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Published in:
Household economic behaviors

DOI:
10.1007/978-1-4419-9431-8_5

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Working Paper

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CESifo working paper, No. 2872

Provided in cooperation with:
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CESIFO WORKING PAPER NO. 2872
CATEGORY 4: LABOUR MARKETS
DECEMBER 2009

CESifo *Working Paper No. 2872*

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Abstract

We estimate a collective time allocation model, where Dutch, Surinamese/Antillean and Turkish households behave as if both spouses maximize a household utility function. We assume that paid labor and housework are the endogenous choice variables and furthermore consider household production. Surinamese/Antillean and Turkish women differ from Dutch women because they value (joint) household production more in their utility function. Surinamese/Antillean and Turkish men, on the other hand, value joint household production less then Dutch men. Turkish households are the more traditional households, in the sense that the woman is more oriented on household production, while the man is oriented on paid labor. It is often believed that the bargaining power of women in more traditional households is relatively low, but our estimation results do not support this idea. In general, the wage elasticities of Dutch, Turkish and Surinamese/Antillean households are comparable. Men and women replace housework hours by paid labor if their hourly wage rate increases but do the opposite when the hourly wage rate of the partner increases.

JEL Code: D12, D13, J22.

Keywords: collective model, labor supply, child care.

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1 Introduction

Like all Western countries, the Netherlands has a sizeable minority of immigrants. Nowadays almost 10 percent of the Dutch population consists of non-Western (first- or second-generation) immigrants, and this number is expected to increase to over 20 percent in the year 2050 (Netherlands Statistics, 2003). In spite of the fact that immigrant households are a substantial and growing group within the total Dutch household population, they are usually under-sampled or neglected in general surveys. Insofar as they participate in a survey, members of those sub-populations are usually lumped together with the main population of Dutch descent. As a consequence, research on household labor supply decisions in the Netherlands tends to neglect the household labor supply decision process of these immigrants.

In this chapter we examine the time allocation decisions of Dutch, Turkish and Surinamese/Antillean households. By assuming endogenous labor supply for men and women and by considering housework and household production, we aim to contribute to a better understanding of the household decision process for the household types we distinguish. Moreover, by making use of the collective household model, we are able to examine individual preferences and the intra-household bargaining process between the household members, so that differences in ethnic background may reveal interesting differences between Dutch and immigrant households.

The four largest immigrant groups in the Netherlands are from Turkey, Morocco, Surinam and the Dutch Antilles. During the 1950s, the Dutch decolonization process attracted immigrants from Indonesia. In the 1960s, inhabitants of Surinam and the Antilles received Dutch nationality, which gave them the right to work and live in the Netherlands (Cornelisse-Vermaat, 2005). In the 1960s and 1970s, when the Dutch economy flourished, Surinamese, Antillean, and Turkish workers came to the Netherlands to find (low income) jobs. These immigrants were mostly men and although their initial intention was to stay in the Netherlands temporarily, they usually stayed permanently. Because we consider Surinamese/Antillean and Turkish households in this study, we shortly characterize these households.

The first group originates from the former Dutch colonies of Surinam and the Dutch Antilles. Surinamese/Antillean households are well integrated in the Dutch society, their mother tongue is frequently Dutch and they received an education which resembles that of the Dutch. Some of them have been in the Netherlands for thirty years or more, while others immigrated rather recently, in the last decade. The Turkish minority is one of the largest minorities in the Netherlands. Most of them came from relatively backward regions in Turkey; they are Muslim, and frequently speak only Turkish within the family. Many

Dutch Turks have double nationality, and a large part of them choose marriage partners from their homeland, who immigrate under the Law of Family Reunion. Their education level is relatively low compared with the Dutch. The integration problems for both groups are reflected by the high percentage of unemployed immigrants relative to the native Dutch (*CBS*, 2003; *SCP*, 2002), the lower education levels of immigrants (*SCP*, 2003), and, according to the (Dutch) Scientific Council for Government Policy (*WRR*), the lack of cohesion between immigrant groups and the native Dutch (WRR, 2001.

This chapter proceeds as follows. In Section 2 we present the theoretical framework. In Section 3 we present the parametric specification of the model and the estimation method. In Section 4 we discuss the data and the estimation results are discussed in Section 5. In order to see how wage changes affect the time allocation choices of households, we derive the wage elasticities in Section 6. Section 7 concludes. The approach in this chapter is similar to that in Van Klaveren, van Praag, and Maassen van den Brink [2008].

2 Theory

We consider a two-earner household where the preferences of spouse i ($i = m, f$) are represented by the following direct utility function:

$$U_i(C, H, le_i, wh_i, jh_i), \tag{1}$$

where $U_i(\cdot)$ is twice continuously differentiable and strictly concave. The individual utility functions depend on the household consumption, C, and the household production, H, and on the time that is spent on leisure (le_i), housework (wh_i) and paid work (jh_i). It is usually assumed that the working effort influences utility negatively through a corresponding loss of leisure hours. However, many studies on life satisfaction find that the experience of unemployment itself, rather than the loss of income through unemployment, reduces life satisfaction (Booth and van Ours, 2007). A similar argument can be made for housework activities, and so men and women may derive positive or negative utility from the performance of housework.

Household expenditures on consumption goods are not observed in the data and, therefore, household consumption, C, is considered to be one Hicksian composite good, whose price is set to unity. The money value of this composite good is set equal to the total household income, Y. We have:

$$C = Y = w_m jh_m + w_f jh_f + y, \tag{2}$$

where $w_m$and w_f represent the wage rates of the spouses, and y stands for the net non-labor income of the household. Household production is generally not observed in data sets either. We represent it by the household technology $h(wh_m, wh_f)$, that is a function of the hours that both spouses spend on housework, and we assume the following functional form:

$$H = h(wh_m, wh_f) = wh_m + \gamma wh_f, \tag{3}$$

where γ represents the marginal productivity of the woman relative to that of the man. With household production we mean the γ weighted sum of hours spent by both partners on what they call 'household tasks'. These tasks include cooking, cleaning, doing the laundry, and other such activities. Of course, the distinction between housework and leisure may be ambiguous, and therefore we leave the empirical definition to the respondents themselves in the empirical analysis.

