Levedahl's explanation for the cashout puzzle in the U.S. Food Stamp Program: A Comment*

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I. Introduction

The "cashout puzzle" is an anomalous empirical regularity noted in studies of the Food Stamp Program, namely that the marginal propensity to consume food out of food stamps is much higher than that out of cash income for those households which spend some cash on food. See Fraker (1990) for a review. The receipt of food benefits in the form of stamps instead of cash does not constrain these households, hence, according to standard microeconomic theory (first considered for the case of food aid by Southworth (1945)), these households would not change their behavior if food stamp benefits were "cashed out." Consequently, according to the standard theory, marginal propensity to consume food out of cash income should be identical to that out of food stamps.

In a paper in this journal, Levedahl (1995) offers an interesting explanation for this puzzle. He conjectures the that marginal propensity to consume food out of stamps is higher than that out of income because the marginal utility of food stamp income is less than that of cash income. In this note, we show that this explanation is questionable. Levedahl's condition, by itself, is neither sufficient nor, indeed, necessary to predict that an unconstrained household will reduce its consumption of food when food stamps are converted to cash income.

II. Results

Consider an individual who consumes two goods, food and a composite non-food item. Food is available from two different sources: cash purchases and purchases through food stamps. Purely for notational simplicity, we shall assume that all prices are equal to one. Let the agent's preferences be given by the utility function:

$$u = u(x, f, s),$$

where x is the amount of the non-food good, f is the amount of food purchased with cash and s is the amount of food purchased with coupons. The utility function is assumed to be increasing and

differentiable up to the second degree in its arguments and strictly quasi-concave in *(x, f)*. The agent has a cash income *I*, consisting of non-welfare income and cash welfare payments (if any).

Let the observed level of consumption of the non-food good and the amount of food purchased with cash be x^* and f^*, respectively, and let the observed provision of food stamps be s^*. In the standard framework, agents consider food purchased with cash income and that purchased with coupons to be perfect substitutes, so that the marginal rate of substitution between these two items is identically unity. Levedahl (1995, p. 962) conjectures that 'the marginal utility of food bought with food stamps is less than the marginal utility of food bought with income'. Thus, formally, at the observed equilibrium, Levedahl's condition is the following.

L: $\dfrac{u_s\left(x^*, f^*, s^*\right)}{u_f\left(x^*, f^*, s^*\right)} < 1$.[1]

Before investigating the relationship between this condition and the cashout puzzle, it is useful to interpret the cash-out puzzle formally. First note that the agent's optimization problem can be written as:

$$\underset{x,F}{Max}\ u(x, F-s, s) \qquad \text{P1}$$

subject to:

$$x + F = Y, \qquad (1)$$

and

$$F \geq s; \qquad (2)$$

where *F* is the total amount of food purchased with cash and coupons, $F = s + f$, and *Y* is the total income of the agent from all sources, cash and coupons, $Y = s + I$.

The cashout puzzle only holds for unconstrained agents—those for whom constraint (2) above holds with strict inequality. Hence, throughout the rest of the note, we shall assume that the

agent is unconstrained. Then, the solution to the agent's optimization problem subject to the budget constraint (1) yields, in the standard way, the demand functions: $x = x(Y, s)$ and $F = F(Y, s)$. We shall assume that both demand functions are differentiable in their arguments. Given cash income, a change in the amount of stamps changes total food consumption both directly, and indirectly, through its impact on total income from all sources, *Y*. Marginal propensity to consume food out of an additional dollar worth of stamps is thus given by $[F_Y + F_s]$. Note that, according to the traditional model, $F_s = 0$, i.e., any change in the amount of food stamps impacts on household food consumption only indirectly, through a corresponding change in total household income, *Y*.

An agent's behavior exhibits the cash-out puzzle if the marginal propensity to consume food out of cash income is less than that out of stamps, i.e., if $F_Y < F_Y + F_s$. Then, since $F_s > 0$, a cash-out, i.e., a conversion of part or all of food stamp income to cash income which leaves his total income from all sources, *Y*, constant, also leads to a fall in his total purchase of food. Let Y^* be the agent's total income from all sources at the observed level of cash income and food stamp provision; $Y^* = I^* + s^*$. The cash-out puzzle at the observed level of income and stamp provision is therefore simply the following restriction on the agent's demand behavior.

CO: $F_s\,(Y^*, s^*) > 0$.

We now show that Levedahl's condition does not explain the cash-out puzzle, since an agent's preferences may satisfy the condition even when her demand behavior *does not* exhibit the puzzle.

Proposition 1. *L does not imply CO*.

