The precautionary saving: theories, measurements and policies

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Abstract
This article focuses on one particular form of saving, the precautionary saving. To this end, a simple theoretical framework is presented within which such a form of saving arises. Next, the potential risks triggering the precautionary saving are discussed. As a second step, examples which highlight the empirical importance of the precautionary saving are provided. Finally, it is shown how the precautionary motive can heavily influence the effects of both fiscal and monetary policies. (JEL: D10, E21, E52, E62)

Introduction

During the last decade, most of the industrialized countries lived periods where both the degree of uncertainty and the households’ saving rates were high. For example, the Great Recession has been characterized by a high level of unemployment which raised both the risk of job losses and the unemployment duration. Meanwhile, households’ saving has increased (see Carroll et al. 2012; Mody et al. 2012). Such an economic phase has contributed to revive the interest in studying the determinants of saving decisions and, in particular, the connection between saving dynamics and uncertainty.

Investigating on why people save is a long-standing issue in the literature. Among others, let me mention the intertemporal motive which pushes individuals to postpone consumption because of patience or returns to saving. Let me then cite the smoothing motive which allows individuals to smooth consumption over time. Further, there is the bequest motive. Finally, I refer to the precautionary motive which was already defined by Keynes (1936) as a way to build up a reserve against unforeseen contingencies.

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This paper discusses some theories, empirical findings and policy implications related to the last cited saving motive within the household sector. It is worth noting that most of the work on precautionary saving focuses on the US economy, hence, if not differently specified, the described papers will refer to the United States.

The article has the following structure. In the first part, I sketch a simple theoretical framework from which the precautionary saving motive arises and present the most common risks that trigger a precautionary saving behavior. In the second part, I highlight the empirical importance of precautionary saving. I present the precautionary saving motive as a device for solving well known empirical puzzles. Further, I describe papers which provide a quantitative assessment of such a form of saving. In the last part, I describe how the effects of both fiscal and monetary policies can be influenced by the form of saving under scrutiny. I then conclude.

**Saving for precautionary motives: theories and causes**

This section recalls a simple theoretical framework within which the precautionary saving motive is at work. The section also spells out the most known risks triggering such a form of saving.

**Sketching a theoretical framework**

Consider a theoretical framework similar to those presented in Hall et al. (1978), Zeldes (1989) or Deaton (1992), which embeds the permanent income hypothesis (PIH).\(^1\) In practice, this dynamic model for households has the following features:\(^2\)

1. A time-separable quadratic utility function (with consumption as the only argument);\(^3\)
2. An exogenous and stochastic labor income process;

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1. Offering an exhaustive list of papers that deals with the PIH is beyond our scope. However, notice that already Friedman (1957) provided qualitative descriptions of the PIH. Additional important papers are Leland (1968) and Caballero (1990).
2. This framework considers the households’ behavior as summarized by the behavior of a representative agent. Afterwards, I present versions of the PIH model which rigorously take into account households’ heterogeneity.
3. Using such a utility function has the advantage of mathematical tractability, whereas it presents the disadvantage of being unrealistic since, after a certain level of consumption, an increase in consumption itself produces a decrease in welfare. Time separability implies that the utility that consumption yields today does not depend on the levels of consumption in other periods.
3. The presence of a single asset whose yield is deterministic (or exogenous) and independent from the income realization;  
4. A terminal condition which rules out Ponzi schemes;  
5. No bequest motives.

The crucial reason for saving in this economy is the smoothing motive. Other than condition (4), there are no constraints on borrowing and households may borrow and lend freely at the riskless interest rate in order to smooth consumption through income shocks. In particular, they will keep their marginal utility of consumption constant over time, implying that, at any date, the optimal level of consumption is the permanent income. The permanent income is the annuity value of the discounted flows of income and assets (human and financial wealth). This consumption level satisfies certainty equivalence, meaning that the variance and higher order moments of the income process do not matter for the determination of consumption. Put it differently, the precautionary saving motive cannot be active in this framework despite the presence of income uncertainty.

To generate the precautionary saving — the extra saving accumulated to hedge against the occurrence of future income shocks — either condition (1) or condition (4), or both, need to be relaxed. For example, using more realistic utility functions, e.g., the constant relative risk aversion (CRRA) or the constant absolute risk aversion (CARA) functions, is a sufficient condition for generating a precautionary saving motive. In particular, Kimball (1990) shows that the precautionary saving is active if agents display prudence, that is, the third derivative of the utility function is positive. Another element triggering precautionary saving is the presence of binding borrowing constraints. When agents face borrowing constraints they fear receiving bad income realizations which would push them towards the constraint, a place where they loose the possibility of smoothing consumption. In order to avoid that, they accumulate some precautionary saving.

