive in domestic work as their husbands (drawing on equation 17). This implies a very strong correlation between AAM and AAD. But this pattern of results could also be consistent with a different (smaller) elasticity of substitution between male and female housework. The estimated slope of the relationship in Figure 17 is -0.095. If we hence assume the elasticity of substitution is 0.095 (as per equation A7 in Appendix 4), this has major implications. It implies that women are about 109 times more productive than their husbands in domestic work (regardless of their relative wage). But this strong dependence on the assumed elasticity of substitution makes it difficult to say more about how large women' AAD needs to be for the results to remain consistent with a Beckerian framework.

Another way to interpret these results is to ask how large a woman's wage advantage would have to be for parity in domestic work time to be expected. This exercise requires extrapolation well outside the support of the data. However it avoids some complications, since it does not require assumptions as to the elasticity of substitution, or the correlation between AAD and AAM. Predicted parity in domestic work occurs when a woman's wage is 109 times higher (and hence that her domestic productivity is also 109 times higher).[26] This is clearly extremely high. If we restrict the sample to couples without children (drawing on Table 8 Panel B), this falls to 12.6. Whilst considerably smaller, this is still an extreme value, well outside of the support of the data.

These results are essentially a consequence of the weak relationship between the relative wage and relative housework time. As mentioned above, however, the relative wage is likely endogenous to this relationship. But the direction of resulting bias is favourable to the emerging conclusion. For example, it is entirely possible that endogeneity explains all of this relationship (i.e. that relative wages are a consequence of earlier time use decisions, rather than a determinant of current time use decisions). If so, this would suggest that comparative advantage has no role at all in explaining gendered time use patterns.

Indeed, we find suggestive support for this endogeneity explanation if we separately consider mens' and womens' housework time. Since most men work full-time, the endogeneity of relative

[26] It is not a coincidence that this number (109) is the same as under the CES interpretation above. But the interpretation here is different.

wages is more likely to generate a (spurious) relationship for females than for males. We separate the LHS of Equation (17) into two components, which respectively address men's and women's responses to relative wages:

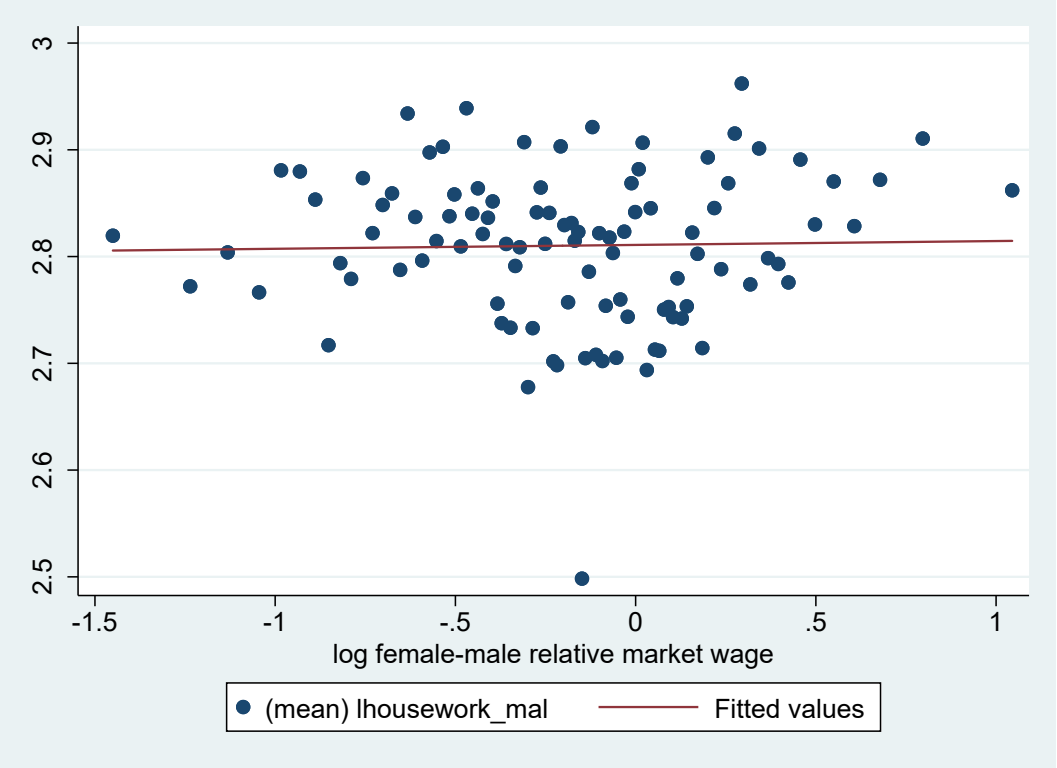
$$\ln t_{mi} = -\ln \frac{c_i}{b_i} + \ln \frac{w_{fi}}{w_{mi}} \tag{18}$$

$$\ln t_{fi} = \ln \frac{c_i}{b_i} - \ln \frac{w_{fi}}{w_{mi}} \tag{19}$$

Figure 18 shows the binned-mean plots corresponding to (18) and (19), for males, and females respectively. Visually, there is no apparent relationship between male housework time and the relative wage. In contrast, there is a clear negative relationship for females. Results from corresponding regression models shown in Table 9 confirm this. As mentioned, this discrepancy may reflect endogeneity related to earlier female time use decisions. Whether or not this is the case, these results strongly suggest that AAM has no role at least men's domestic time use allocation, which immediately contradicts the predictions of models which assume that households allocate their productive time efficiently.