The proof consists of a simple counterexample. Suppose that the agent's preferences are given by the utility function: $u = \frac{s}{2} + f + 2\ln(x+1)$. Obviously, the agent's preferences satisfy

[1] It is easy to see that Levedahl's condition is equivalent to the condition that, in equilibrium, the marginal utility of cash income is greater than the marginal utility of stamp income.

Levedahl's condition. Yet, as can be easily checked, her total expenditure on food remains invariant when the coupon component is replaced partly or wholly by an equivalent cash payment. Thus the agent's consumption behavior will be exactly as predicted by the traditional Southworth (1945) model, even though the utility function satisfies Levedahl's condition. Hence, Levedahl's condition, by itself, does not generate the cash-out puzzle.

This situation is illustrated in Figure 1. Agents allocate cash income between food and the non-food good according to the utility function from Proposition 1, "Utility1" of Figure 1. In this example, s is set at 2 and cash income at 8 while both goods have unit price for simplicity. Unconstrained agents use all stamp income on food by definition and also purchase some food with cash. Thus the choice problem in Figure 1 can be restricted to two dimensions. Solving the constrained maximization problem using the above utility function, it is easy to see that removing the kink in the budget constraint "BC1" by converting food stamps to cash income has no effect on consumption. Likewise, a 1 unit increase in food stamps and a 1 unit increase in cash income to "BC2" both lead to the same increase in food consumption. There is no cashout puzzle since the marginal propensity to consume food out of food stamps and cash income is the same.

In this case, Levedahl's condition neither generates the cashout puzzle nor has any effect on the allocation of cash income between food and the non-food good. (There is no other allocation problem here, since unconstrained agents spend all food stamp income on food.) To see this consider changing u_s/u_f from .5 to 2 by changing the coefficient on s in the utility function. The utility maximing point under budget constraint "BC1" is at the point labelled ◊ in either case[2].

[2] We are grateful to an anonymous referee who conjectured that the Levedahl condition may determine the optimal point along the budget constraint. As this example shows, there are at least some cases for which the condition will have no impact on the optimal bundle.

Proposition 1 shows that Levedahl's hypothesis, by itself, is *not sufficient* to explain the cashout puzzle. We now show that it is *not even necessary*. That is, one may observe the cashout puzzle even when the agent's preferences violate Levedahl's condition.[3]

Proposition 2. *CO does not imply L*.

As before, the proof consists of a counter-example. Suppose that the agent's preferences are given by the utility function: $u = ks + f + 4(x+s)^{1/2}$, where $k \geq 1$. Then, clearly, $u_s / u_f > 1$. Hence, Levedahl's condition is violated; in fact, foods purchased with coupons provide a higher marginal utility than food purchased with cash.[4] Yet, the cashout puzzle is present. Thus, the cashout puzzle may be observed even when agents violate Levedahl's condition.

Figure 2 illustrates the effect of a cashout using the utility function of Proposition 2, again setting *s* at 2, and cash income at 8. Despite the absence of any constraint on the agent, cashout of the stamp benefit causes a reallocation of consumption from O to ◊, thus generating the cashout puzzle. Although not indicated on Figure 2, it is easy to show that increasing stamp income by one unit leads to a two unit increase in total food consumption, while the marginal propensity to consume food from cash income is half of that. Again, changing the ratio of u_s to u_f while leaving the composition of income constant does not change the allocation of expenditure. In addition to being irrelevant to the cashout puzzle, Levedahl's condition has nothing to say about the allocation of cash income for this example.

The stigma hypothesis presumes that the source of the income used to purchase food might affect the utility of food consumption. Replacing food stamp coupons with a cash equivalent should

[3] It is not quite clear to us whether Levedahl intends his condition to be interpreted as an explanation (i.e., a *sufficient* condition) or an implication (i.e., a *necessary* condition) of the cashout puzzle.
[4] See Fraker (1990, pp. A24-A26) for some plausible examples where this may occur.

cause the empirically observed difference in marginal propensities to consume food out of the two different sources of income to disappear.

Using the data which Levedahl uses from the San Diego cashout experiment we may verify this implication of the stigma hypothesis. We find, as Levedahl does, that the marginal propensities to consume out of cash and food stamp income are significantly different for the control group who continued to receive food stamps. The experiment involved the selection of a random sample of households who were given checks instead of food stamp coupons. Participants were able to treat this benefit like any other cash income, thus we would not expect to observe any difference in the marginal propensities to consume out of cash and checks. Yet, we do observe a large and significant difference in marginal propensities to consume out of the two different income sources. These regression results are summarized in Table 1.

Table 1
Is Stigma the explanation?

