Habit Formation and the Gains from Price Stability*

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Abstract

A counter-intuitive result from consumer theory is that consumers facing stable prices will benefit from a mean-preserving spread of those prices (Waugh 1944). This paper explores a new explanation for why the common intuition that price volatility is undesirable may be correct: the presence of habit formation in consumption. If prices are fluctuating, and preferences depend on past consumption, in every period the most favored goods can also be the most expensive ones, with negative consequences for both welfare and nutrition.

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1 Introduction

The jumping off point for this paper is the observation that malnutrition remains stubbornly high in South Asia, despite reasonably robust economic growth in recent years. One potential explanation might be the following: "Over this time period food price volatility increased as South Asia's economies moved towards greater economic openness, and the greater volatility had detrimental consequences for consumers." The first part of the statement is certainly true. Previously stabilized domestic food prices were allowed to co-move with more volatile global food prices, with particularly dramatic increases in food price volatility over the last 5 years (FAO et al., 2011). This paper is focused on exploring the second part of the statement; does higher price volatility harm consumers?

A classic and counter-intuitive result from consumer theory is that a consumer facing stable prices will benefit from a mean-preserving spread of those prices. This insight stretches back to Waugh (1944) and springs from the concavity of the expenditure function in prices. The large literature that followed Waugh's paper showed that the commonly held intuition that stable prices benefit consumers may in fact be correct if prices are uncertain and consumers are sufficiently risk averse (Turnovsky, Shalit and Schmitz, 1980). This paper explores an alternative reason why higher price volatility may harm consumers. If there is habit formation in consumption, preferences will depend on past consumption. Hence, preferences develop to favor the goods that were relatively cheap in the previous period. If prices are fluctuating, as soon as preferences develop to favor a particular good, that good becomes relatively expensive, with negative consequences for welfare.

The nutritional effects of habit formation in the presence of price fluctuations are more nuanced and depend critically on the speed of habit formation and the stochastic process that governs prices. However, I present an example where caloric intake is lower in every period in the presence of habit formation compared to the standard case when household preferences are fixed across time periods. Hence, in the presence of habit formation, increased price volatility could indeed be responsible for mitigating any nutritional gains due to higher household incomes.[1]

This paper complements Atkin (2010), which explores how inter-generational habit formation alters the nutritional impacts of the one-off price changes induced by trade liberalization, and provides direct empirical evidence for habit formation in food consumption amongst poor consumers in India. The paper is also connected to the growing behavioral economics literature in development which investigates the potential links between other non-standard preferences, poverty and poverty-alleviation policies. For example, see Banerjee and Mullainathan (2010) on temptation goods, Duflo, Kremer and Robinson (2008) on nudges and Bryan, Karlan and Nelson (2010) on commitment devices.

Currently, there is renewed interest in the impact of price volatility on poor households in the developing world. This interest springs partly from the rise in food price volatility seen in the 2000s (FAO et al., 2011).[2] The large swings in food prices seen over the last decade are perceived to have adversely affected poor consumers and have become a major global policy issue. For example, in November 2010 the G20 leaders requested that various international organizations work "to develop options for G20 consideration on how to better mitigate and manage the risks associated with the price volatility of food". Following the work of Deaton (1989) and Ravallion and Van de Walle (1991), several recent papers have explored the consequences of these price swings on household welfare (De Janvry and Sadoulet, 2009; Attanasio et al., 2009) and fixed preferences.

This paper is a first step along the path to understanding the role that habit formation plays in potentially exacerbating the negative effects of food-price volatility. I hope that future analysis will be able to provide policymakers with concrete recommendations on the types of policies and institutions that can ameliorate these effects.

[1] See Deaton and Dreze (2008) for a broader discussion on why nutrition has not improved in India alongside income gains.

[2] Although much of the increased volatility can be attributed to global factors such as rising demand from China and the global financial crisis, the market reforms that developing countries instituted over the last twenty years are likely to have increased the price volatility faced by their domestic consumers. For example the "Washington Consensus" package of trade liberalization, reductions in consumer and producer price controls, the removal of marketing boards and reductions in food subsidies has removed many of the price stabilization mechanisms that were previously in place.

The paper proceeds as follows. Subsection 2.1 reproduces Waugh's argument, subsection 2.2 introduces habit formation, subsection 2.3 explores Waugh's result under habit formation, section 2.4 briefly addresses production and subsection 2.5 discusses nutritional effects. Finally, section 3 concludes and discusses future avenues of research.