Overall, we reach the same conclusion as our earlier analysis – that AAM has little or no role in specialisation decisions, contrary to the predictions of a Beckerian model.

A: Males



B: Females

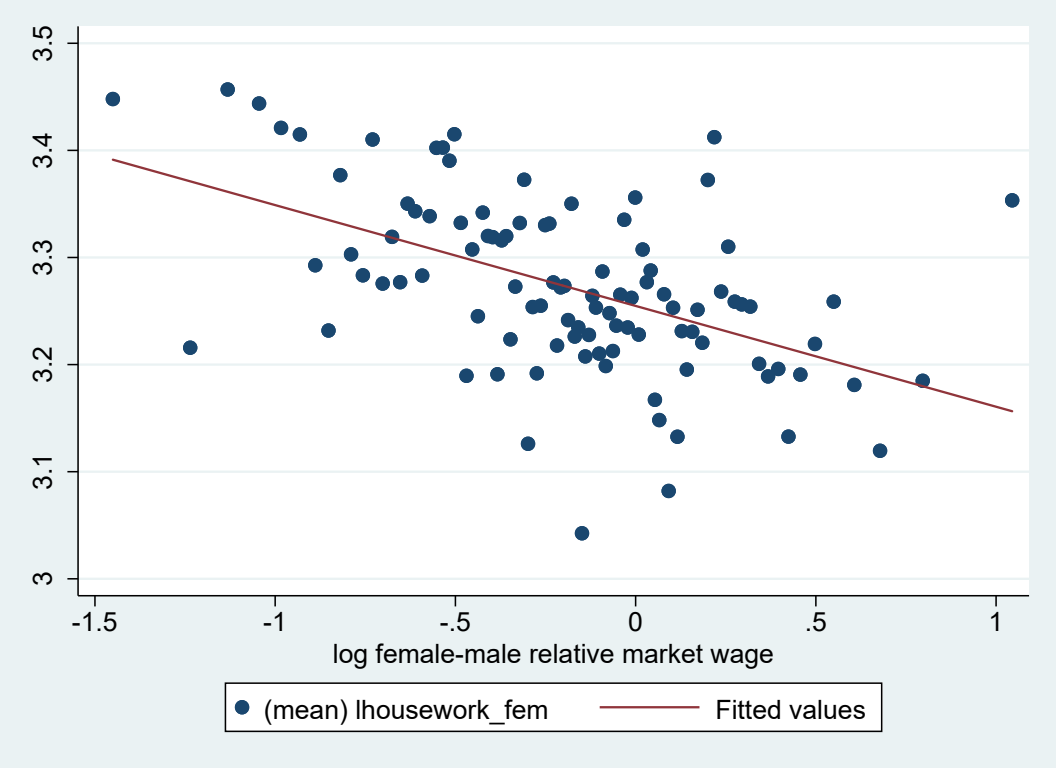


Figure 18: Log domestic work time by log relative wage

Table 9: Regressions of log domestic work time on log relative wage

	(1) No controls	(2) With controls
	A: Log male domestic work	
log (female wage / male wage)	0.003	0.009
	(0.024)	(0.023)
Constant	2.811***	1.012***
	(0.013)	(0.154)
N	24,098	23,713
	A: Log female domestic work	
log (female wage / male wage)	-0.094***	-0.093***
	(0.027)	(0.021)
Constant	3.255***	1.106***
	(0.014)	(0.137)
N	24,118	23,731

Notes: This table presents results from regression models which correspond to Figure 18, and equations (18) and (19). Control variables include quadratics in female age and male age, duration of relationship, and number of children aged 0-5, 5-9 and 10-14, respectively. Robust standard errors in parentheses are clustered on coupleID.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

8. Conclusion

Family economics has evolved considerably since Becker's seminal contributions. To our knowledge, however, Becker's explanation for the sexual division of labour - comparative advantage within households – has not previously been empirically scrutinised directly. Within-household specialisation has not even been directly measured.

