Appendices to:

Social Norms and the Time Allocation of Women's Labor in Burkina Faso*

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Appendix 1

The maximization problem (2) in the text has first order conditions:

$$\begin{aligned} A_{L_a} - a_a(L_a - \bar{L}_a) - \lambda &\geq 0 \\ H_{L_h} - a_h(L_h - \bar{L}_h) - \lambda &\geq 0 \\ pm - a_m(L_m - \bar{L}_m) - \lambda &\geq 0 \\ T - L_a - L_h - L_m &\geq 0 \end{aligned} \qquad \text{(A1)}$$

where λ is the Lagrange multiplier on the time constraint. From the first order conditions we may derive a set of reduced form equations for the allocation of time into each of the three activities. Time in each activity will depend on the level of household capital, the price of the market product, the extent of conformity to social norms, and intensity of penalties from deviating or rewards for conforming.

To examine whether activity-regulating social norms influence the time allocation of women, the first order conditions (3) for the woman can be totally differentiated to yield comparative statics showing how time allocation varies with changes in household capital. The matrix notation of (A2) presents the totally differentiated first order conditions (where we have dropped the subscripts on the labor variables for simplicity):

$$\begin{vmatrix} A_{LL}-a_a & 0 & 0 & -1 \\ 0 & H_{LL}-a_h & 0 & -1 \\ 0 & 0 & -a_m & -1 \\ -1 & -1 & -1 & 0 \end{vmatrix} \cdot \begin{vmatrix} \frac{\partial L_a}{\partial K} \\ \frac{\partial L_h}{\partial K} \\ \frac{\partial L_m}{\partial K} \\ \frac{\partial \bar{e}}{\partial K} \end{vmatrix} \cdot \begin{vmatrix} -A_{LK} \\ -H_{LK} \\ 0 \\ 0 \end{vmatrix} \tag{A2}$$

To derive the comparative statics, we first find an expression for the Hessian determinant:

$$|H| \cdot (A_{LL}-a_a)((H_{LL}-a_h)-a_m) - (H_{LL}-a_h)a_m \tag{A3}$$

or,

$$|H| \cdot -H_{LL}A_{LL} - a_a H_{LL} - a_m A_{LL} - a_h A_{LL} - a_a a_h - a_a a_m - H_{LL} a_m - a_h a_m < 0 \tag{A4}$$

Next we use Cramer's rule:

$$\frac{\partial L_a}{\partial K} \cdot \frac{1}{|H|} \begin{vmatrix} -A_{LK} & 0 & 0 & -1 \\ -H_{LK} & H_{LL}-a_h & 0 & -1 \\ 0 & 0 & -a_m & -1 \\ 0 & -1 & -1 & 0 \end{vmatrix} \tag{A5}$$

which simplifies to:

$$\frac{\partial L_a}{\partial K} \cdot \frac{1}{|H|}(-A_{LK}((-H_{LL}-a_h-a_m)-a_m H_{LK}) \tag{A6}$$

or:

$$\frac{\partial L_a}{\partial K} = \frac{1}{|H|}(A_{LK}H_{LL} - A_{LK}a_h + a_m(H_{LK} - A_{LK})) > 0 \qquad if \quad A_{LK} > H_{LK} \tag{A7}$$

Similarly, we have:

$$\frac{\partial L_h}{\partial K} = \frac{1}{|H|}((A_{LL} - a_a)H_{LK} + a_m(A_{LK} - H_{LK})) \tag{A8}$$

Under the assumption that $A_{LK} > H_{LK}$ the second term is positive, while the first is negative, so the sign of the expression is not determinate.

Finally, we have:

$$\frac{\partial L_m}{\partial K} = \frac{1}{|H|}(-A_{LK}H_{LL} + a_h A_{LK} + H_{LK}a_a - H_{LK}A_{LL}) < 0 \tag{A9}$$

Now we see how the responsiveness (to changes in the farm capital of her husband) of a women's allocation of time to home and market activities varies across the two ethnic groups. Following the assumptions in the text that a_a is zero for the Bwa while a_m is large; and a_a is large for the Mossi while a_m is zero, and a_h is zero for both groups, we may compare the responsiveness of time at home to changes in farm capital. The comparison in responses (when a_h equals zero) reduces to whether the LHS (representing the change in time allocated to home with a change in in farm capital for a Bwa women) is less than the RHS (the change for a Mossi woman):

$$\frac{H_{LK}A_{LL}\%a_m(A_{LK}\&H_{LK})}{\&A_{LL}H_{LL}\%a_m(A_{LL}\%H_{LL})} \quad \textit{for a Bwa woman} \quad < \quad \frac{H_{LK}A_{LL}\&H_{LK}a_a}{\&A_{LL}H_{LL}\%a_aH_{LL}} \quad \textit{for a Mossi woman} \qquad \text{(A10)}$$

Under the assumption that $A_{LK} > H_{LK}$, the expression for the Bwa woman gets smaller and becomes negative as a_m increases, while the expression for the Mossi woman approaches a positive number in the limit as a_a increases.