2 Theoretical Background

In order to fix ideas, I will present a simple two-good partial equilibrium example. There are two food goods, rice, r, and composite food good, w, with one unit of each good providing one calorie. Total household caloric intake in any period is equal to the sum of rice consumption, c_r, and the consumption of the composite food, c_w. In what follows I assume that the price of the composite food is constant in all periods and normalized to a price of 1. A household takes prices as given and receives a fixed endowment of m every period.

2.1 The desirability of price instability for consumers in the absence of habits

In this section, I show the key insight of Waugh (1944); that price instability may benefit consumers. I first present the results in a graphical manner using the concept of consumer surplus that is used in Waugh's original paper. Second, I state the key insight in a more precise algebraic form using the expenditure function.

A large literature on the welfare effects of price instability followed Waugh (1944). One strand has shown that stability of prices at the arithmetic means may be preferable for consumers in the presence of high risk aversion and stochastic prices (Turnovsky, Shalit and Schmitz, 1980). A second strand argues that in the absence of homothetic preferences or in the presence of uncertainty, expected consumer surplus is not a suitable metric (Rogerson, 1980). A third strand argues that in general equilibrium it is not feasible for a social planner to manufacture a mean-preserving spread in prices (Samuelson, 1972).

In order to focus the analysis on the role of habit formation in altering the standard conclusions of the price instability literature, I abstract from these complications by considering an extremely simplified environment. I assume that preferences are homothetic, that households are infinitely lived and myopic and that households have no storage technology (so endowments must be spent in the period they arrive).[3]

Figure 1 shows a downward sloping demand curve for rice for an individual household in any period.[4] I assume that the demand curve has finite negative slope. First consider the case where the price of rice is fixed in every period at some price p_r (and recall that the price of the composite food, p_w, is always 1). Consumer surplus in any period is equal to the shaded area in panel A of figure 1.

Second, consider the case where rice prices fluctuate in every period. In even-numbered periods the rice price is equal to $\underline{p_r} = p_r - \delta_r$, where $0 < \delta_r < p_r$. In odd-numbered periods the rice price is equal to $\overline{p_r} = p_r + \delta_r$. Therefore, the arithmetic mean of rice prices in the fluctuating price case equals the price of rice in the stable price case. During the high-price regime, the loss in consumer surplus is equal to the upper shaded area in panel B of figure 1, while during the low-price regime the gain in consumer surplus is equal to the lower shaded area. As long as demand is downward sloping, the average surplus is higher in the case of fluctuating prices.

More formally, consider the households expenditure function, $e(p_r, p_w, u*)$, the minimum expenditure function required to obtain utility $u*$ at prices p_r and p_w. As the expenditure function is concave in prices, Jensen's inequality implies that:

$$e(p_r, p_w, u*) = e(\frac{1}{2}\underline{p_r} + \frac{1}{2}\overline{p_r}, p_w, u*) > \frac{1}{2}e(\underline{p_r}, p_w, u*) + \frac{1}{2}e(\overline{p_r}, p_w, u*). \quad (1)$$

Therefore, the average expenditure required to obtain $u*$ is lower under mean-preserving

[3] These simplifying assumptions come at considerable cost. A more elaborate investigation into theoretical desirability of price instability under habit formation would have to explore the implications of relaxing all three of these assumptions.

[4] This graphical exposition closely follows Wright (2001).

price fluctuations than under stable prices. Waugh (1944) went further, and assumed that the endowment could be reallocated across time, and therefore utility would be strictly higher in every period for a rational household with inter-temporally additive utility. The commonly stated intuition behind his result is that households mitigate the negative effects of the high prices by reducing rice consumption in even periods and extend the positive effects of low prices by increasing rice consumption in odd periods.

2.2 Introducing habit formation

I now lay out a very general form of habit formation in food consumption. Following Atkin (2011), I amend the expenditure function $e(p_{rt}, p_{wt}, u*; \theta_t)$ to include period subscripts t and a parameter θ_t which represents the household's relative taste for rice. I assume that higher tastes for rice raise the proportional increase in expenditure required to maintain utility u with a rise in the rice price, $\frac{\partial^2 \ln e(p_{rt}, p_{wt}, u*; \theta_t)}{\partial \ln p_{rt} \partial \theta_t} > 0$. Due to Shepherd's lemma, this assumption implies that an increase in θ_t raises the (Hicksian) budget share spent on rice. Hence, the relative consumption of rice is increasing in the tastes for rice, $\frac{d \frac{c_{rt}}{c_{wt}}}{d\theta_t} > 0$.[5]

Furthermore, I assume that the relative tastes for rice increase with the relative consumption of rice in the previous period:

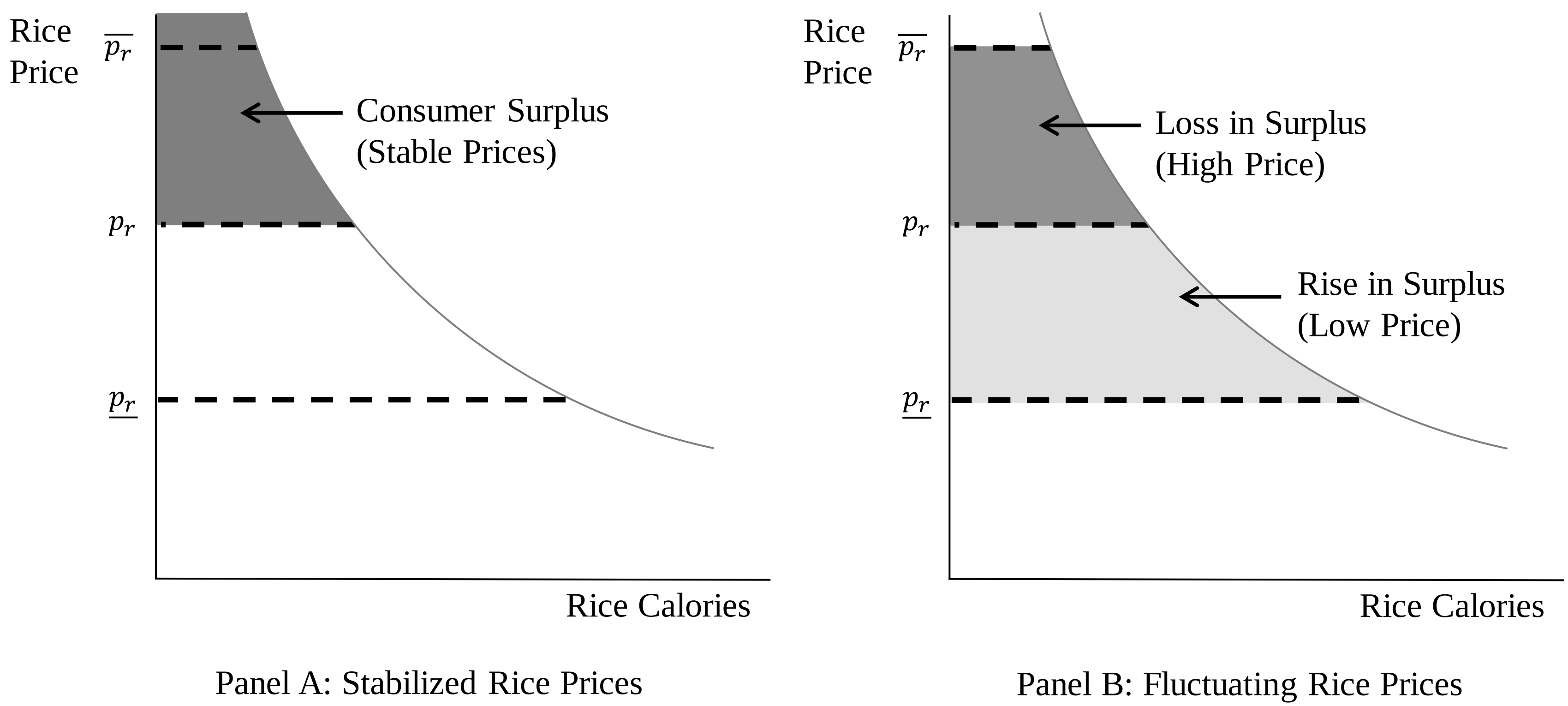
$$\theta_{t+1} = h(\frac{c_{rt}}{c_{wt}}) \ \ with \ \frac{dh(\frac{c_{rt}}{c_{wt}})}{d\frac{c_{rt}}{c_{wt}}} > 0. \tag{2}$$

In period 1, the first period, relative tastes for rice are equal to θ_1.[6] Consumption choices in period t are a function of θ_t, and θ_t depends on past consumption choices. Therefore, current consumption choices depend on both current prices and the whole past history of prices. The case of no habit formation, as explored in the previous section, is simply the case where $\frac{dh(\frac{c_{rt}}{c_{wt}})}{d\frac{c_{rt}}{c_{wt}}} = 0$ and $\theta_t = \theta_1$ for all t. In the next section, I discuss the further restrictions

[5] See appendix A.1 of Atkin (2011) for a proof of this statement.