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4. This hypothesis recalls the existence of incomplete financial markets. In these markets, the assets returns are not state contingent to the income realizations. The diametrically opposite benchmark is having complete markets where a full set of state contingent assets is available to the agents.

5. This condition implies that agents cannot die with a positive level of debt.

6. Intuitively, the certainty equivalence principle establishes that an individual living in a stochastic economy acts as if the economy was deterministic.

7. Notice that that the precautionary saving can also be labeled as (saving for) self-insurance. That is, the absence of other insurance opportunities induces the agents to adjust their asset holdings to acquire self-insurance.

8. Prudence can be broadly defined as a measure of the sensitivity of the consumption choice to risk. If prudence is nil, then uncertainty does not have any possibility of influencing the individual choices through preferences.
Summing-up: a stochastic environment is not sufficient to generate a precautionary saving motive. On top of a stochastic economy, we also need that either the participants to this economy are prudent or constraints that could limit the households’ borrowing capacity.

**Sources of risk**

In the previous section, I highlighted an extremely simple model which embeds two types of risk. These are the labor income uncertainty and the probability for a household to become borrowing constrained. Obviously, more complex and richer models are able to capture many other sources of risk observed in reality.

First of all, labor income uncertainty can be generated not only by an exogenous stochastic flow as described above, but also by shocks to the employment status or to the human capital (see the models developed in Low 2005; Huggett et al. 2011). Second, there are other realistic sources of risks, such as (i) health risks, (ii) shocks to families or (iii) to capital. For example, health shocks may impact on the dynamics of individual earnings, utility and life’s length which, in turn, influence the agents’ saving behaviour (see Palumbo 1999; Attanasio et al. 2010). Also changes in the family composition such as marriage, divorce, and the birth of children may affect the saving dynamics; Cubeddu and Rios-Rull (2003) show that marital status risk can represent an important source of precautionary saving. Finally, the return to financial capital and the house prices are risky. In particular, the latter, which represent a major component of households’ portfolios, have a large idiosyncratic component associated to geographical location (see Davis and Heathcote 2007).

Another source of risk is represented by potential correlations among the risks cited above. For example, a bad health shock to the household head, such as a serious disease or an accident, can decrease the individual productivity or even generate a job displacement which, in turn, decreases the probability of generating children.

So far, I focused on risks occurred at the individual level. However, even the business cycle can represent a cause for a precautionary saving behavior. For example, if the aggregate state of the economy influences the conditional distribution of a specific idiosyncratic risk then a time-varying precautionary saving may occur. Davis and von Wachter (2011) show that earnings losses from job displacement roughly double if they occur in a recession as opposed to an expansion. Further, Guvenen et al. (2014) show that the worst income realizations are more likely in a recession.
The empirical importance of precautionary saving

This section has two aims. First, it shows that the precautionary saving motive is a good candidate to solve well known empirical puzzles within the literature that studies optimal consumption dynamics. Second, it provides some measurements for the saving due to precautionary purposes.

Some puzzles for certainty-equivalence models

I here discuss two facts which are hard to explain within a model with certainty equivalence. These are (i) the excess sensitivity of consumption to transitory income innovations and (ii) the saving behavior of the elderly.\(^9\)

The precautionary saving motive can help explain these puzzles. In order to understand fact (i), let me ask the following question: how does the precautionary saving motive shape the consumption policy function?\(^10\) Figure 1 presents two typical consumption policy functions: one obtained from a PIH model with certainty equivalence (dashed line) and the other generated within a PIH model with a role for precautionary saving (solid line). The first policy function is increasing and linear in wealth. The second one, which lies below the other one, is increasing but concave.\(^11\) This happens because the precautionary motive depresses consumption at any level of wealth, however, it depresses it more at low levels of wealth since the higher is the wealth the easier is bearing the effect of future uncertainty. Put simply, uncertainty makes people consume less and save more on average, but their spending becomes ‘more sensitive’ to an extra dollar of wealth. Such a sensitivity, defined as the marginal propensity to consume out of wealth (MPC), becomes higher as wealth declines or, equivalently, as wealth approaches the borrowing constraint.\(^12\) Unlike it, the certainty-equivalence version of the model generates a constant or wealth-invariant MPC.

Regarding fact (ii), the implication of a life-cycle version of the certainty-equivalence PIH model is that people should accumulate wealth in their first

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9. The definition of excess sensitivity used here is the one in Hall and Mishkin (1982). They define excess sensitivity as the difference between the actual response in consumption and the reaction in the permanent income that occur as the result of a transitory income innovation. It has to be said that this definition differs from the one in Flavin (1981) under which consumption is excessively sensitive to income if it reacts to anticipated changes in income.