Because the aggregated level of household income (that represents consumption) and the weighted sum of the individual hours spent on housework each represent one value for each household, it follows that household consumption and household production are treated as if they are public goods in the household. However, this does not imply that commodities that are bought out of the household income cannot be consumed by one of the two spouses, e.g. clothing, the barber, etc., but it does imply that, even then, a purchase by one of them needs the explicit or implicit approval of the other partner. It is an issue of bargaining between the two partners who in the end gets most of the pie. An immediate consequence of the public good assumption is, however, that it is not possible to examine how the various goods are distributed over the household members.

In the collective model, household decisions are assumed to be Pareto-efficient and under this assumption spouses behave as if an optimal bundle (le_m, wh_m, le_f, wh_f) is chosen that maximizes the following household utility function:[1]

$$\begin{aligned} U_h = {} & \pi(w_m, w_f, \mathbf{d}) \cdot U_m(Y, H, le_m, wh_m, T - le_m - wh_m) \\ & + (1 - \pi(w_m, w_f, \mathbf{d})) \cdot U_f(Y, H, le_f, wh_f, T - le_f - wh_f), \end{aligned} \tag{4}$$

[1] For a discussion of the collective model of household behavior we refer to studies by Vermeulen [2002], Browning et al. [2006] and Donni [2007].

subject to

$$
\begin{aligned}
&(1) \quad Y = w_m \cdot (T - le_m - wh_m) + w_f \cdot (T - le_f - wh_f) + y \\
&(2) \quad H = wh_m + \gamma wh_f \\
&(3) \quad 0 < le_f; le_m; wh_f; wh_m \leq 1,
\end{aligned}
$$

where T is the total time endowment per week, and where job hours of spouse i is replaced by the individual time constraint $T - le_i - wh_i$. For identification purposes, each spouse's leisure is assumed to be a private good, i.e. the husband does not benefit from the wife's leisure, and conversely (Chiappori and Ekeland, 2006).

The individual utility functions are weighted by the utility weight function $\pi(\cdot)$ and this function usually depends on wages, non-labor income *and* on variables that do not enter the individual preferences directly but influence the utility weight distribution. Hereafter, we refer to the latter as distribution factors, d. An intuitive interpretation of the utility weight is that it represents the division of bargaining power between the spouses. The higher the value of $\pi(\cdot)$, the more the utility function of household member m is weighted in the household utility function. An increase in $\pi(\cdot)$ can, therefore, be interpreted as an improvement of the bargaining position of the male.

It is important that $\pi(\cdot)$ depends on the individual wage rates, because otherwise the marginal compensated wage changes of the spouses would have the same effect on each other's labor supply by definition (this is usually referred to as the Slutsky symmetry condition). The model would then collapse into a neo-classical unitary model, where individual preferences are not considered and where the intra-household allocation of welfare cannot be studied. For an elaborate discussion on the consequences when $\pi(\cdot)$ is misspecified we refer to Browning et al. [2006]. We note that the restrictions of the unitary model are often empirically tested and almost always rejected in the empirical literature (see, among others, Ashworth and Ulph, 1981; Kooreman and Kapteyn, 1986; Thomas, 1990; Browning and Costas, 1991; Browning et al., 1994; Kawaguchi, 1994; Fortin and Lacroix, 1997; Lundberg et al., 1997; Browning and Chiappori, 1998; Ward-Batts, 2002).

The corresponding system of partial derivatives with respect to the man's and woman's leisure and housework are:

$$\begin{aligned}
\frac{\partial U_h}{\partial le_m} &= \pi \cdot \frac{\partial U_m}{\partial le_m} + (1-\pi) \cdot \frac{\partial U_f}{\partial le_m} \\
\frac{\partial U_h}{\partial wh_m} &= \pi \cdot \frac{\partial U_m}{\partial wh_m} + (1-\pi) \cdot \frac{\partial U_f}{\partial wh_m} \\
\frac{\partial U_h}{\partial le_f} &= \pi \cdot \frac{\partial U_m}{\partial le_f} + (1-\pi) \cdot \frac{\partial U_f}{\partial le_f} \\
\frac{\partial U_h}{\partial wh_f} &= \pi \cdot \frac{\partial U_m}{\partial wh_f} + (1-\pi) \cdot \frac{\partial U_f}{\partial wh_f}.
\end{aligned} \tag{5}$$

Let us focus on the first partial derivative with respect to male leisure that consists of two terms. The first term represents the male part of the collective utility function, while the second term represents the female part of the collective utility function. The leisure choice of the man influences the household utility through the utility of the man *and* the utility of the woman. In order to see how this happens, we can write the first FOC more extensively as:

$$\frac{\partial U_h}{\partial le_m} = \pi(\frac{\partial U_m}{\partial le_m} + \frac{\partial U_m}{\partial Y}\frac{\partial Y}{\partial le_m} + \frac{\partial U_m}{\partial jh_m}\frac{\partial jh_m}{\partial le_m}) + (1-\pi)(\frac{\partial U_f}{\partial Y}\frac{\partial Y}{\partial le_m}) \tag{6}$$

The first term between parenthesis on the right hand side ($\frac{\partial U_m}{\partial le_m}$) indicates that the man's leisure influences the household utility directly through the utility function of the male. This is the consequence of the identifying assumption that individual leisure is a private good. Male leisure influences the household utility through consumption Y and through the man's job hours, because we have replaced job hours by the individual time constraints. Because household consumption is considered as a public good, the household utility is influenced, through the utility function of both the man and the woman, by the leisure time of the man. As both utility functions are differently weighted in the household utility function, the sum of the individual partial effects are weighted by the utility weight π as well.

We do not repeat this exercise for the other partial derivatives, because the intuition is the same. Assuming that households are in equilibrium, i.e., assuming that the household utility derivatives are equal to zero, and solving the partial derivatives for the choice variables leisure and housework (and consequently job hours) gives the following system of demand functions:

$$\mathbf{z} = g(w_m, w_f, y, \mathbf{d}), \tag{7}$$

where we introduce the shorthand notation $\mathbf{z}$ that stands for the solution vector $z =$

(le_m, wh_m, le_f, wh_f). These 'time' demand functions are functions of the wage rates, the unearned income and the distribution factors that appear in the utility weight.