[6] Unlike Atkin (2011) which explores the implications of inter-generational habit formation on the gains from a one-off trade liberalization episode, habit formation that occurs within the lifetime of individuals is most relevant in the context of price volatility.

Figure 1: Consumer Surplus Under Stable and Fluctuating Prices (No Habit Formation)



on the $e(.,.,.;.)$ and $h(.,.)$ functions that generate the particular behaviors that can negate the classic Waugh (1944) result.

2.3 The desirability of price instability for consumers in the presence of habits

I now compare the cases of stable and fluctuating prices under habit formation. While making welfare statements in the presence of changing preferences is fraught with difficulty, the basic insight can once more be seen both diagrammatically and through the expenditure function.

For expositional purposes, assume that $\theta_1 = h(\frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)})$, where $c_g(p_{rt}, p_{wt}, m, \theta_t)$ is the Marshallian demand for good g. Essentially, initial tastes for rice are equal to the steady state tastes for rice under stable prices. Therefore, if the rice price is stable and equals p_r in every period, tastes are unchanging in all periods, $\theta_1 = \theta_t$, and the stable price case is identical both with and without habit formation.

Now consider the case of fluctuating prices. In period 1, the rice price is relatively high, $p_{r1} = \overline{p_r}$. As long as rice and the composite food are strict gross substitutes, $\frac{d\frac{c_{rt}}{c_{wt}}}{d\frac{p_{rt}}{p_{wt}}} < 0$, households with tastes θ_1 will have lower relative rice consumption in period 1 compared to the scenario where $p_{r1} = p_r$: $\frac{c_r(\overline{p_r},1,m,\theta_1)}{c_w(\overline{p_r},1,m,\theta_1)} < \frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)}$. Hence, $\theta_2 < \theta_1$ due to the habit formation assumption, $\frac{dh(\frac{c_{rt}}{c_{wt}})}{d\frac{c_{rt}}{c_{wt}}} > 0$, and the fact that $\theta_1 = h(\frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)})$. Tastes for rice are low in period 2 when the price of rice is low.

Conversely, as long as the low price of rice in period 2 results in the relative consumption of rice being above the stable price relative consumption of rice, tastes for rice will be high in period 3, when the price of rice is high once more. More precisely, $\theta_3 > \theta_1$ if $\frac{c_r(\underline{p_r},1,m,\theta_2)}{c_w(\underline{p_r},1,m,\theta_2)} > \frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)}$. This condition will be violated if $\frac{dh(\frac{c_{rt}}{c_{wt}})}{d\frac{c_{rt}}{c_{wt}}}$ or $\frac{d\frac{c_{rt}}{c_{wt}}}{d\theta t}$ are particularly large, corresponding to the scenario where the lower tastes for rice overwhelm the low price for rice in period 2. I restrict attention to the case where $\frac{dh(\frac{c_{rt}}{c_{wt}})}{d\frac{c_{rt}}{c_{wt}}}$ and $\frac{d\frac{c_{rt}}{c_{wt}}}{d\theta t}$ are small enough such that $\frac{c_r(\underline{p_r},1,m,\theta_t)}{c_w(\underline{p_r},1,m,\theta_t)} > \frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)}$ for all even t and $\frac{c_r(\overline{p_r},1,m,\theta_t)}{c_w(\overline{p_r},1,m,\theta_t)} < \frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)}$ for all odd

t, and tastes converge towards an oscillating steady state, $\theta_t = \underline{\theta} < \theta_1$ if $p_{rt} = \underline{p_r}$ and $\theta_t = \overline{\theta} > \theta_1$ if $p_{rt} = \overline{p_r}$.[7] Tastes for rice are high in odd periods (when the price of rice is high) and tastes for rice are low in even periods (when the price of rice is low).

The implications of this correlation like relationship between tastes and prices can be explored using the consumer surplus analysis that Waugh employed. This analysis should be treated with some caution due to the well known problems of using consumer surplus for welfare analysis. In particular, tastes may change the marginal utility of income which is assumed to be held constant in such an analysis.

