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The Added Worker Effect and Intrahousehold Aspects of Unemployment[1]

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Abstract

The added worker effect states that unemployment of a household member leads to an increase in labour supply of another household member. This paper investigates whether there is such an effect in a developing country. We use a rich data set for urban Ethiopia.

We first give a brief description of who is unemployed within the household and find that they are mostly related to the household head. Men are not more likely to be unemployed than women once we control for being family in law. The eldest remaining sons in the household are more likely to be unemployed, but this may be due to a selection bias. The oldest remaining unemployed have no higher job aspirations than their younger brothers, suggesting that if older brothers have more entitlements, waiting in unemployment for a good job is not one of them.

We carry out two separate analyses to investigate the added worker effect. First we analyse the effect using *actual* labour supply and find no evidence for an added worker effect once we take unobserved individual effects into account. We then investigate whether there is an added worker effect using *desired labour market participation* and find that there is none. The combined evidence indicates that there is no added worker effect. This suggests that households have other ways to cope with unemployment and is consistent with results from previous analysis which shows that the use of savings (by selling assets) and consumption smoothing are important mechanisms to cope with unemployment.

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1. Introduction

With around fifty percent of the urban young men unemployed, Ethiopia has one of the highest unemployment rates worldwide. Unemployment is concentrated among young, relatively well educated, first time job seekers, who come from middle class families. Almost two thirds of them are looking for a well paid formal sector, mostly public sector job. Mean duration of unemployment is close to four years after correcting for censoring. It is longer for those aspiring to a public sector job.[2] How do people cope with these long periods of unemployment? Since there are no state benefits in Ethiopia, the unemployed have to rely on other (informal) insurance mechanisms. The household is likely to fulfil this role, especially when unemployment is concentrated among young first time job seekers. How do the households cope with an unemployed member? It can follow one or more of the following strategies: use its savings, borrow funds, sell its assets, lower consumption or supply more labour to increase income. The latter is known as the added worker effect. More formally, the added worker effect is defined as the increase in the labour supply of one household member as a consequence of the unemployment of another member. Traditionally the focus is on unemployment of the *primary worker* - whose earnings are the main source of income for the household - and the implications for labour supply of the *secondary* worker. Hence the added worker effect is interpreted as an insurance mechanism. When the labour market has two sectors, one with 'good' and one with 'bad' jobs, the added labour will most likely be supplied in the bad sector, because the good sector is rationed. This paper looks at the added worker effect from women with regard to the unemployment of men. There are two reasons why we restrict ourselves to women. Firstly, the norm in Ethiopia is that

[2] For a detailed analysis of the nature of unemployment in urban Ethiopia, see Serneels (2003).

men engage in market labour; they are the primary workers. [3] Their labour supply is therefore not so much driven by the number of unemployed in the household. [4] This is not to say that there are no women who are primary workers, but in general men play this role. Secondly we want to examine the intra household consequences of the kind of unemployment observed in urban Ethiopia.

The literature on the added worker effect is mostly empirical and concentrates on the effect of the husband's unemployment on his wife's labour supply [see Mincer (1962), Fleisher and Rhodes (1976), Ashenfelter (1980), Layard et al (1980), Bardhan (1984), Lundberg (1985), Maloney (1987, 1991), and Tano (1993)]. The evidence suggests that the effect is small. Women do not move into the labour market when their husband is unemployed. The usual explanation is that the added worker effect is offset by a discouraged worker effect. The fact that the husband becomes unemployed sends a signal of poor job perspectives, which discourages the wife from beginning to look for a job [see Humphrey (1940), Layard et al (1980), Bardhan (1984), Maloney (1991)]. Recent theoretical work by Basu, Genicot and Stiglitz (1998) questions this explanation and argues that the added worker effect may *appear* to be small while *in fact* it is large. Most studies look at the wife's *actual* labour supply, while it would be more accurate to consider her *desired* labour supply. They argue that the other household members may not manage to get a job, but are actually looking for one. Maloney (1987) provides evidence that this is indeed the case: taking underemployment into account; he finds that the added worker effect is significant. Lundberg (1985) and Tano (1993) study the transition from outside the labour force into labour force participation, which includes unemployment, and also find a significant added worker effect.

[3] A good indication for this is that the wages of men are much higher than those of women.
[4] We actually carried out the analysis for men, and find that there are only negative significant effects of the number of unemployed on male labour supply.

The empirical literature on the added worker effect focuses almost exclusively on OECD countries. Nevertheless, the effect seems more relevant for developing countries, where formal insurance against unemployment is absent. Gruber and Cullen (1996) argue precisely that the added worker effect in the US is weak because unemployment benefits offer adequate insurance. They find that benefits crowd out at least a fraction of the added worker effect. We know of only one publication that investigates the added worker effect in a developing country. Bardhan (1984) finds a strong negative effect of the male household unemployment rate on female labour supply in rural West Bengal, India. He concludes that the job search discouragement effect outweighs the income effect related to the unemployment of men in the household. Other work on labour markets in developing countries provides strong evidence that household income has an important effect on female labour supply [see Xiadong and van Soest (2002) for urban Mexico, Serneels (1998) for urban Ethiopia, Awudu and Prasad (2000) for Nepal]. This suggests that if unemployment in the household has a negative effect or no effect on female labour supply, there is a substantial discouragement effect to compensate for the income effect. Indirect evidence for this is offered by Khandker (1988), who observes that if women in rural Bangladesh do not participate in market labour, this is at least in part due to a lack of job opportunities. Gluck and Sahn (2001), using a multi-period multinomial logit, observe for Conakry that the husband's employment status affects the wife's occupational choice. Those with an unemployed husband are more likely to be working in self employment. This may suggest that women with an unemployed husband enter a 'bad' job to supply additional labour.

This paper is structured as follows. In section two we consider the theoretical framework and identify a reduced form equation. We discuss the data in section three. Section four describes who is unemployed within the household. It gives additional

information to what we already know about male unemployment in urban Ethioipia.[5] In section five we test the presence of an added worker effect using *actual* labour supply, while in section six we examine the presence of an added worker effect using *desired* labour market participation. In section seven we explore why we do not observe an added worker effect. Section eight discusses the limitations of the analysis. We summarize our findings in the conclusion.