3 Parametric Specification and Estimation Method

3.1 Parametric Specification

According to the collective approach, household n's behavior may be viewed as the outcome of maximizing a household utility function of the following type:

$$U_{n,h} = \pi_n U_{n,m} + (1 - \pi_n) U_{n,f} \tag{8}$$

subject to

$$\begin{aligned}
&Y = w_m \cdot (T - le_m - wh_m) + w_f \cdot (T - le_f - wh_f) + y \\
&H = wh_m + \gamma \cdot wh_f \\
&0 < le_f, le_m, wh_f, wh_m \leq 1,
\end{aligned}$$

where we assume for the moment that π is a constant variable. The preferences of household member i are described by a log-additive utility function:

$$\begin{aligned}
U_i = &\alpha_{i,1} \ln(le_i) + \alpha_{i,2} \ln(wh_i) + \alpha_{i,3} \ln(H) \\
&+ \alpha_{i,4} \ln(fs + 1) \cdot \ln(H) + \alpha_{i,5} \ln(Y) + \alpha_{i,6} \ln(jh_i).
\end{aligned} \tag{9}$$

Because 20 hours of housework may influence utility differently for a two-person family than it does for a family with two children, we assume that the effect that H has on utility varies with family size (fs), and include an interaction term between H and family size. Assuming that men and women choose an optimal time allocation bundle, we have the following partial derivatives:

$$\begin{aligned}
\frac{\partial U_h}{\partial le_m} &= \frac{\partial U_f}{\partial le_m} + \pi\left(\frac{\partial U_m}{\partial le_m} - \frac{\partial U_f}{\partial le_m}\right) \\
\frac{\partial U_h}{\partial wh_m} &= \frac{\partial U_f}{\partial wh_m} + \pi\left(\frac{\partial U_m}{\partial wh_m} - \frac{\partial U_f}{\partial wh_m}\right) \\
\frac{\partial U_h}{\partial le_f} &= \frac{\partial U_f}{\partial le_f} + \pi\left(\frac{\partial U_m}{\partial le_f} - \frac{\partial U_f}{\partial le_f}\right) \\
\frac{\partial U_h}{\partial wh_f} &= \frac{\partial U_f}{\partial wh_f} + \pi\left(\frac{\partial U_m}{\partial wh_f} - \frac{\partial U_f}{\partial wh_f}\right)
\end{aligned}$$

When we focus on the first two partial derivatives, it holds that the first and the third term in each partial derivative refer to the partner's part of the collective utility function. This part exists because the individual utility of both partners is influenced through H by the partner's hours on housework and through Y by the partner's job hours. Given the chosen parametric specification the derivative $\frac{\partial U_h}{\partial le_m}$ becomes:

$$\frac{\partial U_h}{\partial le_m} = \pi \cdot [\frac{\alpha_{m,1}}{le_m} - \frac{\alpha_{m,5} \cdot w_m}{Y} - \frac{\alpha_{m,6}}{jh_m}] - (1-\pi) \cdot [\frac{\alpha_{f,5} \cdot w_m}{Y}].$$

This derivative is a linear expression in the utility parameters $(\alpha_m, \alpha_f) = \alpha$ of the man and the woman. The corresponding *coefficients* are non-linear expressions in le_m, le_f, wh_m, wh_f, w_m, w_f, fs and y. The first *coefficient*, denoted by $x_{1,m,1}$is , for example, $\frac{1}{le_m}$. Because $\alpha_{m,2}$ does not appear in the first partial derivative we have $x_{1,m,2} = 0$. We may write the first partial derivative as:

$$x'_{1f}\alpha_f + \pi\left(x'_{1m}\alpha_m - x'_{1f}\alpha_f\right). \tag{10}$$

The index 1 refers to the $x-$vector in the first partial derivative. This x-vector is a 6-vector function $x_{1,m}(le_m, le_f, wh_m, wh_f, w_m, w_f, fs, y)$. The other partial derivatives with respect to wh_m, le_f and wh_f can be obtained in a similar manner and the system of partial derivatives can be written as

$$\begin{bmatrix} \pi \cdot x'_{1m} & (1-\pi) \cdot x'_{1f} \\ \pi \cdot x'_{2m} & (1-\pi) \cdot x'_{2f} \\ \pi \cdot x'_{3m} & (1-\pi) \cdot x'_{3f} \\ \pi \cdot x'_{4m} & (1-\pi) \cdot x'_{4f} \end{bmatrix} \alpha = \begin{bmatrix} \pi \cdot X'_m & (1-\pi) \cdot X'_f \end{bmatrix} \alpha, \tag{11}$$

where X'_m and X'_f are $(4 \times 6)-$matrices; and α stands for a 12-vector of utility parameters.

For household n we define the (4×12)-matrix $X'_{n,h} = \begin{bmatrix}\pi_n X'_{n,m} & (1-\pi_n)X'_{n,f}\end{bmatrix}$ so that the expression in (11) can be written as:

$$X'_{n,h}\alpha \tag{12}$$

Throughout this chapter we will use the short-hand notation $z = (le_m, wh_m, le_f, wh_f)$. The system in (11) and (12) is the gradient of the household utility function $U_h(z)$ and we shall write it sometimes as the 4-vector $U'_h(z)$ or, alternatively, as U_z. This system describes the equilibrium if the gradient vector equals the zero vector. The (4×4)-matrix of second-order derivatives of $U''_h(z)$ is denoted by U''_h or U_{zz}.

Up until now, in this section, we have assumed that π is a constant variable. However, as is mentioned by Browning et al. [2006], the collective model collapses into a standard unitary model if the utility weight does not depend on prices, or, in our model, wages. Moreover, the individual bargaining positions are likely to be affected by other factors as well, such as the number of children, the ages of the two partners and the net weekly non-labor income.[2] More formally, we assume that π_n depends on characteristics v and define it as:

$$\pi_n(v) = N(\beta_1 \ln(w_{n,m}) + \beta_2 \ln(w_{n,f}) + \sum_{j=3}^{J} \beta_j \cdot v_{j,n}), \tag{13}$$

where $N(\cdot)$ stands for the standard normal distribution function. This functional specification is convenient because the arguments can take any value on the real axis, while π is automatically constrained in [0,1]. We note that the normal distribution function is used without any probabilistic connotation. For convenience we have listed the wage characteristics in equation (13) separately from the other characteristics that may influence the utility weight (represented by $\sum_{j=3}^{J} \beta_j \cdot v_{j,n}$). Consider the case where $\beta_3 = ... = \beta_J = 0$, $\beta_1 = -\beta_2$ and $w_m = w_f$. We then find that $\pi(v) = \frac{1}{2}$ and this represents an equal division of bargaining power between men and women. In other words, the utility functions of men and women are equally weighted in the household utility function. The weight $\pi(v)$ increases in the man's wage and decreases in the woman's wage. If $\beta_3 = ... = \beta_J = 0$ and $\beta_1 \neq \beta_2$, the weight is asymmetric, that is, even if $w_m = w_f$, we may have $\pi(v) \neq \frac{1}{2}$.

