



# Precautionary saving under liquidity constraints: Evidence from rural Pakistan<sup>☆</sup>

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## ABSTRACT

This paper investigates precautionary saving under liquidity constraints in Pakistan using household panel data. In particular, while it estimates Kimball's [Kimball, M.S. Precautionary saving in the small and in the large. *Econometrica* 1990; 58; 53–73.] prudence parameter based on a framework that is similar to Dynan [Dynan, K.E. How prudent are consumers? *Journal of Political Economy* 1993; 101; 1104–1113.], this study deviates from the framework by explicitly considering liquidity constraints, as in Zeldes [Zeldes, S.P. Consumption and liquidity constraints: an empirical investigation. *Journal of Political Economy* 1989; 97; 305–346.]. By doing so, this paper attempts to differentiate the standard precautionary saving caused by uncertainty from that caused by liquidity constraints. Furthermore, endogenous liquidity constraints are used in order to resolve issues of selection biases. We find substantial evidence of the presence of precautionary saving in Pakistan. More specifically, the estimated prudence is significantly higher for liquidity-constrained households as compared with unconstrained ones. The finding suggests that the precautionary saving motives appear stronger when households see that their access to credit markets is limited.

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## 1. Introduction

In this study, the relationship between liquidity constraints and precautionary saving is empirically examined using household panel data from rural Pakistan. Since the seminal work of Dynan (1993, hereafter Dynan), the small estimates of Kimball's (1990, henceforth Kimball) prudence parameter<sup>1</sup> have presented one of the puzzles in the literature on household consumption behavior, especially in the developed countries. While a growing number of theoretical studies point out the importance of precautionary saving, the existing evidence suggests that precautionary saving motives may not be

empirically important.<sup>2</sup> Indeed, most of the existing studies on precautionary saving tend to focus on the macroeconomic implications of the precautionary saving motive.<sup>3</sup>

While the aggregate implications of precautionary saving are important for developed countries, in this paper, our focus is a developing country, Pakistan, where people, especially the poor, face a wide variety of income shocks. The implications of precautionary saving as a self insurance tool could be non-trivial in the context of developing countries. Poor households in developing countries are known to hold significant amounts of extra saving in a wide variety of forms such as stored grain, cash holdings, jewelry, and livestock (Alderman, 1996; Fafchamps et al., 1998; Park, 2006; Rosenzweig and Wolpin, 1993; Townsend, 1995). Park (2006) argued that grain stocks are the most important form of extra saving in developing countries despite their negative returns. This puzzling behavior may be due to the lack of access to credit and/or reliable saving opportunities. The existing development

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<sup>1</sup> Loosely speaking, Kimball's prudence parameter measures the strength of precautionary saving. We will discuss in details about the concept and the definition of the prudence measure used in this study in a later section.

<sup>2</sup> Using the U.S. data, Dynan found the estimated prudence to be in the range of 0.02–0.3 and argued that this was *too low to be consistent with widely accepted beliefs about risk aversion*. Merrigan and Normandin (1996) reported that based on the U.K. data, the estimated prudence would be between 0.78 and 1.33. Other notable studies on precautionary saving based on the data from developed countries include Parker and Preston (2005); Gourinchas and Parker (2001); and Banks et al. (2001).

<sup>3</sup> The importance of precautionary saving, in general, has been well documented. For an excellent survey, see Browning and Lusardi (1996).

studies have already addressed the effectiveness of mutual or market insurances against income shocks, such as credit market transactions, labor market participation, and mutual transfers (Besley, 1995; Dercon, 2005; Dubois et al., 2008; Fafchamps, 2003; Kochar, 1999; Morduch, 1995; Rosenzweig, 2001; Townsend, 1994; Udry, 1994).<sup>4</sup>

Given what others have documented in the existing studies, we specifically consider the liquidity constraints when we empirically evaluate the role of precautionary saving as self-insurance for rural households. Because poor households are often aware that liquidity constraints might be binding, they would attempt to insure themselves by accumulating precautionary wealth.<sup>5</sup> Further, as Deaton (1991) argued, in the event of unexpected negative shocks, households utilize the financial and physical assets that they have previously accumulated.

To empirically evaluate the precautionary saving motive in Pakistan, we estimate the degree of prudence as in Kimball, following the framework developed by Dynan. Prudence, which is closely related to risk aversion, measures the strength of a household's motives to engage in precautionary saving. The prudence parameter can be estimated based on the second order approximation of the consumption Euler equation. We follow Lee and Sawada (2007) to integrate Dynan's framework with Zeldes' (1989, hereafter Zeldes) model of liquidity constraints, which has been shown as a way to resolve the small prudence puzzle.<sup>6</sup> In addition, the integrated framework can empirically differentiate the standard precautionary saving motive caused by future income risks from that caused by liquidity constraints.

This paper documents substantial evidence of precautionary saving in Pakistan. The results of the study also confirm that estimating prudence without considering liquidity constraints could lead to a nonnegligible omitted variable bias. Furthermore, the findings suggest that the levels of estimated prudence might be associated with the levels of wealth: while the poor and liquidity-constrained households behave prudently, the rich and unconstrained ones do not exhibit precautionary saving motives.

This paper contributes to the literature by (1) considering two major risk-coping strategies, i.e., self-insurance and credit access, in developing countries; (2) explicitly studying the relationship between precautionary saving and liquidity constraints; and (3) reiterating the importance of omitted variable bias in Dynan's framework.