2. Theoretical Framework

We study the added worker effect within the framework of household labour supply. We base our theoretical model on the model developed by Ashenfelter (1980). Its starts from the familiar setting where a household maximizes utility, which is a function of the leisure and consumption of the respective household members, subject to a budget constraint, a time constraint and a non-negativity condition. An additional constraint variable $\bar{H}_i$ is introduced to reflect that desired labour supply may exceed a fixed level. If the constraint is binding, actual hours of work will equal the constraint level $\bar{H}_i$.

$$\max_{L_i} U\left(L_i, C_i\right) \qquad i = 1,..,n \qquad (1.1)$$

subject to:

$$(1)\ \sum_{i=1}^{n} C_i = \sum_{i=1}^{n} w_i H_i + y \qquad (1.2)$$

$$(2)\ L_i = T - H_i \qquad (1.3)$$

$$(3)\ H_i \le \bar{H}_i \qquad (1.4)$$

$$(3)\ \bar{H}_i \ge 0; H_i \ge 0; C_i \ge 0 \qquad (1.5)$$

[5] Namely that it is concentrated among first time job seekers who aspire to a public sector job [see Serneels (2002)].

where L_i is leisure, which is the sum of non-market labour and free time; and C_i is the individual's consumption. H_i is the individual's market labour supply and w_i his or her wage. *y* reflects non-labour household income. Both w_i and *y* are exogenous. The individual chooses H_i to maximize U_i. We assume that all income is consumed, so the constraint expressed by equation (1.2) is binding. Therefore C_i is fully determined once H_i is chosen. An individual's labour supply can then be written as a function of her (shadow) wage, household income, the labour supply constraint of the other household members and the labour income from the other household members:

$$H_i = f\left(w_i, y, \bar{H}_j, w_j H_j\right) \qquad i = 1,..,n \;\; ; \;\; i \neq j \tag{1.6}$$

We now introduce a variable $\left(u_j\right)$ for each of the other household members. The variable is a function of that member's labour supply constraint and labour income:

$$u_j = g\left(\bar{H}_j, w_j H_j\right) \tag{1.7}$$

More specifically, we let it be a logical variable which takes the value one when the constraint is binding and zero otherwise.

$$u_j = True\left(H_j = \bar{H}_j = 0\right) \tag{1.8}$$

or

$$\begin{cases} u_j = 1 \Leftrightarrow \bar{H}_j = H_j = 0 \\ u_j = 0 \Leftrightarrow \bar{H}_j > H_j \geq 0 \;\; or \;\; \bar{H}_j = H_j > 0 \end{cases} \tag{1.9}$$

When the constraint is binding and equal to zero, the individual is unemployed; otherwise she is not. Note that the individual can choose not to work, which may be optimal when income from other sources is large. When she is unemployed, her

income from labour is zero $\left(w_j H_j = 0\right)$, otherwise it is positive $\left(w_j H_j > 0\right)$. We can now rewrite equation (1.6) as follows:

$$H_i = f\left(w_i, y, u_j\right) \quad j = 1,..,n \; ; \; i \neq j \tag{1.10}$$

$$H_i = f\left(w_i, y, u_1..u_n\right) \tag{1.11}$$

In the simple context where only a husband and a wife are working, *n* equals two and the model examines the effect of the husband's employment status on the wife's labour supply. To generalize this to a context where other household members also participate in the labour market, we increase *n*. We will consider four groups of unemployed: young men, adult men, young women, and adult women. A last adaptation has to be made to include corner solutions. Equation (1.11) only holds when the wage exceeds the reservation wage; otherwise, labour supply will be zero. The model thus becomes:

$$\begin{cases} H_i = f\left(w_i, y, u_1..u_n\right) & if \quad w_i > w_i^r \\ H_i = 0 & otherwise \end{cases} \tag{1.12}$$

This will be the key equation for our empirical estimation. We will carry out two separate sets of analysis. In Section five we estimate the added worker effect using *actual* labour supply; while in Section six , we estimate the added worker effect using *desired* labour market participation.

3. Data Description

We use household panel data for urban Ethiopia. The data is collected by Addis Ababa University in co-operation with Göteborg University and the Centre for the Study of African Economies, University of Oxford. The survey sampled 1500 households in the seven largest towns in Ethiopia in 1994 and 2000, giving rise to a panel of 1422

households. The household attrition rate of five percent is mostly due to migration. Individual attrition is higher because people leave the household. Table 1 summarises the average household composition. It has six members; four to five of them of them belong to the nuclear family. The partner of the head of the household is often not living in the household; this occurs mostly in female headed households, which represent forty-four percent of the sample.[6] There are on average three children in a household, but there is substantial variation. Other household members are brothers, sisters, grandchildren, nieces, nephews and other relatives from the household head. The household contains systematically more relatives than relatives-in-law from the household head.

Table 1: Descriptive statistics: Average household composition

Relation to Household head	Average number	Sd	minimum	maximum
Household head	1	0.06	0	1
Wife, Husband or Partner	0.53	0.51	0	3
Son or Daughter	3.10	2.36	0	13
Step-Son or Step-Daughter	0.08	0.41	0	6
Grandchild	0.22	0.74	0	9
Father or Mother	0.04	0.22	0	2
Sister/Brother	0.21	0.68	0	7
Niece or Nephew	0.18	0.60	0	7
Uncle or Aunt	0.03	0.26	0	5
Son or Daughter-In-Law	0.04	0.21	0	3
Father or Mother-In-Law	0.01	0.10	0	1
Brother or Sister-In-Law	0.04	0.24	0	4
Grandparent	0.03	0.25	0	5
Other Relative to Head or His/Her Spouse	0.22	0.63	0	7
Servant	0.14	0.45	0	6
Tenant or Boarder	0.002	0.05	0	1
Other Unrelated Person	0.06	0.37	0	9
Household size	5.92	2.74	1	19

Table 2 gives the distribution of the labour force according to household position, excluding the handicapped, pensioners and those too old to work. Four fifths of the labour force lives with their close relatives. Children represent the largest group,

[6] This is 9% higher than what the census reports for urban areas; most likely because our sample is restricted to the seven largest cities.

followed by household heads and partners. This underlines the importance of including them when investigating the added worker effect.

Table 2: Distribution of the labour force according to household position [7]

	All
Head	20.17
Wife/Husband/Partner	13.16
Son/Daughter	46.33
Step-Son/Daughter	1.21
Grandchild	1.30
Father/Mother	0.47
Sister/Brother	4.50
Niece/Nephew	2.87
Uncle/Aunt	0.45
Son/Daughter-In-Law	0.69
Father/Mother-In-Law	0.09
Brother/Sister-In-Law	0.88
Grandparent	0.13
Other Relative to Head or His/Her Spouse	3.68
Servant	3.11
Tenant/Boarder	0.05
Other Unrelated Person	0.92
Total	100.00

Note that our two points of observations, 1994 and 2000 are quite far apart in time. However, this is what we need given that the average unemployment duration is almost four years.[8]

It is important to note that we restrict ourselves to *market* labour supply, which excludes household female business activities, like making or selling self prepared food, drinks, fuel, pottery and handicrafts or selling small quantities of second hand clothes. These activities are mostly carried out at home and are difficult to distinguish from housework. We consider agricultural work, the only other productive activity carried out outside the labour market, also as housework, because we only analyse

[7] Labour Force is all members older than 15 excluding students, pensioners, handicapped and those too old to work.