Adding a constant, say β_0, to the argument in $N(\cdot)$ would allow for the fact that one of the individual utility functions is structurally overweighted. However, when we included β_0 in the empirical model, it was always estimated as being insignificant and hence we dropped

[2] We note that the fertility decision, and hence the presence of children, likely affects the time that is spent on labor, leisure and housework, simultanously, through preferences and bargaining. However, modelling this decision of having children is beyond the scope of this study.

it from the model.

3.2 Estimation Method

From the partial derivatives in (12) it follows that household n is in equilibrium if :

$$X_n' \alpha = 0, \tag{14}$$

where X_n is a linear function in π_n and α, and where the parameter vector (α, β) has to be estimated.[3] Normally, we would solve this system for the choice variables le_m wh_m, le_f and wh_f for each n, so that we obtain the optimal solution vector $z^* = (le_m^*, wh_m^*, le_f^*, wh_f^*)$. By comparing z_n^* with the observed z_n we can find the optimal parameter estimates that would minimize the difference between z_n^* and z_n. However, this solution vector z^* is highly non-linear in the α and β parameters and so it is difficult to estimate the unknown parameters by a direct estimation method. We propose a more convenient indirect estimation method to estimate the unknown parameter vector (α, β) that is similar to the Wald-test criterion approach (see also Wales and Woodland, 1983, Blundell and Robin, 1999, Van Klaveren et al., 2008). The estimation method is inspired by the fact that (14) is linear in the parameter vector α.

Because the matrix equality in (14) does not hold exactly, we add a stochastic component such that the estimation model becomes:

$$y_n = X_n' \alpha + \varepsilon_n, \tag{15}$$

where y_n is a nuisance vector with $y_n = 0$ for all n, and where ε is a 4-dimensional error vector, which we assume to be $\varepsilon \sim N(0, \Sigma_\varepsilon)$. It is likely that time allocation choices of spouses are not correlated between households and so $E(\varepsilon_n, \varepsilon_{n'}) = 0$ if $n \neq n'$. We do, however, allow the ε terms to be correlated within households, because such a correlation is probable.

The system in equation (15) can be estimated by an iterative two-step procedure. In the first step we set $\beta_1^{(1)} = ... = \beta_J^{(1)} = 1$, yielding the first round utility weight coefficients $\pi_n^{(1)}$. The superscript indicates the iteration round and we note that $\pi_n^{(1)}$ varies with the household characteristics. Conditional on $\pi_n^{(1)}$, we can estimate the α-parameters by the method of Seemingly Unrelated Least Squares (SUR). Estimation of this system under the constraints $\sum \alpha_m = 1$ and $\sum \alpha_f = 1$ is equivalent to minimizing $\sum_1^N \alpha' X_n \Sigma_\varepsilon^{-1} X_n' \alpha$ with

[3] For notational convenience we write π_n instead of $\pi_n(\beta; v_n)$ and leave out the subscript h.

respect to α under those constraints. By assuming, without loss of generality that $\sum \alpha_m = 1$ and $\sum \alpha_f = 1$, we exclude the 'trivial' solution where all parameter estimates are 0. Because the utility functions can be interpreted as a net of indifference curves, the analysis is not affected by this normalization procedure.

In the second step we use the estimated α-parameters in the first iteration round, denoted by $\alpha^{(1)}$, and estimate $\beta_{1,\ldots,J}$ by means of a non-linear maximum likelihood procedure. The estimated β-parameters in the second step are denoted by $\beta^{(2)}$ and we use them in the second iteration round to calculate $\pi_n^{(2)}$. Conditional on $\pi_n^{(2)}$, we re-estimate $\alpha^{(2)}$ and with the estimated $\alpha^{(2)}$-parameters we re-estimate $\beta^{(3)}$. These β's are then used in the third iteration round. We continue this iterative process until convergence is reached.

4 Data

The data were collected between September and November in 2001 by DESAN, a Dutch organization for market research. The aim was to create a balanced sample with as many Dutch households as Turkish and Surinamese/Antillean households. The Dutch sub-sample is randomly drawn from the total pool of phone numbers of the Royal Dutch Mail (KPN). The immigrant sub-sample is drawn from a register owned by DESAN[4]. In Table 1, we show the number of two-earner households differentiated according to ethnic background.

The ethnicity of the spouses is defined as follows. For the respondent, we use the immigrant definition of the Netherlands Statistics, i.e. the respondent is considered to be an immigrant if at least one of the parents is born abroad (Netherlands Statistics, 2000). However, for the respondent's partner we cannot use this definition because there is no information about the parental ethnicity of the partner. For the partner we, therefore, use a question that directly asks for the partner's ethnicity. The household is classified as Dutch, Surinamese/Antillean, or Turkish, if both the respondent and the partner have the same ethnicity.

In order to estimate the model, we need information on paid labor, leisure, and housework. Although this information is available for the respondent, there is no information available on housework for the partner. The hours spent on housework by the partner are therefore imputed, conditional on individual and household characteristics. We denote the amount of housework of the respondent as wh_r, and that of the partner as wh_p. The time endowment

[4]Strictly speaking we cannot label households from the second generation as immigrant households. However, for convenience, we will refer to Turkish, Surinamese/Antillean households as immigrant households.