While most of the existing studies on risk and household behavior in developing countries tend to ignore the simultaneous employment of different risk-coping strategies by households (Rosenzweig, 2001), analyses based on a single method of risk-coping in isolation may be incomplete (Alderman and Paxson, 1992, p. 2). As such, this paper aims to bridge the gap in the existing literature by explicitly considering both self-insurance tools and credit accessibility within an integrated framework.<sup>7</sup>

Second, this paper investigates the empirical relationship between precautionary saving and liquidity constraints, which is largely unknown in the literature. Based on numerical studies, Zeldes (1984) showed that liquidity constraints could induce precautionary

<sup>4</sup> When facing negative income shocks, a household can utilize credit market transactions to smooth consumption by reallocating future resources for present use (Eswaran and Kotwal, 1989; Besley, 1995). Yet, there is plenty of evidence that poor households have only limited access to the credit market and are, therefore, constrained from borrowing (Morduch, 1990; Pender, 1996).

<sup>5</sup> Following Carroll and Kimball (2007), we use the term precautionary wealth instead of precautionary savings to avoid confusion. Precautionary savings at any date refers to the stock of extra wealth that results from the past flow of precautionary saving.

<sup>6</sup> Lee and Sawada (2007) argued that most of the previous studies overlooked the potential omitted variable bias in the consumption Euler equation estimation, caused by liquidity constraints, and presented a way to resolve the puzzle.

<sup>7</sup> This type of study is also of practical importance since changes in the costs and benefits of one coping strategy affect the manner in which other strategies are used, and thus, the interactions among different strategies may be important for a policy design. For example, Cox and Jimenez (1990) have shown that public transfers crowd out altruistically-motivated private transfers, mitigating the net effectiveness of public interventions.

saving even under the quadratic utility function, which rule out precautionary saving because the third derivative is zero.<sup>8</sup> Carroll and Kimball (2001) also developed a rigorous theory and a numerical analysis to explain the relationship between precautionary saving and liquidity constraints.<sup>9</sup> However, there has been little consensus with regard to studies on the empirical relationship between the two. To examine this relationship, we adopt the Lee and Sawada (2007)'s method and then consider endogenous liquidity constraints for resolving issues of sample selection biases, following Jappelli (1990); Jappelli, Pischeke, and Souleles (1998); Garcia, Lusardi, and Ng (1997); and Hajivassiliou and Ioannides (2007).<sup>10</sup>

Finally, this paper reconfirms that small estimates of the prudence parameter based on the Dynan's specification might be due to the omitted variable bias. While existing studies such as Chen and Zhou (2003) for China, Hori and Shimizutami (2006) for Japan, Ludvigson and Paxson (2001) for the U.S., and Merrigan and Normandin (1996) for the U.K. suggested several possible reasons for the small estimates of the prudence puzzle, we argue that the liquidity constraint appears to be one of the key factors to resolve the puzzle. We use the households' direct responses on credit accessibility to identify liquidity constrained households. Then, we show that prudence estimates from the Dynan specification could lead to an omitted variable bias when a large portion of the households is, indeed, liquidity-constrained.

In summary, this study documents strong evidence of precautionary saving under liquidity constraints in Pakistan. Further, the degree of precautionary saving gets significantly lowered once the liquidity constraint is not controlled for, suggesting a possible omitted variable bias in the Dynan's specification. Moreover, estimated prudence is substantially higher for the liquidity-constrained. The results are robust even when the endogeneity bias with regard to liquidity constraints is carefully eliminated. The precautionary saving motives are found to be stronger when households have limited access to credit markets, suggesting that the levels of estimated prudence may be associated with levels of wealth: the rich, who have credit market access, display few precautionary saving motives.<sup>11</sup> Furthermore, this pattern becomes more conspicuous when we control for the households that could access informal credit markets. The results indicate that (1) precautionary saving is an important self-insurance vehicle against income shocks for poor households that face liquidity constraints and (2) the effects of liquidity constraints on precautionary saving vary with on the level of wealth. Finally, we also document a relatively weak but interesting relationship between the precautionary saving motive and the distance to a bank.

The remainder of this paper is structured as follows. The next section begins with a brief theoretical background of the degree of precautionary saving measured by prudence and its association with risk aversion. We then, present an integrated framework of precautionary saving and liquidity constraints for estimation. Section 3 describes the Pakistani household panel data set and presents the estimation results. The final section summarizes our findings, discusses potential policy implications, and concludes the paper.

<sup>8</sup> As we will explain in a later section, Kimball's prudence is determined by the curvature of the marginal utility of the household utility function. Moreover, prudence requires a positive third derivative of a household's utility function,  $U''' > 0$ . As a result, the quadratic utility function whose  $U''' = 0$  does not show any prudence.

<sup>9</sup> Nire (2006) quantitatively studied the combined effect of liquidity constraints and precautionary saving based on a dynamic general equilibrium model and argued that uninsurable shocks can have a significant effect on aggregate savings. See Samwick (2003) and Xu (1995) for other theoretical treatments.

<sup>10</sup> There exist a large number of discussions on the usefulness of the consumption Euler estimation approach. See Attanasio and Low (2004), Carroll (2001), and Ludvigson and Paxson (2001) for examples.

<sup>11</sup> This is consistent with the findings of Alderman (1996) who estimated saving functions directly using the same data as ours; he found that the wealthiest households saved their entire transitory income.

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