[8] As a matter of fact we tried with a shorter panel that was only two years apart, but because of the long duration, not many young unemployed had changed status.

urban households. Agricultural labour represents only one percent of urban professional activities.

A unique feature about the data is that it contains information on the desire to work. Respondents were asked for their main activity, which was classified in one of the more than twenty categories, including household work and unemployment. When an individual described himself as unemployed, he was asked whether he was looking for work or not. This enables us to distinguish between those who are actively looking for a job and those who are not. We consider those who are looking for work as having a desire to work and thus participating in the labour force, while those who are not looking for work are classified as *not* participating in the labour market. Those who carry out housework are also considered *not* to be participating in the labour market.

Whether the unemployed who are not looking for work should be considered as unemployed at all, is a discussion that goes back a long way and is treated in more detail in Flinn and Heckman (1983). We can roughly distinguish two competing views, which are in other places called the broad and narrow definitions of unemployment [see Knight and Kingdon (2001)]. The first one defines unemployment as all those who would take a job when they are offered one; the second defines the unemployed as those who actively search for a job. Those who use the broad rather than narrow definition argue that individuals who are not looking for work still have a desire to work, but are just discouraged to search actively, because of the high prevalence of unemployment. In this paper we use the conservative, narrow, definition. However, the difference between the broad and narrow definitions of unemployment is extremely small in our data: only six percent of the unemployed are not looking for work. Not surprisingly, we find that our results are robust, whichever definition we use.

4. Who is unemployed within the household?

This section examines who is unemployed within the household, and what their position is. We carry out a probit analysis using the 2000 cross section data.[9] Table 3 reports the results in marginal effects and confirms the findings from earlier work that the young relatively highly educated, those with junior or secondary education, are more likely to be unemployed [see Serneels (2002)]. Gender also has an effect: men are *more* likely to be unemployed, but this becomes insignificant when we control for whether the individual belongs to the family-in-law. Relatives-in-law are less likely to be unemployed. This is a robust finding throughout our analysis and suggests that Ethiopian households do not adopt unemployed family- in-law. When we introduce an interaction term between gender and family-in-law, we find that men who belong to the family-in-law are more likely to be unemployed, although the effect is only significant at the twelve percent level. This suggests that only *male* unemployed relatives-in-law are adopted by the household. In other words, female relatives-in-law are only accepted when they are not unemployed and thus have a job or carry out housework. This is consistent with the finding for rural Ethiopia, that daughters-in-law, when present in the household, work harder (Fafchamps and Quisimbing 2000). We also find that relatives of the first degree[10] are ten percent more likely to be unemployed, which confirms that the nuclear household does not adopt other unemployed members. Since this is urban data, it also suggests that job related migration from rural to urban areas, which is believed to depend on social and family networks [see Granovetter (1994)], takes place *after* a job has been found.

[9] The findings hold for the 1994 data as well.

[10] Relatives of the first degree to the household head are children, parents and siblings, but not the partner

Table 3: Probit individual unemployment of all household members (marginal effects)

	(1)	(2)	(3)
Age of the household member	-0.017960	-0.015746	-0.015631
	(0.002338)**	(0.002380)**	(0.002383)**
Age squared	0.000150	0.000124	0.000123
	(0.000028)**	(0.000029)**	(0.000029)**
Male	0.033441	0.017929	0.013523
	(0.013839)*	(0.013737)	(0.013788)
Highest level of education is primary	0.011416	0.013343	0.013627
	(0.022953)	(0.022616)	(0.022598)
Highest level of education is junior secondary	0.066193	0.063453	0.062086
	(0.025284)**	(0.024857)*	(0.024762)*
Highest level of education is senior secondary	0.053397	0.052515	0.052575
	(0.020461)**	(0.020091)**	(0.020016)**
Highest level of education is tertiary	-0.159096	-0.155295	-0.154691
	(0.013580)**	(0.013146)**	(0.013083)**
Mean value of assets per household member	-0.000009	-0.000010	-0.000009
	(0.000004)*	(0.000004)*	(0.000004)*
First degree relative: child, parent, sibling (not partner)	0.143347	0.120345	0.120363
	(0.025078)**	(0.024401)**	(0.024342)**
Eldest of remaining children and grandchildren	0.080897	0.068804	0.069139
	(0.024405)**	(0.023459)**	(0.023408)**
Ethnicity same as household head	0.034187	0.016278	0.016593
	(0.021659)	(0.023675)	(0.023594)
Religion same as household head	0.014180	0.017753	0.018764
	(0.029754)	(0.029237)	(0.028996)
Relatives-in-law: partner, child in law, parent in law*		-0.111304	-0.121786
		(0.018114)**	(0.018566)**
Male x relative in law			0.111778
			(0.082390)
Observations	4026	4026	4026

Robust standard errors in parentheses, + significant at 10%; * significant at 5%; ** significant at 1%

To investigate birth order effects, we develop a variable for birth order. The variable reflects the birth order of the members *remaining* in the household, since that is the only information we have. Its coefficient is highly significant; being the eldest of the remaining children and grandchildren gives a seven percent higher probability of being in unemployed. Does this mean that birth order gives an entitlement to unemployment, just as it has been observed to lead to higher education and earnings (Behrman and Taubman 1986)? Not necessarily. Because we only measure birth order for those remaining in the household, our results suffer from a selectivity bias: those who have left the household and who are also more likely to be employed, are excluded from our analysis. Our result may just reflect that elder children stay in their parental home when they are unemployed, while younger children stay with their parents even when they have a job, because they are too young to start their own household. In the context of a dual labour market the entitlement to unemployment may be an entitlement to wait

for a good job. To further investigate whether birth order affects this kind of entitlement, we analyse whether older individuals have different job aspirations than their younger siblings. Table 4 shows that the evidence is weak.

Table 4: Birth order and job aspirations of the eldest versus the youngest child

	Men		Women	
	Youngest remaining in the household	Eldest remaining in the household	Youngest remaining in the household	Eldest remaining in the household
Looking for a 'good' job[11]	46%	49%	55%	48%
Looking for 'any work' or 'bad' job	54%	51%	45%	52%
	100%	100%	100%	100%

Elder sons have only slightly higher aspirations than their younger brothers, and the difference is not significant. So if the elder men are more entitled to unemployment, this is not an entitlement to wait for a good job. For women, we get the opposite result: elder remaining daughters have *lower* job aspirations than their younger sisters. Does this confirm the common impression that elder daughters have to help more in the household, thereby sacrificing their own career prospects? Not necessarily, because there is again a selection bias. The result may just reflect that women with the lowest employment probabilities stay longer in the household.