Table 1: **Households by Ethnicity**

Ethnicity	**Frequency**	**Percentage**
Dutch	153	42.86
Surinamese/Antillean	113	31.65
Turkish	91	25.49
Total	357	100.00

per week is 168 hours, and so we should have $wh_p \in [0,168]$. Therefore, we define the auxiliary variable θ for the respondents of the N available households as:

$$\theta_{n,r} = \log(\frac{wh_{n,r}}{168 - wh_{n,r}}). \tag{16}$$

The inverse of (16) equals $wh_r = \frac{168}{1+e^{-\theta_{n,r}}}$ and it is easy to check that $wh_{n,r} \in [0,168]$ for any real number of $\theta_{n,r}$.[5] Using the auxiliary variable, we estimate the following equation by means of Ordinary Least Squares (OLS):

$$\theta_{n,r} = \delta_0 + \delta_1 \cdot s^h_{n,1} + ... + \delta_k \cdot s^h_{n,k} + \delta_{k+1} \cdot s^r_{n,k} + ... + \delta_K \cdot s^r_{n,K} + \epsilon \tag{17}$$

where s^h_n are household characteristics; and s^r_n are individual characteristics of the respondents for the N available households. The explanatory variables that we use are gender, the hourly wage rate, age, education level, the number of children between certain age levels, having a computer at home and the ethnicity of the household, using Dutch households as the reference group. The education variable represents the highest education level that is attained and it is measured on an eight-point scale, where one stands for primary school as highest education level and eight stands for having a university degree. The estimation results are shown in Table 2.

From equation (16) it follows that a negative correlation between, for example, the male dummy and θ can be interpreted as a negative correlation between the male dummy and the hours spent on housework. As was to be expected, men spend less time on housework than women, and the presence of children increases the time that respondents devote to housework. The estimation results suggest that ethnicity is not correlated with the time devoted to housework, however the effect of household ethnicity is captured by the child variables.

By estimating equation (17) and obtaining $\hat{\delta}_0$, ..., $\hat{\delta}_K$, we can impute the missing values

[5] If $\theta = 0$, then $wh_r = 84$; if $\theta \to \infty$ then $wh_r \to 168$; and if $\theta \to -\infty$, then $wh_r \to 0$

Table 2: **Housework estimates for the respondents**

Characteristics	**Estimate**	**t-value**
Male	-0.504***	-4.90
Hourly wage rate	0.003	0.40
Age	0.004	0.55
Highest education level	-0.030	-1.11
Log(#-children 0/3+1)	1.126***	7.31
Log(#-children 4/11+1)	0.583***	5.03
Log(#-children 12/15+1)	0.573***	3.86
Log(#-children 16/25+1)	0.393**	2.54
Surinamese/Antillean	-0.026	-0.22
Turkish	0.166	1.25
Computer at home	0.134*	1.82
constant	-3.251***	-9.45
N	357	
Adjusted R^2	0.274	

Note: */**/*** statistically significant at the 10/5/1 percent level.

$\hat{wh}_{n,p}$ by calculating $\hat{\theta}_{n,p}$:

$$\widehat{\theta}_{n,p} = \hat{\delta}_0 + \hat{\delta}_1 \cdot s^h_{n,1} + ... + \hat{\delta}_j \cdot s^h_{n,k} + \hat{\delta}_{k+1} \cdot s^p_{n,k} + ... + \hat{\delta}_n \cdot s^p_{n,K}. \tag{18}$$

In equation (18) the respondent's characteristics are replaced by the characteristics of the partner whose housework hours wh_p are not observed. Using $\hat{\theta}_{n,p}$ and equation (16) we can obtain values for $\hat{wh}_{n,p}$ by inverting (16) as

$$wh_{n,p} = \frac{168}{1 + e^{-\hat{\theta}_{n,p}}} \tag{19}$$

Table 3 displays the summary statistics, after imputation, for the different household types that we distinguish. The hours spent on paid work, housework and leisure are hours per week.

The values associated with Surinamese/Antillean households are always in between those of Dutch and Turkish households. This is not so surprising, because Surinamese and Antillean households are more similar to Dutch households than Turkish households. The descriptives statistics are in line with those usually found for the Netherlands (see Netherlands Statistics, 2003). When we compare the men of the different household types with their partners we find that they are older, spend more hours on paid work, spend less hours

Table 3: **Descriptive Statistics**

	Dutch	**Sur./Ant.**	**Turkish**
Male			
Time spent on paid work	39.97	37.58	39.37
Time spent on housework	8.24	11.33	14.74
Time spent on leisure	119.79	119.10	113.89
Education level	5.45	5.33	4.55
Age level	39.35	41.41	36.04
Hourly wage rate	10.00	9.65	8.19
Female			
Time spent on paid work	25.84	29.27	26.56
Time spent on housework	16.69	17.89	23.59
Time spent on leisure	125.48	120.84	117.85
Education level	5.22	4.81	3.67
Age level	37.33	38.07	32.76
Hourly wage rate	9.16	8.82	8.00
Household			
#-children 0/3	0.29	0.27	0.27
#-children 4/11	0.44	0.58	0.88
#-children 12/15	0.23	0.38	0.35
#-children 16/25	0.16	0.42	0.32
#-children 25 plus	0.01	0.03	0.01
Family size	3.13	3.68	3.84
Household income per week	637.83	615.44	522.46
N	153	113	91

on housework and earn a higher hourly wage. Furthermore, we find that Dutch (wo)men earn more per hour than immigrant (wo)men. The average family size is largest for Turkish households, followed by Surinamese/Antillean and Dutch households.

According to Netherlands Statistics, Surinamese/Antillean and Turkish men and women are lower educated than Dutch men and women (Netherlands Statistics, 2003). This is also the case in our sample, except for Surinamese/Antillean men, who are about equally well educated than Dutch men. This means that well educated Surinamese/Antillean men are overrepresented in our sample.

5 Estimation Results

We focus first on the estimated preference parameters (α_m, α_f) for Dutch, Surinamese/Antillean and Turkish households. The estimation results are displayed in Table 4. The table also displays γ that represents the marginal productivity of the woman relative to that of the man, and the utility weight $\overline{\pi}$, that represents how the individual utility functions are, on average, weighted in the household utility function.

Following the definition of household tasks, it is not assumed that household hours of male and female are perfect substitutes, i.e. $\gamma = 1$. If $\gamma > 1$, this means that the woman is marginally more productive in the household and if $\gamma < 1$ this means that the man is marginally more productive in the household. To asses γ, we let it vary with a width of 0.025, and choose the γ estimate that yields the highest log likelihood of the linear parameters.

The relative marginal productivity is 0.98 for Dutch households, 0.8 for Turkish households, and 1.35 for Surinamese/Antillean. This means that the marginal housework hour of the Surinamese/Antillean woman is more valuable than that of her partner. The marginal housework hour of Dutch men is about equally productive than the marginal housework hour of Dutch women. The marginal housework hour of Turkish men is more productive than that of the Turkish women. Although γ may reflect the ratio of productivity, it may also reflect cultural backgrounds where different norms and values apply. It is well known that the roles of male co-workers in the household are very differently interpreted in the three ethnic communities considered. Hence, we should be careful when making a productivity statement based on the value of the γ parameter. The model is, nevertheless, more flexible by allowing for a rate of substitution that may be different from 1.