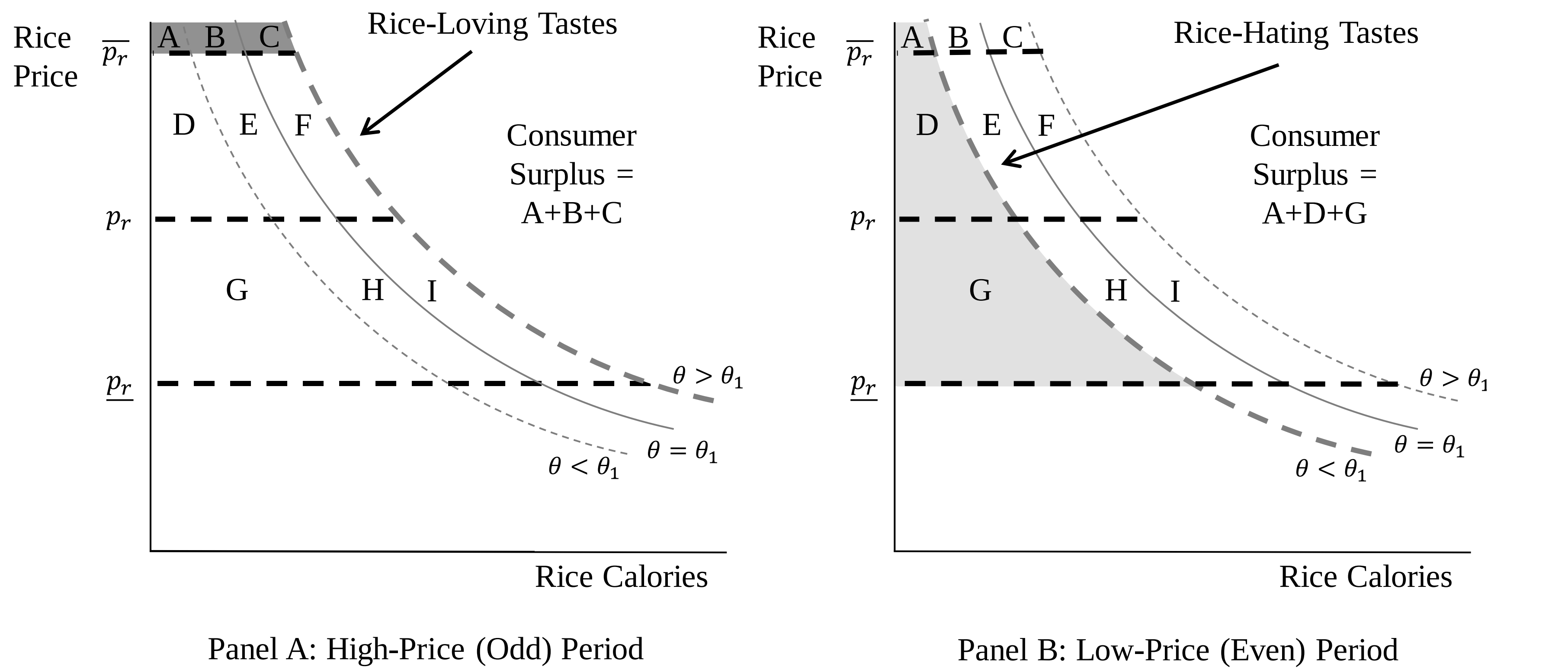
Figure 2 shows the consumer surplus when preferences change each period in the manner described above. Panel A shows a typical odd period. The price of rice is high and accordingly tastes for rice are high. Therefore, I draw a demand curve that is shifted outwards in comparison to the the case of $\theta_t = \theta_1$. Consumer surplus is equal to blocks $A + B + C$. Conversely, panel B shows an even period where both tastes for rice and prices are low. Consumer surplus is equal to blocks $A + D + G$.

The average consumer surplus over the two periods under fluctuating prices and habit formation is equal to $A + \frac{B+C+D+G}{2}$. Under stable prices, consumer surplus is equal to $A + B + D + E$ both with and without habit formation. Therefore, the average surplus of consumers will be higher under fluctuating prices and habit formation only if $\frac{C+G}{2} > \frac{B+D}{2} + E$, with the net effect indeterminate. Contrast this result with the situation where there is no habit formation and the surplus under fluctuating prices is $A + B + \frac{D+E+G+H}{2}$ and hence the average surplus of consumers will always be higher under fluctuating prices as $G+H > D+E$.

It is also straightforward to see how habit formation invalidates the standard expenditure function proof for the case of no habit formation. Recall from 1 (amended to include the

[7] One example where such an oscillating steady state does exist is the tractable combination of the iso-elastic utility function $u(c_{rt}, c_{wt}) = \theta_t \frac{c_{rt}^{1-\frac{1}{e}}}{1-\frac{1}{e}} + (1 - \theta_t) \frac{c_{wt}^{1-\frac{1}{e}}}{1-\frac{1}{e}}$ and the habit formation function $\theta_{t+1} = \frac{1}{1+(c_{rt}/c_{wt})^{-\nu}}$ with $\nu > 0$.