We find no evidence that having the same ethnicity or religion as the household head affects one's employment status. In line with the results for 1994, we find that the unemployed are more likely to come from households with low consumption and asset value per capita. When we replicate the results for the young only, the group we are mainly interested in, the results remain the same.

[11] Civil servant, International Organization employee, public or private sector enterprise employee are considered to be 'good' jobs, while self-employment, casual worker, co-operative worker, domestic and agricultural worker are considered 'bad' jobs.

We conclude that the unemployed in a household are very likely to be related to the household. We find that birth order has a positive effect on being unemployed, but this result may suffer from a selection bias. However, we do not find that elder sons have higher job aspirations than their younger brothers. So if elder sons are more entitled to unemployment, this is not an entitlement to wait for a good job. Family-in- law of the household head who live in the household are unlikely to be unemployed, although men are more likely to be unemployed than women. Finally, we confirm results of the analysis on an earlier round of the data that the urban unemployed are more likely to come from households with low asset value and consumption per capita.

5. The added worker effect using actual labour supply

In this section we analyse the added worker effect using *actual* labour supply. The standard method to estimate equation (1.12) is to apply a tobit latent variable model:

$$H_i^* = f\left(w_i, y, u_1..u_n\right) \tag{1.13}$$

$$\begin{cases} H_i = H_i^* \ if \quad H_i^* > 0 \\ H_i = 0 \quad if \quad H_i^* \le 0 \end{cases} \tag{1.14}$$

We can write the linear approximation to equation (1.13) as follows:

$$H_i^* = \beta_0 + \beta_1 w_i + \beta_2 y_{hi} + \beta_{31} u_1 + .. + \beta_{3n} u_n + v_i \tag{1.15}$$

We consider four categories of household members: young men (age thirty or below), adult men, young women and adult women and examine the added work of women when a member of any category is unemployed. Implicitly this means that we consider young and adult men to be primary workers, while young and adult women are secondary workers. This is an expansion of the traditional approach where women represent the secondary workers and their husband is the primary worker. The reason is

that thirty-seven percent of the urban Ethiopian households are headed by a woman. In ninety percent of these households, there is no partner present. Only nineteen percent of the female household heads are married, indicating that the man is living away and has a long term engagement in migrant work.[12] They are likely to receive remittances. The other eighty-one percent however, depends mostly on income generated by the household members.

We are especially interested in the added worker effect caused by unemployment of young and adult men. The latter for the obvious reason that he is still the primary worker 'par excellence'. The special interest for young men springs from the observation that his earnings are about twice those of young and adult women, which makes him a good candidate to replace a missing primary worker.[13]

Assuming that the added worker effect is equal for members of the same category, we can write (1.15) as:

$$H_i^* = \beta_0 + \beta_1 w_i + \beta_2 y_h + \beta_{31} u_{ym} + \beta_{31} u_{am} + \beta_{31} u_{yw} + \beta_{31} u_{aw} + v_i \qquad (1.16)$$

We control for two other variables that are known to play a role in female labour supply decisions (see Killingsworth and Heckman 1986): the individual's age and age squared and the number of young children[14] in the household. A simulation shows that our results remain the same if we drop these variables, but we prefer to keep them because they control for heterogeneity and make the empirical models behave better. The

[12] Other female household heads lost their partner because he died (50%); or because the couple is separated or divorced (divorce is accepted in the Ethiopian Christian Orthodox church. Eight percent of the women household heads are single and have never been married.
[13] Median earnings for young men are 39 USD 1994 PPP per month; for young women 17 USD; for adult women 15 USD. Median earnings for adult men are 58 USD.
[14] Under age 6

variable w_i is not observed for individuals who are not engaged in market labour. We predict their occupation and earnings using an occupation-specific earnings function. We do this separately for men and women. The methodology is described in detail in Section 0in the appendix. The earnings of the self-employed are constructed using a Cobb Douglas production function, as described in Section 0in the appendix.

To investigate whether there is an added worker effect, we apply equation (1.16) to different parts of the data. Table 5 gives an overview of the models we estimate. We consider two different equations. The first equation is the one shown in equation (1.16) ; the second is the difference of equation (1.16):

$$\Delta H_i^* = \beta_0 + \beta_1 \Delta w_i + \beta_2 \Delta y_h + \beta_{31} \Delta u_{ym} + \beta_{31} \Delta u_{am} + \beta_{31} \Delta u_{yw} + \beta_{31} \Delta u_{aw} + v_i \qquad (1.17)$$

We estimate each of the equations separately for young and adult women because we expect that the labour supply decision is different for these two groups.[15]

[15] Note also that we work with the age ranges at t_1, but we get the same results for all models when we use the age ranges at t_2; which proves the robustness of our results for the definition of age ranges.

Table 5: Overview of the models to estimate the added worker effect using actual labour supply

Name	Model	Part of the data applied to	Estimation method
(1) balanced panel	$H_i^* = \beta_0 + \beta_1 w_{it} + \beta_2 y_{it} + \beta_{31} u_{itym} + \beta_{32} u_{itam} + \beta_{33} u_{ityw} + \beta_{34} u_{itaw} + v_i$	$\forall i : \exists t : t = 1 \wedge \exists t : t = 2$	Random effects tobit
(2) panel with attrition	$H_i^* = \beta_0 + \beta_1 w_{it} + \beta_2 y_{it} + \beta_{31} u_{itym} + \beta_{32} u_{itam} + \beta_{33} u_{ityw} + \beta_{34} u_{itaw} + v_i$	$\forall i : \exists t : t = 1$ $\wedge \exists i : t = 2$	Random effect tobit
(3) rotating panel	$H_i^* = \beta_0 + \beta_1 w_{it} + \beta_2 y_{it} + \beta_{31} u_{itym} + \beta_{32} u_{itam} + \beta_{33} u_{ityw} + \beta_{34} u_{itaw} + v_i$	$\forall i : \exists t : t = 1 \vee \exists t : t = 2$ $\wedge \exists i : t = 1 \wedge t = 2$	Random effects tobit
(4) cross section 1994	$H_i^* = \beta_0 + \beta_1 w_{it} + \beta_2 y_{it} + \beta_{31} u_{itym} + \beta_{32} u_{itam} + \beta_{33} u_{ityw} + \beta_{34} u_{itaw} + v_i$	$\forall i : t = 1$	Censored Least Absolute Deviation (CLAD) with bootstrapped standard errors
(5) cross section 2000	$H_i^* = \beta_0 + \beta_1 w_{it} + \beta_2 y_{it} + \beta_{31} u_{itym} + \beta_{32} u_{itam} + \beta_{33} u_{ityw} + \beta_{34} u_{itaw} + v_i$	$\forall i : t = 2$	Censored Least Absolute Deviation (CLAD) with bootstrapped standard errors
(6) difference model	$\Delta H_i^* = \beta_0 + \beta_1 \Delta w_i + \beta_2 \Delta y_i + \beta_{31} \Delta u_{iym} + \beta_{32} \Delta u_{iam} + \beta_{33} \Delta u_{iyw} + \beta_{34} \Delta u_{iaw} + v_i$	$\forall i : \exists t : t = 1 \wedge \exists t : t = 2$	OLS with robust standard errors

Note 1: The balanced panel only contains the individuals coming from households that are present in both rounds; the panel with attrition contains only those individuals whose household was present in the first round; while in the rotated panel, the individuals from households who have left in the second round are replaced by individuals coming from similar households as those who have left.