For Dutch men, the most important variables in their utility function are leisure and household income. For Dutch women, leisure seems to be the most important variable and

Table 4: **Estimated preference parameters**

Dutch	Male		Female	
	Estimate	**t-value**	**Estimate**	**t-value**
Leisure	0.752	66.00	0.759	50.55
Housework	0.005	4.19	-0.003	-2.35
Household production (H)	-0.010	-0.59	0.066	3.15
H – interaction term	-0.001	-0.04	0.084	2.86
Household income	0.223	10.61	0.095	4.63
Job hours	0.031	3.44	-0.001	-0.15

Surinamese/Antillean	Male		Female	
	Estimate	**t-value**	**Estimate**	**t-value**
Leisure	0.841	62.72	0.681	63.47
Housework	0.006	5.97	-0.014	-10.13
Household production (H)	-0.053	-0.56	0.133	1.37
H – interaction term	-0.140	-1.55	0.167	1.84
Household income	0.299	8.61	0.009	0.28
Job hours	0.048	3.85	0.024	3.50

Turkish	Male		Female	
	Estimate	**t-value**	**Estimate**	**t-value**
Leisure	0.924	64.82	0.499	34.08
Housework	0.019	8.12	-0.009	-6.40
Household production (H)	-0.095	-1.78	0.205	3.11
H – interaction term	-0.107	-1.90	0.180	2.57
Household income	0.115	4.36	0.133	5.64
Job hours	0.144	13.69	-0.009	-3.79

	Dutch	**Surinamese/Antillean**	**Turkish**
$\overline{\pi}$	0.55	0.47	0.52
γ	0.98	1.35	0.80
N	153	113	91

household income less so. Dutch women do not derive utility from individual household chores, but they do find joint household production important. So household tasks have to be done, but preferably not by themselves but by the partner. The importance of joint household production increases the larger the size of the family.

Leisure and household income are the most important variables in the utility function of Surinamese/Antillean Men. For these men, also joint household production interacted with family size is important, although this variable enters the utility function negatively. The estimation results for Dutch and Surinamese/Antillean men are rather similar, which is not that surprising, given the similarities in background characteristics (see Table 3).

Surinamese/Antillean and Dutch women appear to have different preferences, although leisure is important for both groups. While joint household production and household production interacted with family size significantly enter the utility function of both Dutch and Surinamese/Antillean women, these variables are much more important for the latter group.

Turkish families appear to be different from Surinamese/Antillean and Dutch households. The most important variable for Turkish men is leisure. Other, but less important variables, are household income and job hours. Household production and household production interacted with family size appear negatively in the utility function of Turkish men. For Turkish women, on the other hand, household production and household production interacted with family size is very important, just as leisure is important to these women. While leisure is important, the coefficient of leisure is much smaller than the leisure coefficient of Surinamese/Antillean and Dutch women. An explanation for the preference differences between Turkish households and the other households that we distinguish is that these households are in general more traditional: men specialize on the labor market, and women specialize in household work.

In Table 4, we report the average utility weight, $\overline{\pi}$. When $\overline{\pi}$ is higher than 0.5, this means that the utility function of the male is more heavily weighted in the collective utility function. For Dutch households, $\overline{\pi}$ is slightly higher than 0.5, as is also the case for Turkish households. The latter result is interesting, because a more traditional household is usually associated with a situation where the bargaining position of the woman is relatively low. However, our results indicate that Turkish households are the more traditional households, but we do not find evidence that the bargaining position of women is relatively low. For Surinamese/Antillean households, we find that the value is slightly below 0.5. This means that the relative bargaining position of the two spouses in Surinamese/Antillean households differs from that in Dutch and Turkish households. An explanation for this result may be

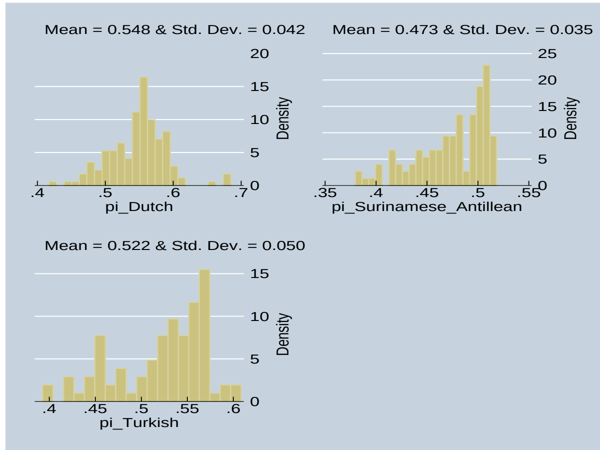

Figure 1: **Distribution graphs of utility weight function**

that the divorce rate in Surinamese/Antillean families is relatively high, so that it is more important to maintain a higher degree of independence.

The distributions of π_n for the three household types are shown in Figure 1. The upper left graph shows the distribution of π_n for Dutch households and we find that it is approximately normally distributed around the mean of 0.55. For Surinamese/Antillean households (upper right graph) we find that the power distribution is skewed to the left and so the median value of π_n is smaller than the average value of π_n. A t-test shows that $\overline{\pi}$ is significantly smaller than 0.5 for Surinamese/Antillean households and this means that the utility weight that is assigned to the woman's utility function is frequently higher than the weight that is assigned to the man's utility function. For Turkish households (lower left graph) we find very different values for π_n, and that most values are above 0.5. A t-test indicates that $\overline{\pi}$ is significantly higher than 0.5, which means that the utility function of Turkish men gets, on average, more weight in the collective household utility function. More generally, Figure 1 shows that there is substantial variation in the distribution of the utility weight between individual households.

Table 5 shows the estimation results concerning the utility weight, where the utility weight depends on wage rates, the number of children between certain age levels and age.[6] For Dutch households we find that age, the hourly wage rate, and the number of children aged between zero and three influences the utility weight distribution. When partners are about the same age, the age effect will be small. However, if the age difference increases,

[6]Because the education levels of men and women and the unearned income were not significant, we dropped these variables from the model.