Figure 2: Consumer Surplus Under Fluctuating Prices (Habit Formation)



unbiased tastes θ_1 in the expenditure function):

$$e(p_r, p_w, u*; \theta_1) = e(\frac{1}{2}\underline{p_r} + \frac{1}{2}\overline{p_r}, p_w, u*; \theta_1) > \frac{1}{2}e(\underline{p_r}, p_w, u*; \theta_1) + \frac{1}{2}e(\overline{p_r}, p_w, u*; \theta_1). \tag{3}$$

However, with habit formation, if

$$\left.\frac{\partial e(p_{rt}, p_{wt}, u*; \theta_t)}{\partial \theta_t}\right|_{p_{rt}<p_r} < 0, \tag{4}$$

$$\left.\frac{\partial e(p_{rt}, p_{wt}, u*; \theta_t)}{\partial \theta_t}\right|_{p_{rt}>p_r} > 0, \tag{5}$$

then the previous inequality may no longer hold as more expenditure is required to obtain $u*$ when either rice prices and tastes are low or rice prices and tastes are high:

$$e(p_r, p_w, u*; \theta_1) \ngtr \frac{1}{2}e(\underline{p_r}, p_w, u*; \underline{\theta}) + \frac{1}{2}e(\overline{p_r}, p_w, u*; \overline{\theta}). \tag{6}$$

Conditions 4 and 5 are intuitive; the expenditure required to maintain utility $u*$ is smaller the higher are the tastes for rice when rice is cheap, and larger the higher are the tastes for rice when rice is expensive. These conditions will be satisfied by a subset of expenditure functions for which $\frac{\partial^2 \ln e(p_{rt}, p_{wt}, u*; \theta_t)}{\partial \ln p_{rt} \partial \theta_t} > 0$.

In conclusion, in a world with habit formation, the key result contained in Waugh (1944) will not necessarily hold.

2.4 Production

Up to this point, the production side has been ignored as I assumed that consumers received a fixed endowment and prices are exogenous. These assumptions may be reasonable for urban populations consuming imported foods, but they are less realistic in a rural setting where consumers may also be producers. As shown by Oi (1961), producers also prefer fluctuating prices. However, Massell (1969) showed that price stabilization can be desirable in aggregate if consumption and production are modeled together, and price fluctuations are driven supply shocks.[8] Incorporating habit formation into an analysis that includes both production and consumption is beyond the scope of the present paper. I will conjecture that, since habit formation is sufficient to invalidate the Waugh (1944) result when consumption is considered alone, habits are also likely to make stabilization relatively more desirable in a framework that includes production.

2.5 Nutritional effects

I have not yet addressed the nutritional impacts of stable versus fluctuating prices. While there is no nutritional equivalent of Waugh (1944) as households do not maximize caloric intake, habit formation will reduce the nutritional benefits (or potentially increase the nutritional costs) of price instability through a similar mechanism.

The mechanism can be seen most easily by plotting budget sets and indifference curves for the two goods, rice and the composite food. I relax the assumption of homothetic preferences and provide a visual example of a case where habit formation makes price instability less desirable. Panel A of figure 3 shows consumption choices in six different scenarios: under three different rice prices $p_{rt} \in (p_r, \underline{p_r}, \overline{p_r})$ (labeled A, B and C respectively) and under both no habit formation and habit formation (superscripted NH and H). I set $m = 2000$, $p_r = 1$, $\underline{p_r} = 0.25$ and $\overline{p_r} = 1.75$, and label the three budget lines with the appropriate rice price. The dashed indifference curves represent the no habit-formation case, where $\theta_t = \theta_1$. The particular preferences shown are symmetric in rice and the composite food, hence the indifference curves are tangential to the 45 degree line at a half rice-half composite bundle. The solid indifference curves represent the habit-formation case. Following the habit formation logic of the previous section, the indifference curve favors rice when $p_{rt} = 1.75$ and favors wheat when $p_{rt} = 0.25$.