This paper has sought to address these gaps. We have shown that comparative advantage plays little or no role in explaining the sexual division of labour through two complementary analyses. First, drawing on newly developed specialisation indices, we found that specialisation conforms much more with sex than with AAM. The small role that AAM seems to have is likely overestimated, since current AAM may simply reflect earlier time use decisions which affect human capital, and are in turn driven by gender norms. Amongst same-sex couples (for whom this complication is not relevant) AAM plays no role at all in specialisation. Secondly, we illustrate and test the predictions of a formal Beckerian domestic production model. Whilst there are considerable challenges in testing this model directly, we find that a woman would need to be 109

times more productive in market work than her husband before reaching expected parity in domestic work. Even this estimate is likely severely biased downwards due to endogeneity of relative wages to earlier time use decisions. Furthermore, only women's domestic work time seems to respond to relative wages, whilst men's does not respond at all. This provides further support for the endogenous AAD interpretation, since such endogeneity is likely to affect women more than men, since womens' market work hours vary much more.

By default, we conclude that gender norms are the likely explanation for the sexual division of labour – not only in the case where women's earnings are higher than males (as per Betrand *et al.*, 2015 and others).

Our specialisation indices allow us to make a number of additional observations. Within-household specialisation behaviour is diverse, and does not always conform with AAM or with sex. Some couples specialise completely but many do not specialise at all. Overall, the degree of specialisation has fallen somewhat over recent decades, primarily due to a reduction in sex-based specialisation and more equal participation in market work. There are considerable differences between couple-types in the extent of specialisation, but these are almost completely explained by the presence of children (and to a lesser extent expectations of having children in the future).

We have attempted to contribute to the understanding of specialisation and the sexual division of labour in the 21st century. However, the role of men and women in contemporary society is changing rapidly, largely due to technology, but also due to broader institutional reforms accommodating such development (consider, for example, the introduction of paternity leave in many organisations). Perhaps more than most other fields of economics, it is necessary to continually revisit the role of gender at home and at work, and the implications this has for couple-behaviour more broadly. With non-traditional households becoming more prevalent in society (for example, same-sex, polyamorous, single-parent, childless, *etc.*), and our understanding of gender becoming more complex, typical household structures will continue to shift, and the study of such behaviour will become more relevant. Thus more work is needed, and needed often, for this field to keep pace with societal change more broadly.

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Appendix 1 Additional Descriptive Statistics

Table A1.1: Descriptive statistics by Couple Type (weighted)

Variable	Married Heterosexual	Unmarried Heterosexual	Gay	Lesbian
SI_1	0.398	0.324	0.272	0.280
	(0.270)	(0.258)	(0.256)	(0.242)
N	*33,824*	*10,873*	*249*	*391*
SI_2	0.297	0.189		
	(0.379)	(0.368)		
N	*33,824*	*10,873*		
SI_3	0.124	0.079	-0.039	-0.023
	(0.395)	(0.351)	(0.291)	(0.364)
N	*16,284*	*5,783*	*115*	*193*
Couple Age	44.023	36.076	40.169	38.813
	(9.855)	(10.661)	(9.803)	(9.625)
Couple Duration	18.427	6.072	6.201	7.034
	(10.814)	(6.367)	(4.931)	(5.526)
Children Aged 0-4	0.248	0.206	0.003	0.152
	(0.432)	(0.404)	(0.059)	(0.359)
Children Aged 5-9	0.233	0.144	0.007	0.078
	(0.423)	(0.351)	(0.083)	(0.268)
Children Aged 10-14	0.230	0.129	0.000	0.038
	(0.421)	(0.335)	(0.000)	(0.191)
Any Children < 15	0.518	0.357	0.007	0.221
	(0.500)	(0.479)	(0.083)	(0.415)
Likely to Have [More Children]	3.113	5.518	2.130	3.925
	(3.925)	(3.920)	(2.488)	(3.800)
Desires [More] Children	3.700	5.923	3.179	4.724
	(3.984)	(3.790)	(3.150)	(4.000)
Log Relative Wage	0.403	0.337	0.342	0.246
	(0.355)	(0.314)	(0.333)	(0.181)

Time-use (hours in a typical week, per couple)

Domestic Work	63.159	50.881	26.560	46.437
	(37.372)	(39.328)	(13.546)	(38.950)
Housework	24.400	19.245	13.313	18.658
	(13.863)	(12.732)	(6.844)	(10.596)
Household Errands	9.212	8.114	7.622	7.848
	(7.016)	(6.311)	(6.125)	(5.529)
Childcare	21.446	16.302	1.713	14.263
	(27.686)	(27.639)	(7.477)	(30.890)
Outdoor Tasks	8.100	7.220	3.912	5.668
	(7.837)	(8.487)	(4.280)	(6.163)
Market Work	71.462	75.380	76.994	71.804
	(25.627)	(26.167)	(27.060)	(27.443)
Paid Employment	64.210	67.778	69.692	64.018
	(23.330)	(23.756)	(24.086)	(25.317)
Commuting	7.251	7.603	7.302	7.786
	(5.790)	(5.895)	(5.030)	(6.285)