Table 5: **Estimated utility weight functions**

	Dutch		**Sur./Ant.**	
	Estimate	**t-value**	**Estimate**	**t-value**
Log(w_{male})	0.174***	3.20	0.011	0.40
Log(w_{female})	-0.190***	-3.96	0.029	0.94
Log(#-children 0/3+1)	-0.185***	-3.87	-0.222***	-6.91
Log(#-children 4/11+1)	0.033	0.89	-0.089***	-4.43
Log(#-children 12/15+1)	0.001	0.02	-0.043**	-2.04
Log(#-children >16+1)	-0.073	-1.22	0.030	1.36
Log(age_{male})	0.445***	2.92	0.050	0.57
Log(age_{female})	-0.402**	-2.62	-0.082	-0.89
N	153		113	
	Turkish			
	Estimate	**t-value**		
Log(w_{male})	0.144***	4.20		
Log(w_{female})	-0.100***	-3.88		
Log(#-children 0/3+1)	-0.360***	-8.38		
Log(#-children 4/11+1)	-0.007	-0.27		
Log(#-children 12/16+1)	-0.064**	-2.06		
Log(#-children >16+1)	-0.099***	-2.95		
Log(age_{male})	-0.032	-0.42		
Log(age_{female})	0.041	0.55		
N	91			

Note: */**/*** statistically significant at the 10/5/1 percent level.

the utility weight distribution shifts to the advantage of the older partner, mostly men. The bargaining power of the woman increases when there are children present in the household aged between 0 and 3. The wage rate effects are as expected: the power distribution will shift in the direction of the partner whose hourly wage rate increases.

For Surinamese/Antillean households, the variation in the power distribution is entirely driven by the presence of children in the household. This is an interesting result. Apparently, the time allocation choices are not influenced by the individual wage rates and so a wage increase influences the time allocation choices of the partner only through the effect of the household income in the utility function and not through bargaining. Surinamese/Antillean women have more bargaining power if there are (more) children in the household and the bargaining effect is more pronounced when the children are younger. Similar to Dutch households, we find a wage effect for Turkish households, although this effect is not as strong. Also for Turkish households we find that the presence of children increase the bargaining power of the woman and that this effect is more pronounced when the children are between zero and three years old.

6 Wage Effects

Time allocation choices depend on the wage rates of both partners, so it is interesting to examine how time allocation choices react to marginal wage changes. More formally, if the wage vector $(w_m, w_f) = w$ changes by Δw, we are interested in the change in $z(w)$. Note that we use the short-hand notation $z = (le_m, wh_m, le_f, wh_f)$. The wage effect matrix can be written as:[7]

$$\frac{\partial z}{\partial w} = -\left(U_{zz}\right)^{-1}\left[\underbrace{\pi U_{m,zw} + (1-\pi)U_{f,zw}}_{A} + \underbrace{\left[U_{m,z} - U_{f,z}\right]\left[\frac{\partial \pi}{\partial w}\right]'}_{B}\right], \tag{20}$$

and consists of two parts. Part A, represents the usual gross substitution effect and part B represents the bargaining effect. From the identity $jh + wh + le \equiv 24$, it follows that the wage effects on job hours of the man and the woman are:

$$\frac{\partial jh_m}{\partial w} = -\left(\frac{\partial wh_m}{\partial w} + \frac{\partial le_m}{\partial w}\right)$$

and

$$\frac{\partial jh_f}{\partial w} = -\left(\frac{\partial wh_f}{\partial w} + \frac{\partial le_f}{\partial w}\right).$$

The corresponding elasticities, $\frac{\partial z}{\partial w}.\frac{w}{z}$, can be obtained using (20). The elasticities are evaluated in the sample mean and are displayed in Table 6.

For all three household types we find a minor wage effect on the time that is allocated to leisure. It seems that men and women replace job hours for housework hours or vice versa. Men and women replace housework hours by paid labor if their hourly wage rate increases and that they do the opposite when the hourly wage rate of the partner increases. The labor supply wage elasticities in this study are in line with those usually found for the Netherlands, although they are more pronounced. Evers et al. [2005] performed a meta-analysis and considered 239 wage elasticities from 32 empirical studies for different countries. For the Netherlands, they found that the labor supply wage elasticities for men and women

[7] In Appendix A we show how this wage effect matrix is constructed.

Table 6: **Wage Elasticities**

	Dutch		**Surinamese/ Antillean**		**Turkish**	
	$\mathbf{w}_m$	$\mathbf{w}_f$	$\mathbf{w}_m$	$\mathbf{w}_f$	$\mathbf{w}_m$	$\mathbf{w}_f$
le_m	-0.15	0.15	-0.02	0.12	-0.02	0.06
wh_m	-4.41	4.11	-4.24	2.32	-1.46	1.26
jh_m	1.16	-1.10	1.08	-0.85	0.53	-0.57
le_f	0.17	-0.16	0.07	-0.14	0.23	-0.26
wh_f	2.63	-2.60	2.51	-1.24	0.38	-0.48
jh_f	-1.89	1.78	-1.88	1.54	-1.31	1.75

are, on average, 0.1 and 0.5, while we find 1.16 and 1.78. The wage elasticities used by Evers et al. [2005] are estimated on the basis of individual labor supply data, where the interaction between the household members and the time that is spent on housework are not considered, and this may explain why the wage elasticities are more pronounced in this study.

In Table 3, we found that the values of the descriptive statistics associated with Surinamese/Antillean households were in between those of Dutch and Turkish households and in Table 6 we find the same for the wage elasticities values, with the exception of the labor supply wage elasticity of women. The wage elasticities for Surinamese/Antillean households are not the result of bargaining between the household members, because the individual wage rates were not significant in the utility weight function. It follows that the wage elasticities for Surinamese/Antillean households purely represent the usual gross substitution effect, i.e. part A in equation (20). Based on our preference parameter and utility weight function estimates, we conclude that wage elasticity differences between Dutch and Surinamese/Antillean households are the result of bargaining between Dutch men and women and are, at the same time, the result of a preference difference with respect to the joint household production. This explains why the housework wage elasticity for Surinamese/Antillean women is smaller than that for Dutch women.