Note 2: For the panel data we prefer the random effects tobit rather than the pooled tobit because all models fail a test for dynamic completeness (Wooldridge 2002). Using a conditional moment test developed by Söderbom (2002), we find that the ordinary tobit fails the heteroscedasticity or normality condition for all the models applied to the cross section data. We therefore programmed the non-parametric estimation method Censored Least Absolute Deviation. When censoring exceeds 50%, we use the third quartile rather than the median as point of reference, as suggested by Pagan and Ullah (1999). The standard errors are obtained using a bootstrapping programme from Rogers (1993). The corrected standard errors are not available for the 1994 cross section data because the bootstrapping did not converge. However, the results are robust with those from trimmed least squares estimation. The 1994 results thus have to be interpreted with caution. For model (6) we use OLS and report the Hubert White Sandwich standard errors.

To estimate equation (1.16), we focus on the results obtained from the balanced panel, which are reported in Table 6. We find no added worker effect: none of the coefficients of the number of unemployed is significantly greater than zero. We also find that shadow earnings have the expected sign and are significant. Household welfare, measured by assets, has no significant influence, while the number of young children has a negative effect on the labour supply of both young and adult women. For young women, age also has a (concave) effect: the older they are, the more labour they supply, but at a decreasing rate.

Table 6: Random effects tobit applied to balanced panel data (using actual labour supply)

	Actual labour supply (hrs/wk)	
	(1)	(2)
	Young women	Adult women
Age	12.17998	-0.58189
	(4.39310)**	(2.64192)
Age squared	-0.20538	-0.01164
	(0.08228)*	(0.02925)
Number of young unemployed men	3.03085	-1.66700
	(4.90225)	(3.63254)
Number of adult unemployed men	-3.45601	5.04878
	(7.04181)	(6.88412)
Number of (other) young unemployed women	-1.14493	-2.84456
	(4.20303)	(3.51213)
Number of (other) adult unemployed women	-0.73586	7.50846
	(12.90662)	(11.99942)
Shadow earnings	0.05602	0.11825
	(0.00935)**	(0.01323)**
Value of assets per household member	0.00032	-0.00001
	(0.00079)	(0.00081)
Number of children under six	-14.90697	-7.88840
	(3.69756)**	(4.08587)+
Constant	-181.35927	4.80032
	(57.31747)**	(58.30988)
Observations	514	602
Number of individuals	257	301

Standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Because the balanced panel may suffer from a self selection bias, we compare its results with those obtained from the panel with attrition, which includes the households that only have an observation for the first period. We find that none of the coefficients are significantly different, as can be seen in Table 7. To check the robustness of our estimates further, we examine the results of the rotated panel, where households that

have exited were replaced by neighbouring households with a similar composition and characteristics. Again none of the results obtained from the balanced panel are contradicted. But the rotated panel suggests that there is a discouragement effect for young women from young unemployed women. Young women would thus be less likely to supply more labour when there are other unemployed young women in the household.

Table 7: The added worker effect for the level models (using actual labour supply)

	Actual labour supply (hrs/wk)	
	(1)	(2)
	Young women	Adult women
The number of unemployed young men in the household		
Balanced panel	3.03	-1.67
Unbalanced panel with attrition	-2.52	-2.75
Unbalanced panel rotation	-3.71	-3.70
Cross section 1994 [1]	-20.22	-3.71
Cross section 2000 [2]	5.16	0.27
The number of unemployed adult men in the household		
Balanced panel	-3.46	5.05
Unbalanced panel with attrition	11.19	-1.61
Unbalanced panel rotation	6.87	0.90
Cross section 1994	15.74	1.16
Cross section 2000	-4.16	3.10
The number of other unemployed young women in the household		
Balanced panel	-1.14	-2.84
Unbalanced panel with attrition	-6.15	-3.81
Unbalanced panel rotation	-10.26**	-4.05
Cross section 1994	3.73	0.31
Cross section 2000	-4.64	-0.65
The number of other unemployed adult women in the household		
Balanced panel	-0.74	7.51
Unbalanced panel with attrition	4.04	13.00
Unbalanced panel rotation	-2.06	7.09
Cross section 1994	5.90	2.78
Cross section 2000	-22.65	4.26

+ significant at 10%; * significant at 5%; ** significant at 1%

[1] For young men, young women and adult women because censoring exceeds 50%

[2] Censored Least Absolute Deviation (CLAD) model with censoring at the median for men, CLAD with censoring at the third quartile (0.75) for women. The standard errors are corrected by bootstrapping

All the above models fail a test for dynamic completeness[3], therefore we prefer a random effects rather than a pooled tobit, although the results do not differ significantly. To further test the robustness, we also apply an unobserved effects tobit, as suggested by Wooldridge (2002). This includes the mean of some dependent variables over the two periods to proxy unobserved effects, but the obtained results (not reported) are very similar. Because there are little other tests available for the random effects tobit, we further investigate the robustness of our results by comparing them with those from the cross sections. Again, none of the results are significantly different from those obtained from the balanced panel, as can be seen in Table 7.

The above estimation methods have the shortcoming of not accounting for unobserved heterogeneity. To eliminate unobserved effects we estimate the difference model, represented by equation (1.17). Table 8 reports the results of the OLS estimation. Since the models suffer from heteroscedasticity, we use the Hubert-White sandwich standard errors to test the significance of the coefficients.

Table 8: The added worker effect examined from the difference model (using actual labour supply)

	Difference in actual labour supply (hrs/wk)	
	Young women	Adult Women
The number of unemployed young men in the household	0.44	-1.36
The number of unemployed adult men in the household	-4.99*	0.15
The number of (other) unemployed young women in the household	-1.66	1.30
The number of (other) unemployed adult women in the household	-13.43	2.76

+ significant at 10%; * significant at 5%; ** significant at 1%

The results confirm that there is no added worker effect. We only observe discouraged workers effects: young men work less when there are unemployed young women in the

[3] Dynamic complete models have the property that the density of y conditional on x is independent of the past values of y and x.

household, while young women work less when there are adult unemployed men in the household. It suggests that the other effects we observed above are due to unobserved heterogeneity.