	Pooled Sample (n=953)	Unconstrained Stamp (n=487)	Check (n=466)
Linear Model			
MPC(Y)	.046**	.051**	.037**
	(.01)	(.014)	(.014)
MPC(FSB)	.318**	.416**	.221*
	(.089)	(.132)	(.122)
MPC(FSB) - MPC(Y)	.272**	.365**	.184
	(.089)	(.132)	(.122)
Double-log Model			
MPC(Y)	.069**	.075**	.063**
	(.01)	(.013)	(.014)
MPC(FSB)	.307**	.393**	.235**
	(.057)	(.078)	(.084)
MPC(FSB) - MPC(Y)	.238**	.318**	.172**
	(.053)	(.074)	(.078)

Notes: MPC(Y) is the marginal propensity to consume out of income and MPC(FSB) is the marginal propensity to consume out of food stamp (check) benefits. The standard errors are in parentheses. * indicates the variable is statistically significant at the 90 percent confidence level; ** indicates the variable is statistically significant at the 95 percent confidence level. Data is from the San Diego Cash-out Experiment, conducted by the USDA Food and Consumer Service.

For both a linear and a linear-in-logs specification with a full set of control variables for household size, composition, tastes, and in-kind food income, the marginal propensity to consume food out of both food stamps and checks is significantly larger than that out of cash income. Pooling the experimental and control groups and using interactive dummies, we reject that the slope coefficients on checks and stamps are different and again find a significant difference between the marginal impact of benefits and cash income. We report both the pooled and separate regression results.

At the very least, these results cast doubt on the stigma hypothesis, by itself, as an explanation of the cashout puzzle. We would caution against drawing definitive conclusions from these estimates as they treat all households as individual decision-making units. Simply including different-sourced income in a regression does not provide any explanation of why different sources of income should lead to different consumption patterns without some model of what occurs *within* households. For a complete discussion of the regression results presented here and an attempt to explain the cashout puzzle through intra-household dynamics, see Breunig et. al. (2001).

On a theoretical level, our results establish that Levedahl's hypothesis, by itself, is an inadequate explanation for the cashout puzzle, and that the importance of this hypothesis for analysis of the puzzle remains as yet unclear. Whether this hypothesis can be rehabilitated, by identifying additional, empirically plausible, conditions under which it either generates the puzzle, or else is required for the puzzle to be observed, remains an open question. For the San Diego cashout experiment, removal of the source of stigma does not eliminate the empirical puzzle.

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Figure 1
Levedahl's Condition holds, no Cashout Puzzle

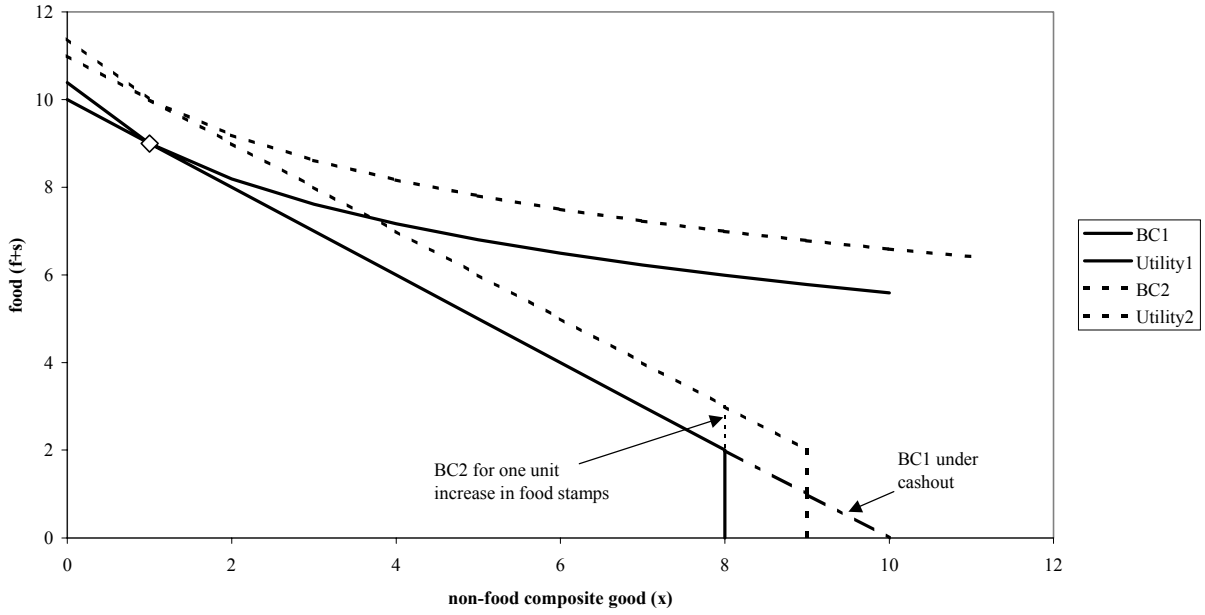

Figure 2
Cashout puzzle present, Levedahl's Condition fails to hold