Appendix 2 Description of Variables

Variable	*HILDA Identifier*	*Construction*
Hourly Wage	wscmei jbmhruc	Hourly wages defined as current weekly gross wages in main job divided by hours usually worked per week in main job. For each individual, we construct hourly wages based on their median non-missing hourly wage in a five-year window; 2 year preceding and 2 years following the current wave. Hourly wages are restricted to between AUD $1.90 and AUD $211.
Couple Type	hhpxid hgsex mrcurr	Couples are matched together based on their unique partner identifier. Gay and lesbian households are determined when corresponding partners are the same-sex, whilst heterosexual couples are different-sex. Both heterosexual partners must be recorded as married to be classified as such, else the couple is listed as unmarried. Couple type is equal to one if classified as married heterosexual, two if unmarried heterosexual, three if gay and four if lesbian.
Children Aged 0-4	hhd0_4	Dummy variable equal to one if there are one or more dependent children between the ages of 0 and 4 living in the household, zero otherwise.
Children Aged 5-9	hhd5_9	Dummy variable equal to one if there are one or more dependent children between the ages of 5 and 9 living in the household, zero otherwise.
Children Aged 10-14	hhd1014	Dummy variable equal to one if there are one or more dependent children between the ages of 10 and 14 living in the household, zero otherwise.
Couple Duration	orcdur mrcdur mrplvt	For unmarried heterosexual and same-sex couples, duration is equal to orcdur (current de-facto duration). For married heterosexual couples, duration is equal to mrcdur (current marriage duration) plus mrplvt (years living together before present marriage).
Likely to Have [More Children]	icexpct	Constructed using the average score of both couple members per couple wave observation. Considers whether the respondent is likely to have children in the future. Ranges from zero to 10.
Desires [More] Children	iclike	Constructed using the average score of both couple members per couple wave observation. Considers whether the respondent would like to have children in the future. Ranges from zero to 10.
Conservatism	atwkmpl	Constructed using the average score of both couple members per couple wave observation. Asks respondents whether they consider men to make better political leaders than women on a scale of 0 (strongly disagree) to 7 (strongly agree). Variable only available in waves 5, 8, 11 and 15. *Note:* When analysis was only restricted to these waves, the inclusion of this variable does not change the estimated coefficient for unmarried couples.

Additional Explanatory Variables used in Regression Models for Specialisation Index I

Couple Age	hgage	Constructed by taking the average age of both couple members.
Couple Age Squared	hgage	Constructed by squaring the couple age variable.

Log Relative Wage	Hourly Wage	Equal to the absolute value of the log of relative wages between couple members i.e. | ln (hourly wage partner 1 / hourly wage partner 2) |

Additional Explanatory Variables used in Regression Models for Specialisation Index 2

Female Age	hgage	The age of the female partner.
Male Age	hgage	The age of the male partner.
Female Age Squared	hgage	Constructed by squaring the female age variable.
Male Age Squared	hgage	Constructed by squaring the male age variable.
Log Relative Wage SI_2	Hourly Wage	ln (hourly wage male partner/ hourly wage female partner)

Additional Explanatory Variables used in Regression Models for Specialisation Index 3

Age Higher Hourly Wage Earner	hgage	The age of the partner with the higher hourly wage.
Age Lower Hourly Wage Earner	hgage	The age of the partner with the lower hourly wage.
Age Squared – Higher Hourly Wage Earner	hgage	Constructed by the squaring the age of the higher hourly wage earner variable.
Age Squared – Lower Hourly Wage Earner	hgage	Constructed by the squaring the age of the lower hourly wage earner variable.
Log Relative Wage SI_3	Hourly Wage	ln (hourly wage of the partner with the higher hourly wage/ hourly wage of the partner with the lower hourly wage)

Appendix 3 Unweighted Tables and Regression Results

Table A3.1
Correlations between the specialisation indices (unweighted)

	SI1	*SI2*	*SI3*
SI1	1.000		
SI2	0.627	1.000	
SI3	0.298	0.326	1.000

Table A3.2
Couples specialising according to AA (unweighted)

	Mean	*SD*
SI2 > 0	0.771	(0.420)
SI3 > 0	0.614	(0.487)

Table A3.3

Mean of SI_3 by couple type and minimum wage gap (unweighted)

	Couple Type			
	Married Heterosexual	Unmarried Heterosexual	Gay	Lesbian
		A. > 5% wage gap		
Mean SI_3	0.121	0.077	-0.046	0.000
(SE)	(0.003)	(0.005)	(0.030)	(0.025)
N 22,471				
		B. > 10% wage gap		
Mean SI_3	0.132	0.087	-0.045	0.021
(SE)	(0.003	(0.005)	(0.031)	(0.029)
N 19,864				
		C. > 20% wage gap		
Mean SI_3	0.156	0.108	-0.048	0.047
(SE)	(0.004)	(0.006)	(0.034)	(0.033)
N 14,814				
		D. > 50% wage gap		
Mean SI_3	0.239	0.186	-0.052	-0.407
(SE)	(0.008)	(0.014)	(0.129)	(0.271)
N 3787				