Finally to consider how the <u>magnitude</u> of the negative effect of farm capital on time allocated to income-generating activities changes across ethnic groups (whether absolute value $\left|\frac{ML_m^{Bwa}}{MK}\right| > \left|\frac{ML_m^{Mossi}}{MK}\right|$), note that under the assumptions in the text the relevant comparison is:

$$\left|\frac{\&H_{LK}A_{LL}\&A_{LK}H_{LL}}{\&A_{LL}H_{LL}\%a_m(A_{LL}\%H_{LL})}\right| \quad \textit{for a Bwa woman} \quad < \quad \left|\frac{\&H_{LK}A_{LL}\&A_{LK}H_{LL}\%a_aH_{LK}}{\&A_{LL}H_{LL}\%a_aH_{LL}}\right| \quad \textit{for a Mossi woman} \qquad \text{(A11)}$$

Since as a_a increases the RHS approaches a finite number, while as a_m increases for the Bwa the LHS approaches zero, we expect that for Bwa women time in income-generating activities is less responsive to changes in farm capital than for Mossi women.

Appendix 2: Estimations with sample broken down by time period

Results of estimations with percent time allocated to activity as dependent variable, with separated according to market days or week days

	Week days						Market days					
	home time		income-generating		husband's field		home time		income-generating		husband's field	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
Constant	0.168	1.59	0.740	6.95***	0.063	0.70	0.313	2.68***	0.676	5.66***	-0.034	-0.64
CHILDBF	-0.091	-2.53**	0.046	1.28	0.049	1.59	0.001	0.04	-0.000	-0.01	0.003	0.14
CHILD210	0.013	0.80	-0.005	-0.29	-0.003	-0.23	0.002	0.12	-0.009	-0.50	0.007	0.83
OLDERG	-0.035	-1.72*	-0.008	-0.40	0.038	2.17**	-0.088	-3.94***	0.074	3.27***	0.010	0.99
OLDERB	0.017	0.98	-0.008	-0.45	-0.010	-0.64	0.048	2.53**	-0.044	-2.27**	-0.002	-0.23
BD	0.003	1.77*	-0.003	-2.20**	0.000	0.17	-0.001	-0.56	-0.001	-0.31	0.001	1.58
WID	0.065	1.50	0.017	0.38	-0.108	-2.79***	-0.013	-0.28	0.015	0.30	-0.012	-0.51
SCHYR	0.008	0.47	0.003	0.16	-0.006	-0.46	0.001	0.08	0.008	0.45	-0.010	-1.14
OXEN	0.011	0.36	-0.004	-0.14	-0.002	-0.06	0.107	3.26***	-0.113	-3.36***	0.011	0.77
OXSQ	-0.001	-0.40	-0.001	-0.17	0.001	0.41	-0.012	-3.07***	0.012	3.05***	-0.001	-0.60
BWA	0.231	3.91***	-0.097	-1.63*	-0.221	-4.26***	0.275	4.20***	-0.180	-2.69***	-0.137	-4.39***
OXBWA	-0.078	-2.04**	-0.021	-0.55	0.149	4.31***	-0.116	-2.74***	0.072	1.67*	0.070	3.34***
OXSQBWA	0.010	1.91*	0.004	0.82	-0.021	-4.30***	0.013	2.44**	-0.008	-1.40	-0.009	-3.15***
EDU	0.001	0.59	0.001	0.47	-0.003	-1.37	0.000	0.10	-0.000	-0.08	-0.001	-0.56
FCHIEF	-0.080	-1.42	0.080	1.41	-0.000	-0.01	0.024	0.39	-0.020	-0.32	0.000	0.00
BROS	0.004	0.55	0.000	0.01	-0.004	-0.79	-0.001	-0.19	0.007	0.90	-0.005	-1.52
SALAR	-0.004	-0.08	-0.069	-1.42	0.058	1.46	0.044	0.83	-0.043	-0.79	-0.001	-0.04
FARMEE	-0.120	-2.46**	0.042	0.86	0.075	1.81*	-0.058	-1.08	0.011	0.20	0.036	1.48
HOMETOT	-0.016	-1.33	0.016	1.29	0.002	0.16	-0.014	-1.03	0.021	1.55	-0.005	-0.82
COWI	0.036	1.13	-0.031	-0.97	-0.004	-0.14	-0.005	-0.14	0.000	0.01	0.004	0.24
PEAK	-0.032	-1.11	-0.178	-6.18***	0.202	8.08***	-0.004	-0.13	-0.086	-2.65***	0.090	6.10***
R-square	0.210		0.290				0.260		0.240			
Log-likelihood					-5.877						20.100	
	100		100		100		100		100		100	

*significant at 10% level, **significant at 5% level, ***significant at 1% level.