Panel B of figure 3 superimposes iso-calorie lines over the consumption choices A^H, A^{NH},

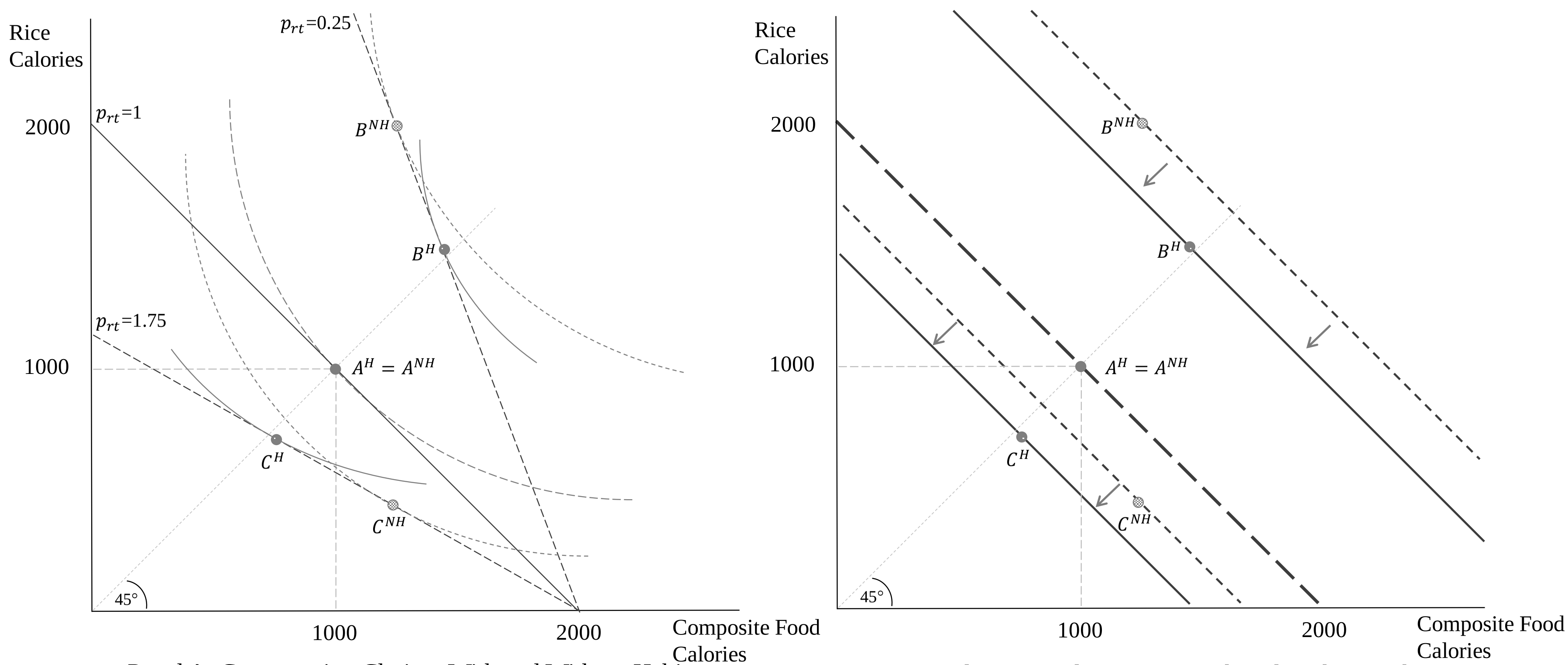
[8] Wright (2001) surveys the literature and discusses the fragility of this result.

B^H, B^{NH}, C^H and C^{NH}. Since quantities are defined in terms of calories, the iso-calorie lines have a gradient of -1 with caloric intake increasing as the iso-calorie lines move to the north-east. The level of caloric intake under stable prices is identical in the case of both habits and no habits is lower than the average caloric intake with fluctuating prices in this particular example.[9] However, caloric intake is lower under habit formation both when rice prices are low (compare the iso-calorie lines passing through B^{NH} and B^H) and when rice prices are high (compare the iso-calorie lines passing through C^{NH} and C^H).

If prices oscillate, the presence of habit formation in consumption means that households consume less relatively cheap rice in even periods and more relatively expensive rice in odd periods. Accordingly, in this two-good example where both foods have the same mean price, caloric intake is lower in every period in the presence of habit formation compared to the standard case when household preferences are fixed across time periods. Of course, the case of perfectly oscillating prices is an extreme one. For example, imagine an alternative price regime where rice prices switched only every two periods rather than every period. In the symmetric two-good example above, households in a world with habit formation would have lower caloric intake in the first period after any price switch, but would have higher caloric intake in the second period as preferences favored the relatively cheap food. Therefore, the net effect of habit formation will depend crucially on the speed of habit formation and precise stochastic process governing price fluctuations.

[9] The fact that the level of caloric intake under stable prices is identical in the case of both habits and no habits results from the assumption that $\theta_1 = h(\frac{c_r(p_r,1,m,\theta_1)}{c_w(p_r,1,m,\theta_1)})$. More generally, habit formation will change the level of caloric intake even under stable prices (and stable tastes). However, I abstract from this possibility in order to focus on how fluctuating prices alter caloric intake both with and without habit formation.