Table A3.4

Unweighted estimates from SI_1 regressions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.433***	0.545***	0.545***	0.445***	0.602***	0.581***	0.475***
	(0.006)	(0.033)	(0.034)	(0.031)	(0.032)	(0.046)	(0.049)
Unmarried Heterosexual	-0.0731***	-0.0794***	-0.0761***	-0.0227***	-0.0186**	-0.0150*	-0.0118
	(0.005)	(0.006)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Gay	-0.137***	-0.139***	-0.140***	-0.0534	-0.0329	-0.0367	-0.0149
	(0.037)	(0.037)	(0.041)	(0.040)	(0.040)	(0.031)	(0.028)
Lesbian	-0.127***	-0.128***	-0.122***	-0.0678***	-0.0529**	-0.0159	0.0252
	(0.018)	(0.018)	(0.019)	(0.017)	(0.017)	(0.019)	(0.022)
Couple Age		-0.00538***	-0.00541**	-0.00798***	-0.0177***	-0.0175***	-0.0142***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Couple Age Squared		0.00616**	0.00562**	0.0123***	0.0247***	0.0246***	0.0189***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)
Couple Duration			0.000666	0.00205***	0.00161***	0.00170**	0.000901
			(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Children Aged 0-4				0.227***	0.229***	0.235***	0.222***
				(0.005)	(0.005)	(0.005)	(0.006)
Children Aged 5-9					0.0578***	0.0516***	0.0348***
					(0.004)	(0.005)	(0.006)
Children Aged 10-14					0.0477***	0.0535***	0.0338***
					(0.005)	(0.006)	(0.007)
Likely to Have [More] Children						-0.00137	-0.000693
						(0.001)	(0.002)
Desires [More] Children						0.000988	-0.000117

						(0.001)	(0.002)
Log Relative Wage							0.103***
							(0.008)
N	45560	45560	44783	44783	44783	27503	15177
R-sq	0.020	0.021	0.021	0.125	0.137	0.185	0.198

Standard errors in parentheses

=* p<0.05 ** p<0.01 *** p<0.001

Table A3.5

Unweighted estimates from SI_2 regression

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.343***	0.163**	0.153**	0.0266	0.259***	0.462***	0.442***
	(0.008)	(0.051)	(0.052)	(0.048)	(0.051)	(0.069)	(0.073)
Unmarried Heterosexual	-0.110***	-0.127***	-0.117***	-0.0517***	-0.0468***	-0.0495***	-0.0505***
	(0.008)	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Female Age		-0.0138***	-0.0136**	-0.0115**	-0.0209***	-0.0216***	-0.0119*
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
Male Age		0.0260***	0.0260***	0.0212***	0.0161***	0.00284	-0.00725
		(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Female Age Squared		0.0188***	0.0177***	0.0187***	0.0311***	0.0333***	0.0211**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.008)
Male Age Squared		-0.0359***	-0.0363***	-0.0296***	-0.0235***	-0.00524	0.00654
		(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)
Couple Duration			0.00134*	0.00301***	0.00236***	0.00239**	0.00115
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Children Aged 0-4				0.278***	0.285***	0.303***	0.286***
				(0.007)	(0.007)	(0.007)	(0.008)
Children Aged 5-9					0.0693***	0.0762***	0.0583***
					(0.006)	(0.007)	(0.009)
Children Aged 10-14					0.0810***	0.0812***	0.0605***
					(0.007)	(0.008)	(0.010)
Likely to Have [More] Children						0.00166	0.00188
						(0.002)	(0.002)
Desires [More] Children						-0.000372	-0.00141
						(0.002)	(0.002)
Log Relative Wage SI_2							0.0951***
							(0.009)

N	44918	44918	44194	44194	44194	27101	14945
R-sq	0.020	0.037	0.037	0.116	0.129	0.185	0.196