Although the wage elasticities for Turkish households are comparable to those of Dutch and Surinamese/Antillean households, they are less pronounced. This confirms the idea that Turkish households are the more traditional households, since time allocation choices are less responsive to wage changes. However, the labor supply wage elasticity for Turkish women is higher than that for Surinamese/Antillean women and comparable to that of Dutch women, and in that sense, Turkish households cannot be characterized as the more traditional households. The housework wage elasticity of Turkish men is lower than that of Dutch and Surinamese/Antillean men. An explanation for this result is that labor supply choices are to a large extent determined by gender roles. Turkish men, often, do not perform housework activities, such as cleaning, ironing etc. Although Turkish households are, on average, more traditional, the housework wage elasticity for men can be caused by the less traditional Turkish households in the sample and this would also explain why the total housework wage elasticity is less pronounced.

Unfortunately, cross-elasticities for the Netherlands are (almost) never reported in empirical studies, and so it is not possible to relate our findings to those of other studies. That men and women work more labor hours if their hourly wage increases, but work less labor hours if the hourly wage rate of the partner increases, is an interesting result from a policy perspective. Let us focus, for example, on the wage elasticities of Dutch households that are remarkably symmetric.

The point of departure for current Dutch government policies is the idea that women supply more hours of paid labor if there wage rate is increased. This result is in line with the wage elasticities in Table 6. It is also in line with the observation that in young Dutch two-earner households both partners frequently have less than a full-time job. Policy makers often mention that increasing the labor supply of women is beneficial because it generates extra benefits through income taxes. However, usually they do not take into account the cross-elasticities. Thereby, they neglect the possibility that men in two-earner households, who generally pay higher marginal taxes than their partner, may supply less paid labor when the partner supplies more paid labor. As a consequence, the total benefits for the government may be smaller than expected, or may even be negative. Government tax policy should thus take these cross-effects into account when they estimate the prospective tax benefits of increasing female labor participation.

7 Conclusion

In this study, we examined the time allocation decisions of Dutch, Surinamese/Antillean and Turkish households. We assume that paid labor and housework are the endogenous choice variables and furthermore consider household production. By using the theoretical framework of the collective household model, we can examine individual preferences and the intra-household bargaining process between the household members.

We find that leisure and household income are important utility variables for the household types we distinguish. Surinamese/Antillean and Turkish women differ from Dutch women because they value (joint) household production much more in their utility function.

Surinamese/Antillean and Turkish men, on the other hand, value joint household production less then Dutch men. Turkish households are the more traditional households, in the sense that the woman is more oriented on household production, while the man is oriented on paid labor.

It is often believed that the bargaining power of women in more traditional households is relatively low, but our estimation results do not support this idea. For Dutch and Turkish households, we find that the man has slightly more bargaining power than his partner, and that the bargaining power varies in a similar way with individual and household characteristics. It increases with wage and the presence of young children increases the bargaining power of women. We conclude that the distribution of bargaining power within Turkish households is comparable with that of Dutch households, even though more traditional gender roles apply in Turkish household. For Surinamese/Antillean households we find that the distribution of bargaining power within the household is entirely driven by the presence of children. The bargaining power of the woman increases when there are (more) children in the household. It follows that time allocation choices of Surinamese/Antillean men and women are only influenced by the partner's wage through the household income and not through bargaining, because the individual bargaining position is not affected by the individual wage rates.

In general, the wage elasticities of Dutch, Turkish and Surinamese/Antillean households are comparable, although those for Turkish households are less pronounced. Because the wage elasticities with respect to leisure are close to zero, we find that men and women replace housework hours by paid labor if their hourly wage rate increases and that they do the opposite when the hourly wage rate of the partner increases. The labor supply wage elasticities that we find are comparable with those usually found for the Netherlands, although they are more pronounced.

The less pronounced wage elasticities of Turkish households may reflect that these are the more traditional, however, at the same time we find that the labor supply wage elasticity of Turkish women resembles that of Dutch women, and in that sense we cannot refer to the Turkish households as being more traditional. The wage elasticity with respect to housework for Surinamese/Antillean women is smaller than that for Dutch women. This difference is the result of bargaining within Dutch households, and, at the same time, is the result of a preference difference with respect to the joint household production.

Cross-elasticities are (almost) never reported and this is unfortunate because of its policy relevance. Based on our estimation results, and ignoring cross-elasticities, it is beneficial to increase the labor supply of women, as long as the costs are lower than the extra benefits that are recieved through income taxes. However, taking into account the cross-wage elasticities, we find that such an increase in the labor supply of women comes along with a decrease in the labor supply of men, who generally pay higher marginal taxes than their partner. Government tax policy should thus take these cross-effects into account when they estimate the prospective tax benefits of increasing female labor participation.

Appendix A

In this appendix we show how the wage effect matrix is constructed. Let us return to the system in (11) and assume that $w^{(0)}, z^{(0)}$ represents the situation *ex ante*, and that $w^{(1)}, z^{(1)}$ is the new equilibrium. The (4×12)-matrix X is a function of w and by differentiating the elements of the matrix X also with respect to w, we add two columns to the matrix U_{zz}, producing the (4×6)-matrix $(U_{zz} \quad U'_{zw})$. The matrix U'_{zw} is a (4×2)-matrix. Because $\frac{\partial U_h}{\partial z} = \pi \frac{\partial U_m}{\partial z} + (1 - \pi) \frac{\partial U_f}{\partial z} = 0$, we have to take into account that π depends on the wage vector as well:

$$
\begin{aligned}
U_{zz} &= \pi \cdot U_{m,zz} + (1 - \pi) \cdot U_{f,zz} \\
U_{zw} &= \pi \cdot U_{m,zw} + (1 - \pi) U_{f,zw} + [U_{m,z} - U_{f,z}] \left[\frac{\partial \pi}{\partial w} \right]',
\end{aligned}
$$

where the last element is the product of a (1×2)- matrix and a $(4 \times 1)-$matrix, resulting in a (4×2)- matrix. Denoting $z^{(1)} - z^{(0)} = \Delta z$, the new equilibrium has to satisfy the equation:

$$U_{zz} \Delta z + U'_{zw} \Delta w = 0.$$

The wage effect matrix is therefore:

$$\frac{\partial z}{\partial w} = -\left(U_{zz}\right)^{-1} \left[\pi U_{m,zw} + (1 - \pi) U_{f,zw} + [U_{m,z} - U_{f,z}] \left[\frac{\partial \pi}{\partial w} \right]' \right]$$

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