We obtain the same results when we restrict ourselves to the sub-sample of non-negative values, which shows that an increase in labour supply is not related to changes in the number of unemployed in the household (results not reported).

We conclude that, using actual labour supply, we find no evidence for an added worker effect of women as a response to the unemployment of other household members.

6. The added worker effect using desired labour force participation

A valid criticism on most of the empirical literature of the added worker effect is that it is based on *actual* labour supply. However, when unemployment is high, people may *want* to supply additional labour but be unable to do so. In this section we investigate whether someone is more likely to have a *desire* to work when there are unemployed members in the household. We only look at the labour market participation decision, and not at the number of hours, since we do not have information on the desired *hours* of labour supply. We rewrite equation (1.12) by introducing a binary variable *Labour Market Participation* (*LMP*):

$$\begin{cases} LMP_i = 1 \;\; if \quad w_i > w_i^r \\ LMP_i = 0 \quad otherwise \end{cases} \tag{1.18}$$

We can estimate this equation by a probit latent variable model; we write:

$$LMP_i^* = \Phi\left(w_i, y, u_1..u_n\right) \tag{1.19}$$

$$\begin{cases} LMP_i = 1 \quad if \quad LMP_i^* > 0 \\ LMP_i = 0 \quad if \quad LMP_i^* \leq 0 \end{cases} \tag{1.20}$$

Equation (1.19) can be written as:

$$LMP_i^* = \Pr\left(LMP_i = 1\right) = \Phi\left(\beta_0 + \beta_1 w_i + \beta_2 y_{hi} + \beta_{31} u_1 + .. + \beta_{3n} u_n + v_i\right) \tag{1.21}$$

Considering the same four categories of household members as before (young men, adult men, young women and adult women), we write (1.21) as:

$$LMP_i^* = \Phi\left(\beta_0 + \beta_1 w_i + \beta_2 y_{hi} + \beta_{31} u_{ym} + \beta_{32} u_{am} + \beta_{33} u_{yw} + \beta_{34} u_{aw} + v_i\right) \tag{1.22}$$

Again we include the variables age, age squared and the number of young children in the household to make the model behave better. We apply equation (1.22) to different parts of the data. Table 9 gives an overview of the models we estimate.

We estimate the model separately for young and adult women. Note that we do not apply the fully differenced model, where both dependent and independent variables are differenced because in the case of a probit model, this does not eliminate the unobserved individual effects and therefore loses its attraction. [4]

We focus on the results obtained from the balanced panel, which are reported in Table 10. We observe that there is a positive association between young women's desire to work and the number of other young women in the household who are unemployed. This suggests that young women are more likely to have a desire to work when their sisters are unemployed.

[4] because $\Delta y_i^* = y_{2i}^* - y_{1i}^* = \Phi\left(\beta_1' X_{1i} + c_i + v_{1i}\right) - \Phi\left(\beta_2' X_{2i} + c_i + v_{2i}\right) \neq \Phi\left(\beta' \Delta X_i + \Delta v_i\right)$

Table 9: Overview of the models estimated for the added worker effect based on desired labour force participation

Name	Model	Part of the data applied to	Estimation method
(1) balanced panel	$\Pr\left(LMP_{it}=1\right)=\Phi\left(\beta_0+\beta_1 w_{it}+\beta_2 y_{it}+\beta_{31}u_{itym}+\beta_{32}u_{itam}+\beta_{33}u_{ityw}+\beta_{34}u_{itaw}+v_i\right)$	$\forall i:\exists t:t=1\wedge\exists t:t=2$	Panel probit
(2) panel with attrition	$\Pr\left(LMP_{it}=1\right)=\Phi\left(\beta_0+\beta_1 w_{it}+\beta_2 y_{it}+\beta_{31}u_{itym}+\beta_{32}u_{itam}+\beta_{33}u_{ityw}+\beta_{34}u_{itaw}+v_i\right)$	$\forall i:\exists t:t=1$ $\wedge\exists i:t=2$	Panel probit
(3) rotating panel	$\Pr\left(LMP_{it}=1\right)=\Phi\left(\beta_0+\beta_1 w_{it}+\beta_2 y_{it}+\beta_{31}u_{itym}+\beta_{32}u_{itam}+\beta_{33}u_{ityw}+\beta_{34}u_{itaw}+v_i\right)$	$\forall i:\exists t:t=1\vee\exists t:t=2$ $\wedge\exists i:\exists t:t=1\wedge t=2$	Panel probit
(4) cross section 1994	$\Pr\left(LMP_{it}=1\right)=\Phi\left(\beta_0+\beta_1 w_{it}+\beta_2 y_{it}+\beta_{31}u_{itym}+\beta_{32}u_{itam}+\beta_{33}u_{ityw}+\beta_{34}u_{itaw}+v_i\right)$	$\forall i:\exists t:t=1$	Heteroscedastic probit
(5) cross section 2000	$\Pr\left(LMP_{it}=1\right)=\Phi\left(\beta_0+\beta_1 w_{it}+\beta_2 y_{it}+\beta_{31}u_{itym}+\beta_{32}u_{itam}+\beta_{33}u_{ityw}+\beta_{34}u_{itaw}+v_i\right)$	$\forall i:\exists t:t=2$	Heteroscedastic probit

Note 1: The balanced panel only contains the individuals coming from households that are present in both rounds; the panel with attrition contains only those individuals whose household was present in the first round; while in the rotated panel, the individuals from households who have left in the second round are replaced by individuals coming from similar households as those who have left.

Note2: For the panel data we prefer the random effects probit rather than the pooled probit because all models fail a test for dynamic completeness (Wooldridge 2002). For models (4) – (6) we use a conditional moment test described by Pagan and Vella (1989) and find that the ordinary probit fails the heteroscedasticity or normality condition for in most cases. If this is the case we use a heteroscedastic probit where the variance is a function of the variable that causes heteroscedasticity. However, in one case the results obtained in this way are sensitive to the variables chosen to determine the variance; in that is case we estimate an ordinary probit and report the corrected Hubert-White Sandwich standard errors.