=* p<0.05, ** p<0.01, *** p<0.001

Table A3.6

Unweighted estimates from SI_3 regressions

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Constant	0.146***	-0.107	-0.127*	-0.145*	-0.0343	0.0494	-0.0108
	(0.011)	(0.059)	(0.060)	(0.059)	(0.062)	(0.095)	(0.093)
Unmarried Heterosexual	-0.0436***	-0.0364***	-0.0224*	-0.00548	-0.00320	0.00330	0.00830
	(0.009)	(0.010)	(0.011)	(0.011)	(0.011)	(0.013)	(0.012)
Gay	-0.166***	-0.185***	-0.159**	-0.132**	-0.119*	-0.108*	-0.0984
	(0.036)	(0.046)	(0.050)	(0.050)	(0.049)	(0.051)	(0.053)
Lesbian	-0.120***	-0.130***	-0.114**	-0.101**	-0.0913*	-0.0686	-0.0452
	(0.032)	(0.033)	(0.035)	(0.037)	(0.037)	(0.051)	(0.050)
Age (Higher Hourly Wage Earner)		0.0408***	0.0402***	0.0400***	0.0367***	0.0218***	0.0188**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Age (Lower Hourly Wage Earner)		-0.0287***	-0.0273***	-0.0284***	-0.0319***	-0.0211**	-0.0178**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)
Age square (Higher Hourly Wage Earner)		-0.0315***	-0.0314***	-0.0305***	-0.0264***	-0.00407	-0.00233
		(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)
Age squared (Higher Hourly Wage Earner)		0.0172**	0.0147**	0.0164**	0.0210***	0.00172	-0.00136
		(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)
Couple Duration			0.00176*	0.00223**	0.00190**	0.00377***	0.00365***
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Children Aged 0-4				0.0721***	0.0780***	0.0896***	0.0858***
				(0.012)	(0.012)	(0.013)	(0.012)
Children Aged 5-9					0.0269*	0.0256*	0.0248*
					(0.010)	(0.012)	(0.012)
Children Aged 10-14					0.0440***	0.0341**	0.0325*
					(0.010)	(0.013)	(0.013)
Likely to Have [More] Children						-0.00120	-0.00124

						(0.003)	(0.003)
Desires [More] Children						0.000562	0.000770
						(0.003)	(0.003)
Log Relative Wage SI3							0.176***
							(0.018)
N	22471	22471	22094	22094	22094	13536	13536
R-sq	0.004	0.039	0.039	0.044	0.046	0.067	0.085

Standard errors in parentheses

=* p<0.05 ** p<0.01 *** p<0.001

Appendix 4 Extension of the Theoretical Model to a More General Class of Production Functions

In this Appendix, we show that the insights of Section 7 extend to the more general class of CES productions functions, regardless of the assumed elasticity of substitution between male and female domestic work. The CES production function which corresponds with (7) is:

$$Z_i = x_i^{\beta}\left[at_{mi}^{r}+(1-a)t_{fi}^{r}\right]^{1/r} \quad \text{(A1)}$$

Where $\frac{1}{1-r} = s$, where s is the elasticity of substitution between $t_{mi}$and t_{fi}

Productivity in domestic work for the male and female are represented by a, and $1-a$ respectively. As with the Cobb-Douglas function, these productivities are relative, and are individually specific.

Substituting the same constraints as previously: (8), (9) and (10) into (A1), the couple's problem is to maximise:

$$Z_i = [w_{mi}(T_{mi}-t_{mi}) + w_{fi}(T_{fi}-t_{fi})]^{\beta}\left[at_{mi}^{r}+(1-a)t_{fi}^{r}\right]^{1/r} \quad \text{(A2)}$$

Taking logs:

$$\ln Z_i = \beta \ln[w_{mi}(T_{mi}-t_{mi}) + w_{fi}(T_{fi}-t_{fi})] + {}^{1}/_{r} \ln\left[at_{mi}^{r}+(1-a)t_{fi}^{r}\right] \quad \text{(A3)}$$

The first order conditions are:

$$\frac{\partial Z_i}{\partial t_{mi}} = \frac{-\beta w_{mi}}{w_{mi}(T_{mi}-t_{mi})+w_{fi}(T_{fi}-t_{fi})} + \frac{at_{mi}^{r-1}}{at_{mi}^{r}+(1-a)t_{fi}^{r}} = 0 \quad \text{(A4)}$$

$$\frac{\partial Z_i}{\partial t_{fi}} = \frac{-\beta w_{fi}}{w_{mi}(T_{mi}-t_{mi})+w_{fi}(T_{fi}-t_{fi})} + \frac{(1-a)t_{fi}^{r-1}}{at_{mi}^{r}+(1-a)t_{fi}^{r}} = 0 \quad \text{(A5)}$$

Equations (A4) and (A5) imply:

$$\frac{t_{fi}}{t_{mi}} = \left[\frac{(1-a)}{a} / \frac{w_{fi}}{w_{mi}}\right]^{s} \quad \text{(A6)}$$

Or in logs:

$$\ln \frac{t_{fi}}{t_{mi}} = s \ln \frac{(1-a)}{a} - s \ln \frac{w_{fi}}{w_{mi}} \quad \text{(A7)}$$

This implies a linear relationship between the log relative domestic time allocation and log relative wage, just as the Cobb-Douglas production function, as per equation (18). The only difference is the slope of this relationship, which here is equal to the elasticity of substitution between male and female domestic work.