Table 3a: Results of estimations with percent time allocated to activity as dependent variable, with separated according to market days or week days

Results of estimations with percent time allocated to activity as dependent variable, with sample separated according to peak or off-peak time

	Peak days						Off-peak days					
	home time		income-generating		husband's field		home time		income-generating		husband's field	
	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat	coefficient	t-stat
Constant	0.340	3.08***	0.569	5.20***	0.048	0.58	0.172	1.50	0.768	6.76***	0.017	0.31
CHILDBF	-0.041	-1.09	0.023	0.63	0.023	0.82	-0.049	-1.24	0.023	0.58	0.021	1.19
CHILD210	0.011	0.70	-0.014	-0.85	0.005	0.37	0.003	0.18	0.000	0.02	0.000	0.01
OLDERG	-0.053	-2.54**	0.012	0.58	0.040	2.55***	-0.069	-3.15***	0.054	2.50**	0.008	0.70
OLDERB	0.019	1.03	-0.011	-0.59	-0.010	-0.64	0.047	2.49***	-0.041	-2.23**	-0.001	-0.13
BD	-0.001	-0.43	-0.001	-0.75	0.002	1.53	0.002	1.47	-0.003	-1.66*	0.000	0.12
WID	-0.007	-0.17	0.014	0.31	-0.013	-0.38	0.059	1.25	0.017	0.38	-0.080	-3.39***
SCHYR	0.007	0.39	-0.001	-0.04	-0.004	-0.35	0.003	0.14	0.012	0.66	-0.008	-0.99
OXEN	0.053	1.70*	-0.027	-0.89	-0.023	-1.06	0.065	2.01**	-0.090	-2.81***	0.023	1.67*
OXSQ	-0.006	-1.64*	0.002	0.64	0.003	1.30	-0.007	-1.91*	0.009	2.44**	-0.002	-1.33
BWA	0.236	3.82***	-0.025	-0.41	-0.295	-6.18***	0.270	4.19***	-0.252	-3.96***	-0.074	-2.42**
OXBWA	-0.062	-1.55	-0.091	-2.28**	0.209	6.66***	-0.133	-3.17***	0.142	3.44***	0.027	1.29
OXSQBWA	0.006	1.12	0.012	2.40**	-0.026	-6.05***	0.017	3.16***	-0.016	-3.02***	-0.006	-1.92*
EDU	0.001	0.56	0.001	0.40	-0.003	-1.79*	0.000	0.11	-0.000	-0.02	-0.000	-0.38
FCHIEF	0.015	0.26	0.018	0.32	-0.026	-0.57	-0.071	-1.16	0.041	0.68	0.015	0.51
BROS	0.005	0.77	0.000	0.06	-0.005	-0.97	-0.003	-0.43	0.006	0.89	-0.004	-1.24
SALAR	-0.000	-0.01	-0.027	-0.54	0.018	0.49	0.041	0.77	-0.086	-1.65*	0.027	1.13
FARMEE	-0.100	-1.97**	0.017	0.34	0.086	2.30**	-0.078	-1.47	0.036	0.68	0.026	1.06
HOMETOT	-0.003	-0.26	0.008	0.65	-0.002	-0.19	-0.027	-2.01**	0.029	2.21**	-0.002	-0.35
COWI	-0.025	-0.77	0.016	0.49	0.010	0.42	0.056	1.64*	-0.047	-1.38	-0.008	-0.52
WEEK	-0.064	-2.14**	-0.099	-3.34***	0.166	7.35***	-0.036	-1.16	-0.007	-0.22	0.043	2.96***
R-square	0.220		0.260				0.250		0.220			
Log-likelihood					30.960						-8.360	
	100		100		100		100		100		100	

*significant at 10% level, **significant at 5% level, ***significant at 1% level.

Table 3b: Results of estimations with percent time allocated to activity as dependent variable, with sample separated according to peak or off-peak time