Table 10: Balanced panel estimates using desired labour market participation

	Desired labour force participation	
	(1)	(2)
	Young women	Adult women
Age	0.05995	-0.19026
	(0.14325)	(0.07669)*
Age squared	-0.00216	0.00152
	(0.00269)	(0.00076)*
The number of young unemployed men in the household	0.25169	-0.14007
	(0.20628)	(0.15398)
The number of adult unemployed men in the household	0.44208	-0.08738
	(0.32782)	(0.27367)
The number of (other) young unemployed women in the household	**0.93836**	-0.20144
	(0.25255)**	(0.14184)
The number of (other) adult unemployed men in the household	0.59762	0.68316
	(0.61573)	(0.49562)
Shadow earnings	0.00276	0.00594
	(0.00063)**	(0.00093)**
Value of assets per household member	-0.00004	-0.00004
	(0.00003)	(0.00005)
Number of children under six	-0.43412	-0.30939
	(0.12127)**	(0.16255)+
Constant	0.71843	4.81440
	(1.85540)	(1.87888)*
Observations	702	912
Number of individuals	351	456

Standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

However, it is unlikely that this should be interpreted as an added worker effect. Young women earn on average only slightly more than adult women, and are therefore probably not more likely than adult women to enter the labour force as an added worker. Besides, young and adult men still earn more, so the added labour would be expected as a reaction to the unemployment of young or adult men rather than to the unemployment of other young women. Since the majority of the unemployed are looking for work, the observed positive effect is likely to reflect that young women are more likely to have a desire to work when their sisters do so. We conclude that we find no added worker effect when we use desired labour force participation.

How robust are our results? Because there are no tests available (yet) to test the assumption underlying the random effects probit [20], we check the robustness of the coefficients first by using a slightly different estimation method and second by

[20] The random effects probit relies on three assumptions (Wooldridge 2002): (1) the independent variables are strictly exogenous conditional on the unobserved effects; (2) the dependent variables are, conditional on the independent variables and the unobserved effects, serially uncorrelated and (3) the random effects are normally distributed.

comparing with the results obtained from applying the same model to other parts of the data. A first comparison is with the results obtained from a different estimation method. The panel probit is estimated by Generalized Estimating Equations (GEE) method using a Gauss-Hermite quadrature approximation to the variance matrix (see Liang and Zeger 1986), we check whether other quadrature approximations give similar results. The obtained results differ less than one point four percent (1.4%) indicating that the original results are robust.

To further investigate the robustness of our results and to see whether our panel suffers from a selection bias, we compare it with the results obtained from the panel with attrition. We find that none of the results are contradicted, as is clear from Table 11; although the figures suggest that there is a positive association between young women's desire to work and the number of young unemployed men in the household. To check the robustness of our results further, we apply the same model to the panel with rotation. Again, none of the results obtained from the balanced panel are contradicted. Note that the coefficient reflecting the added worker effect of young women as a response to the unemployment of young men now has a higher significance. This may be because the panel with attrition includes those households which were interviewed in wave one, but not in wave two. Their dropping out of the sample is usually caused by migration. We also know that migration is mostly work related. Therefore the panel with attrition is likely to contain more households with unemployed. This may explain the higher significance. The higher significance of some coefficients in the rotated panel may be caused by the fact that new households are not exactly the same as the replaced ones.

Table 11: The added worker effect using desired labour market participation

	Labour Market Participation	
	Young women	Adult women
The number of unemployed young men in the household		
Balanced panel	0.25	-0.14
Unbalanced panel with attrition	0.49**	-0.15
Unbalanced panel rotation	0.30*	-0.17
Cross section 1994	0.01	-0.13*
Cross section 2000	0.12	-0.11*
The number of unemployed adult men in the household		
Balanced panel	0.44	-0.09
Unbalanced panel with attrition	0.40	0.01
Unbalanced panel rotation	0.38	0.01
Cross section 1994	-0.01	0.03
Cross section 2000	0.18	0.09
The number of (other) unemployed young women in the household		
Balanced panel	0.94**	-0.20
Unbalanced panel with attrition	0.92**	-0.17
Unbalanced panel rotation	0.56**	-0.22 +
Cross section 1994	0.06	-0.13
Cross section 2000	0.17	-0.04
The number of (other) unemployed adult women in the household		
Balanced panel	0.60	0.68
Unbalanced panel with attrition	0.43	0.60
Unbalanced panel rotation	0.63+	0.58
Cross section 1994	0.05	0.17
Cross section 2000	0.50	0.19**

** = significant at the 1% level; * = significant at the 5% level; + = significant at the 10% level

The panel data models are all random effects since there is no method to estimate fixed effect probit models. We test the models for dynamic completeness following Wooldridge (2002) and find that they all fail. Therefore we do not report the results of the pooled probit models, even though in some cases correlation between the error terms of both periods is low, indicating that the pooled results are not significantly different from the random effect model. Using a different quadrature method for the estimation yields similar results. In all the cases the differences are small to very small.

A final check on the robustness of the results is to compare them with the two cross sections. We tested the cross section probit models for normality and homoscedasticity using a conditional moment test following Stewart (1999) and Pagan and Vella (1989). When the model fails homoscedasticity, we develop a heteroscedastic probit where the variance is a function of the variable that causes heteroscedasticity.

Again none of the results from the balanced panel are contradicted. In three cases the sign is different but the magnitude is small and the significance is very low. In another three cases the cross section coefficients have a higher significance than those from the balanced panel. The reason is that the cross section models suffer from heterogeneity in unobserved effects, while the random effect (panel) models allow for clustering of the unobserved effects around individuals.

We conclude that we only find evidence for an association between young women's desire to work and the number of other young unemployed women in the household. Given that young women are not primary workers, we cannot interpret this as reflecting an added worker effect. We do not find any other evidence for the existence of an added worker effect using desired labour force participation.

7. Why do we not observe an added worker effect in the traditional sense?

We have shown above that we do not observe an added worker, whether we use actual or desired labour supply. As mentioned before, this is consistent with other research that finds a small or no added worker effect. Since we also measured desired labour supply, we cconlcude that women do not want to supply additional labour as a response to unemployment within the household.

In previous work we find suggestive evidence that households have other coping mechanisms to deal with unemployment [see Serneels (2003)]. We find that the unemployed young men come from households with a lower value of assets and consumption per household member. This suggests that households cope with unemployment by using their savings (selling their assets), and cutting back on consumption, rather than by sending in secondary workers in the labour market. Why do households use their savings and cut back their consumption instead of generating more income by supplying additional labour to the market? The reason is that women's earnings do not exceed the (shadow) cost of their household activities; therefore households do not (want to) supply additional female labour. We can see two separate factors that cause the lower earnings of women. More analysis is needed to establish these facts fomally. The first is that women earn less than men, in whatever job they are engaged. Second, and more important, the labour market seems segmented in good and bad jobs, and women have a lower chance to get a good job.[21] Because of the wide gap between earnings from a bad job and a good job (the latter is two and a half times the former), expected female earnings are too low to trigger off additional labour.

8. Limitations of the analysis

We discuss two issues that are relevant for the interpretation of the above results.