Appendix 5 Sensitivity analysis – treatment of missing wage observations

This Appendix shows results of sensitivity tests which aim to address potential sample-selection bias due to missing wage observations. Such sample-selection issues may affect the SI3 analysis and the assessment of the Beckerian theoretical model. In the main analysis, we have already partially addressed this issue, drawing on the panel dimension of the data. Specifically, rather than drawing only on contemporaneous observations of wages, we have used each person's median observed wage over a 5 year period. Nevertheless, for many couples, at least one member does not have a wage observation over such a 5-year period, and so they were dropped the analysis. Here we have taken three alternate approaches to deal with such missing data, which lead to progressively larger samples.

Extending the five-year wage window

First, for individuals with a missing relative wage in the main analysis, we extend the 5-year window as far as necessary until we observe a non-missing wage observation. Under this approach, our sample for SI_3 grows from 22,375 to 28,480, an increase of 27%. As shown in Table A5.1, the mean of SI_3 increases only marginally under this approach, from 0.114 to 0.122. The means of SI_3 by couple type are also quite similar, as are the remaining couple-type differences after observed characteristics are held constant.

Imputing a wage for self-employed persons

Next, we impute a crude wage for self-employed people for whom we still do not have an hourly wage observation. For them, we assign a wage equal to the median weekly own-business income for Australian business owners, divided by 37.5, using ABS data.[27] This approached increases the sample by a further 3,694 observations. Column (3) of Table A5.1 shows that key results drawn from this sample are very similar to those from the original sample.

Assigning the minimum wage to remaining observations

Finally, we assign the minimum wage for any remaining people who do not yet have an hourly wage observation. These are people who are not self-employed, and who did not work as employee at any wave of their time in the HILDA survey (or did not provide a valid response to the questions

[27] ABS 2018, Cat No. 2071.0. This data was collected during the 2016 Australian census. For earlier (later) years, we deflate (inflate) this hourly wage estimate by 3.5% per annum.

about earnings and hours worked in any given wave). This imputation adds another 2,137 couple-year observations for the SI_3 analysis. Under this approach, the final sample includes 34,311 observations. Key results from this sample are shown in Column (4) of Table A5.1. These are, in most respects, again very similar to those from the original sample. The exception to this is the coefficient for gay couples in Panel C, which (whilst remaining statistically insignificant) has a different sign to the earlier columns.

Table A5.1: Sensitivity of key results to treatment of missing wage observations

	Original sample (1)	Extended sample 2 (2)	Extended sample 3 (3)	Extended sample 4 (4)
A: Number of couple observations				
No. of couples with non-missing wage	22,375	28,480	32,174	34,311
B: Mean of SI_3				
Overall	0.114	0.122	0.118	0.126
by couple type:				
Married heterosexual	0.124	0.137	0.135	0.142
Unmarried heterosexual	0.079	0.083	0.071	0.080
Gay	-0.039	-0.053	-0.029	0.034
Lesbian	-0.023	0.019	0.012	0.028
C: Differences after controlling for observed characteristics				
Unmarried heterosexual	0.005	-0.004	-0.004	-0.004
Gay	-0.087	-0.103*	-0.085	0.031
Lesbian	-0.105	-0.097*	-0.121**	-0.105*

Notes: The extended samples allocate non-missing wages using an increasing liberal approach as described in the text. Estimates have been weighted, consistent with the main analysis. The results shown in Panel C correspond with the coefficients of each couple type in Column (7) of Table 7.

Relationship between relative domestic work time and log relative wage

The analysis in section 7 is also subject to sample selection bias due to missing relative wage observations. The relationship between relative work time and the log relative wage is what drives all of the results in that section. This relationship is very similar in the extended samples described above. As an example, this is demonstrated in Figure A5.1 for Extended Sample 4.