Figure 3: Caloric Intake Under Stable and Fluctuating Prices



Panel A: Consumption Choices With and Without Habits

Panel B: Iso-Calorie Lines With and Without Habits

3 Conclusions and Policy Implications

The aim of this paper is to show that price volatility may be more damaging for consumers in terms of both welfare and nutrition if there is habit formation in consumption. The basic intuition is that if commodity prices oscillate every period, and current preferences depend on the previous periods consumption, habit formation can lead to preferences that systematically favor the goods which are particularly expensive this period.

There are several fruitful avenues for further research on this subject. In terms of the model, I simplified the analysis in two important respects. First, I assumed that households were myopic and could not store their endowment between periods. Second, as discussed in section 2.4, I ignored the production side of the economy and assumed that price shocks were exogenous. A more thorough analysis should relax both these simplifying assumptions.

The stylized model considered price fluctuations of a single food relative to some composite food. Any empirical analysis would need to consider multiple goods with different degrees of substitutability (perhaps determined by habit formation) and a rich set of stochastic price processes. Atkin (2010) provides a methodology that could be used to implement such an analysis. He estimates tastes for 52 foods across the regions of India and explores the nutritional impacts of trade-induced price changes both with and without habit formation. A similar strategy could be used to test the welfare predictions of a model of price volatility and habit formation. Finally, the nutritional effects of price volatility in the presence of habit formation depend on the speed of habit formation, the stochastic process governing price fluctuations and the price-per-calorie of each food. A counterfactual exercise using parameters estimated from household surveys could deduce the net effect of habit formation on the nutritional impacts of price volatility as well as explore the efficacy of current policies designed to mitigate the harmful nutritional effects of price volatility.

References

Atkin, David. 2010. "Trade, Tastes and Nutrition in India." *Yale Economic Growth Center Discussion Papers*, 986.

Atkin, David. 2011. "Trade, Tastes and Nutrition in India." Working Paper, Yale University.

Attanasio, O., V. DiMaro, V. Lechene, and D. Phillips. 2009. "The Welfare Consequence of Increases in Food Prices in Rural Mexico and Colombia." Working Paper, UCL.

Banerjee, A., and S. Mullainathan. 2010. "The Shape of Temptation: Implications for the Economic Lives of the Poor." National Bureau of Economic Research.

Bryan, G., D. Karlan, and S. Nelson. 2010. "Commitment Devices." *Annual Review of Economics*, 2(1): 671–698.

Deaton, A. 1989. "Rice Prices and Income Distribution in Thailand: a Non-Parametric Analysis." *The Economic Journal*, 99(395): 1–37.

Deaton, Angus, and Jean Dreze. 2008. "Nutrition in India: Facts and Interpretations." Princeton University RPDS Working Papers.

De Janvry, Alain, and Elizabeth Sadoulet. 2009. "The Impact of Rising Food Prices on Household Welfare in India."

Duflo, E., M. Kremer, and J. Robinson. 2008. "How High are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya." *The American Economic Review*, 98(2): 482–488.

FAO, IFAD, IMF, OECD, UNCTAD, WFP, World Bank, WTO, IFPRI, and UN HLTF. 2011. "Price Volatility in Food and Agricultural Markets: Policy Responses."

Massell, Benton F. 1969. "Price stabilization and welfare." *The Quarterly Journal of Economics*, 83(2): 284.

Oi, Walter Y. 1961. "The Desirability of Price Instability Under Perfect Competition." *Econometrica*, 58–64.

Ravallion, M., and D. Van de Walle. 1991. "The Impact on Poverty of Food Pricing Reforms: a Welfare Analysis for Indonesia." *Journal of Policy Modeling*, 13(2): 281–299.

Rogerson, William P. 1980. "Aggregate Expected Consumer Surplus as a Welfare Index with an Application to Price Stabilization." *Econometrica*, 48(2): pp. 423–436.

Samuelson, Paul .A. 1972. "The Consumer Does Benefit from Feasible Price Stability." *The Quarterly Journal of Economics*, 86(3): 476.

Turnovsky, Stephen J., Haim Shalit, and Andrew Schmitz. 1980. "Consumer's Surplus, Price Instability, and Consumer Welfare." *Econometrica: Journal of the Econometric Society*, 135–152.

Waugh, Frank. V. 1944. "Does the Consumer Benefit from Price Instability?" *The Quarterly Journal of Economics*, 58(4): 602.

Wright, Brian. 2001. "Storage and Price Stabilization." *Handbook of Agricultural Economics*, 1: 817–861.