The concept of the household

Throughout the analysis, we consider the household as a closed entity that does not change over time. But, of course, households change. The most relevant change is

[21] A full proof of segmentation in the labour market is not obvious, as shown by Heckman and Salacek (1985) and Heckman and Hotz (1986). Nevertheless, one can come to suggestive evedence, as argued by Dickens and Lang (1987) and Magnac (1991). Although we do not test it formally, we also find suggestive evidence for segmentation in the labour market [see Serneels (2000)].

that young people leave the household and start their own family. This also depends on their employment status. Young men especially are more likely to leave the household when they have work. To put it differently, they are more likely to stay in the parental household as long as they are unemployed. Young women, on the other hand are more likely to stay in the parental household until they are married, independent of whether they have a job or not. Because our estimates are conditional on the presence of unemployed members in the household, the fact that they move out when working does not affect our results.

Another important change in household composition is early death of one of the parents, as well as divorce. We discussed in Section 3. that thirty-seven percent of the households have a female household head. In ninety percent of these female headed households there is no partner present. This absence of an adult male primary worker may have triggered off entry into the labour force already. It underlines that labour supply may be a consequence of factors other than the number of unemployed in the household.

Simultaneity

We have paid no attention to the issue of simultaneity. The methodology we use to investigate the added worker effect does not enable us to draw conclusions on the direction of causation. We cannot exclude that causation goes the other way around. Adult women may for example supply more labour so that their sons have more leisure. This may be because parents are happy to increase their own labour supply to improve the child's wellbeing.[22] Or, if unemployment takes the form of queuing for a good job,

[22] This is exactly what Becker hinted at with his Rotten Kids Theorem, where the preferences of one household member (the parent) depends on the wellbeing of another member (the kid). In a dynamic

it may be the case that the son's unemployment is a household portfolio investment decision to optimize future income streams. Mothers may anticipate this and supply additional labour. In our case, we observe no simultaneous relationship. This suggests that there is also no effect of mother's labour supply on the son's unemployment. We could investigate this further using an instrumental variable model. However, the lack of valid instruments prohibits us from examining this. [23]

9. Summary and Conclusion

We first look at the characteristics of the unemployed within the household and find that men are more likely to be unemployed than women, but once we control for being family-in-law, this effect becomes less significant. The strong negative effect of being family-in-law and the strong positive effect of biological closeness to the household head indicate that the Ethiopian nuclear household does not adopt other unemployed members. Since we consider urban households, this in itself provides counter evidence to the notion that rural people move to urban areas in order to search for work, while staying with family. We find that older sons who remain in the household are more likely to be unemployed, but this may be due to self-selection. More importantly, we find no evidence that job aspirations of young men are related to their birth order. Elder daughters who remain in the household have lower job aspirations than their younger sisters, but this may also be the result of self-selection. Our analysis also confirms earlier results that the unemployed come from households with low assets and consumption per household member.

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model children will anticipate their parent's behaviour and will be less likely to supply labour themselves [see Gintis (2000)].

[23] We find no satisfying instruments, i.e. variables that are correlated with unemployment of the primary worker, but not with labour supply of the secondary worker.

In other work, we saw that the duration of unemployment in urban Ethiopia may be very long, namely close to four years. The question arises how people cope with these long periods of unemployment. We investigate one such coping mechanism, the added worker effect. This is defined as secondary workers supplying additional labour when the primary worker in the household becomes unemployed. Because people may be willing but not able to supply more labour we use both actual and desired labour force participation.

Using actual labour supply we find no evidence for an added worker effect. This result is robust to different parts of the data. A difference model, which eliminates unobserved individual effects, also gives the same result. When using desired labour force participation, we also find no evidence for an added worker effect. We do find a positive relationship between the number of (other) young unemployed women and the desire to work of young women, but argue that this is not an added worker effect, but rather a positive influence of the sister's desire to work.

The data also suggests that factors other than the number of unemployed household members are important determinants of female labour force participation. Over one third of the households are female headed. About half of the female heads of household are widowed, a fifth are separated or divorced. These factors are important alternatives that trigger the woman's entry in the labour market.

We conclude that the added worker effect is no mechanism to cope with unemployment in the household. Given the long periods of unemployment, which represent a substantial draw on the household's resources, this suggests that the household uses other coping mechanisms. One of them seems to be selling assets - the main source of saving; another is consumption smoothing.

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11. Appendix

Construction of shadow earnings

To obtain shadow earnings, we first distinguish four groups of occupations: civil servants, public enterprise employees, private enterprise employees and self-employed. The last group consists of own account workers, casual workers, co-operative and domestic workers. People working for an international organization are considered to be civil servants.[24] Using a multinomial logit, we model occupational choice separately for men and women. Following Schmidt and Strauss (1975) we then predict the occupation for those not working (the unemployed and those engaged in housework). We compared different models and selected the model that performed best, i.e. led to the lowest number of wrong predictions for the working. We then ran a separate wage equation for each occupational category and each gender (eight separate groups). The earnings of the self-employed are obtained from a Cobb Douglas production function as described in Section 0 following. We explored different specifications of the earnings equation for each occupational category, and selected the one with the lowest prediction error. This model is then used to predict shadow earnings for those individuals for whom there is no earnings data available (the unemployed and those engaged in housework).

[24] We explored three different categorizations for occupation and found that this one fitted best; i.e. had the highest number of correct predictions of occupation for those working (more than 80% in all cases).

Earnings of the self-employed

The earnings of wage workers and casual workers are directly observed. Not so for employers and the self-employed. However, we can predict their earnings from a production function. To model the returns to self-employment, we develop a Cobb-Douglas production function. We assume that labour is homogenous. We ignore that there may be differences in returns to own and hired labour because for the majority of self-employed their business is a one man or family business. In its log-linear form and allowing for market imperfections by including control variables, the production function looks as follows:

$$y_i = a + \alpha k_i + \beta l_i + X_i \tag{1.23}$$

where:

y_i = *ln(monthly revenue)*

k_i = *ln (value of the business)*

l_i = *ln (number of people working in the business, including the manager)*

X_i = *town and sector dummies, years of schooling and gender of the entrepreneur and whether he has another business*

Profits will be maximised when:

$$\begin{aligned} \frac{\partial \pi}{\partial K} = 0 \Rightarrow \frac{\partial Y}{\partial K} = r \Rightarrow r = \alpha A K^{\alpha-1} L^{\beta} = \alpha \frac{Y}{K} \Rightarrow rK = \alpha Y \\ \frac{\partial \pi}{\partial L} = 0 \Rightarrow \frac{\partial Y}{\partial L} = w \Rightarrow w = \beta A K^{\alpha} L^{\beta-1} = \beta \frac{Y}{L} \Rightarrow wL = \beta Y \end{aligned} \tag{1.24}$$

For each business, we can predict income from labour for the self-employed as follows:

$$w = \frac{\beta Y}{L} \tag{1.25}$$