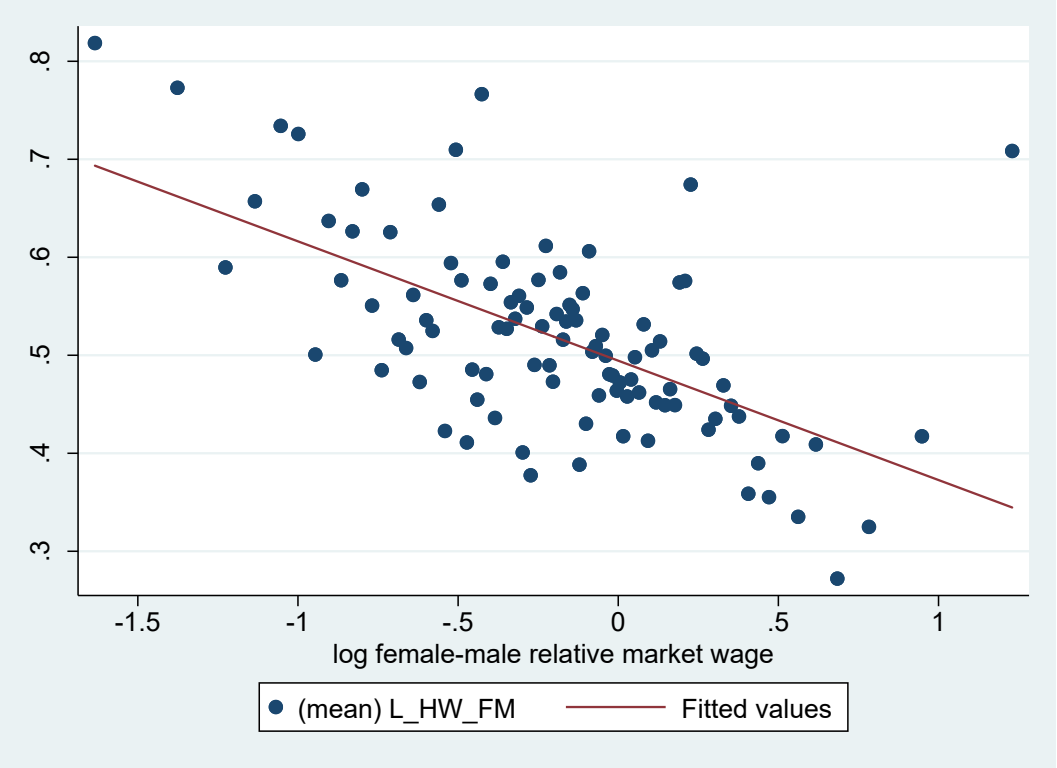

Figure A5.1: Log relative domestic work time by log relative wage with Extended Sample 4

Appendix 6 Sensitivity analysis – outliers

This Appendix addresses sensitivity of key results to the treatment of extreme outliers in time use data - specifically, any observations whose reported time in paid work and domestic work exceeds the reasonable limits of non-sleeping time.

Assuming eight hours of sleeping time every day, this leaves a maximum of 112 hours that are able to be allocated between paid work and domestic labour, in line with Becker's full income hypothesis (1991). For just 1,981 couple-wave observations, the sum of at least one partner's reported hours in housework and domestic work exceeds 112 hours, reflecting less than 5% of the full sample.

Estimates testing the sensitivity of key results to the treatment of outliers are shown in Table A6.1.

Commencing with SI_1, after dropping extreme outliers, the number of couple-wave observations is 43,356, reflecting approximately 96% of the original sample. Due to the small drop in couple wave observations, the relative change in both the mean and differences between couple types after controlling for observed characteristics is minor. The mean of SI_1 declines from 0.383 to 0.379, which is expected given that the inclusion of outliers in the original sample is likely to increase the degree of specialisation. With respect to the regression estimates for SI_1, the exclusion of outliers does not change the couple-type coefficients greatly, and certainly not qualitatively, with differences in the extent of specialisation between couple types being mostly explained by observed characteristics, consistent with the main analysis.

For SI_2, after excluding outliers the sample decreases to 41,179, equal to 92% of the original SI_2 sample, and thus reflecting a proportionally higher decline in sample size compared to the first index. Despite this, the changes to both the mean and couple-type coefficients remain negligible. The overall mean for SI_2 declines marginally to 0.265, and the coefficient for unmarried heterosexual couples does not change at the three decimal place level in either size or statistical power.

Table A6.1: Sensitivity of key results to treatment of outliers

	SI_1		SI_2		SI_3	
	Original sample (1)	Excluding outliers (2)	Original sample (3)	Excluding outliers (4)	Original sample (5)	Excluding outliers (6)
A: Number of couple observations						
No. of couples with non-missing wage	45,337	43,356	44,697	41,179	22,375	20,724
% of original sample	100%	95.63%	100%	92.13%	100%	92.62%
B: Mean						
Overall	0.383	0.379	0.278	0.265	0.114	0.110
by couple type:						
Married heterosexual	0.398	0.394	0.297	0.285	0.124	0.121
Unmarried heterosexual	0.324	0.318	0.189	0.172	0.079	0.075
Gay	0.272	0.272	n/a	n/a	-0.039	-0.039
Lesbian	0.280	0.274	n/a	n/a	-0.023	-0.033
C: Differences after controlling for observed characteristics						
Unmarried heterosexual	-0.00859	-0.0065	-0.053***	-0.053***	0.00475	0.00468
Gay	-0.0244	-0.0211	n/a	n/a	-0.0871	-0.0827
Lesbian	0.0442	0.0457	n/a	n/a	-0.105	-0.113

Notes: The results in column (1), (3) and (5) of Panel C correspond with the coefficients of each couple type in Column (7) of Tables 5, 6 and 7 respectively. Estimates have been weighted consistent with the main analysis.

Finally, for SI_3, the sample excluding outliers is 20,724, reflecting 93% of the original sample. The mean of SI_3 decreases marginally for all couple types, with the overall mean declining from 0.114 to 0.110. Similarly, the exclusion of outliers does not change the couple-type coefficients greatly, with the only changes occurring at the second decimal place level.

Overall, this indicates our results are robust to the treatment of outliers, across all three indices.