10. The consumption policy function, resulting from solving an economic model, can be broadly defined as a law that assigns an optimal level of consumption for any current level of wealth, conditional on a particular income realization.

11. Notice that Figure 1 does not have a quantitative objective. It just describes the typical shapes of two different policy functions.

12. Notice two things here. First, the MPC is the slope of the policy function. Hence, for a non-linear policy function, this slope varies with wealth. Second, Figure 1 depicts a borrowing constraint. At this constraint the (net) wealth is typically negative. However, it is common to see models where borrowing is not permitted; in those cases the borrowing limit is set to zero.
part of life while decumulating it during old age. The second part of the sentence has been tested empirically since the seventies. Mirer (1979) use cross-sectional data to show that assets do not run down during old age; conversely Hurd (1987), using panel data, argues that the wealth of elderly families does decline over time. Subsequently, both Modigliani (1988) and Kotlikoff (1988) agree on the following concept: elderly people do not drawn down their wealth as intensively as predicted by a life-cycle model with certainty equivalence and no bequest motives. On top of bequests and the uncertainty related to the moment of death, a precautionary saving motive can help solve this puzzle. Intuitively, the possibility of getting serious illness, with important associated costs for treatments, can be a crucial source of uncertainty for the elderly. Hence, old age households can keep part of their wealth as a buffer for the occurrence of these health shocks. De Nardi et al. (2010) estimate that the risk of incurring in high medical expenses is a key driver for saving in the old age.
Measuring precautionary saving

There have been several attempts to test for the presence of the precautionary saving behavior within the household sector. Some authors estimate reduced form equations inspired by the class of PIH models with a role for precautionary saving. For example, Lusardi (1998) shows that various measures of wealth are positively and significantly correlated with a subjective measure of income risk (the probability of a job loss), controlling for many other individual characteristics. Other authors follow a more structural approach in the sense that they estimate one particular implication of the PIH model: the Euler equation. Under the non-certainty-equivalence version of the model, the Euler equation includes also the expected consumption variance which embeds all the information that individuals have on their future risks. Both Jappelli and Pistaferri (2000) and Bertola et al. (2005) estimate an Euler equation by proxying such a consumption variance with the subjective variance of income calculated within the Survey on Household Income and Wealth (SHIW), an Italian panel dataset. These authors find that the precautionary saving motive is active, implicitly rejecting the certainty-equivalence version of the PIH model.

Interestingly, Gourinchas and Parker (2001, 2002) estimate the whole PIH model, not only a single equation of it. This allows the authors to decompose household wealth in several components among which the share due to precautionary motives. Specifically, they use household survey data, like the Consumer Expenditure Survey (CEX) and PSID, and simulation techniques in order to estimate a version of the PIH model which explicitly accounts for age heterogeneity. They find that around 60% of nonpension liquid wealth is due to the precautionary motive. Such a form of saving is mostly generated by the behaviour of the young while, after age 45, households start to save mainly for retirement and bequest.

In the first part of the paper, I sketched a version of the PIH model with exogenous production, where the equilibrium interest rate is deterministic or exogenous, and with the presence of a representative agent. Aiyagari (1994) develops a general equilibrium model with heterogenous households, in terms of wealth and productivity, that behave as if they were in a PIH economy with a role for precautionary saving. Next to the household sector, there is a representative firm which competitively maximizes profits. The resulting equilibrium interest rate equates the capital demanded by the firm with the (claims of) capital supplied by households. Within this framework,

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13. The Euler equation is an equilibrium condition which typically describes the optimal allocation of consumption in two consecutive periods of time. Generally, the degree of patience, the returns to assets and the perceived uncertainty influence such an allocation.

14. It is worth recalling the pioneer paper of Bewley (1977) who proposed a model for the household sector where the heterogenous agents were subject to incomplete financial markets.
the author calculates the share of aggregate saving explained by income uncertainty. He shows that the level of precautionary saving heavily depends on some model parameters like, for example, the serial correlation of earnings. The higher is the value of the earnings persistence, the higher is the variance of the whole income process, hence the higher is the level of precautionary saving. For a relatively high degree of persistence, the precautionary saving motive can explain more than 30% of the aggregate saving rate.

Based on the standard version of the PIH model, agents cut consumption in order to increase their level of precautionary saving. Similarly, agents could save more by working harder. Pijoan-Mas (2006) extends the Aiyagari (1994) model by making labor supply endogenous and shows that individuals use also the work effort as a self-insurance mechanism. Quantitatively, he shows that aggregate consumption is 0.6% lower while work effort is 18% higher because of the presence of a precautionary saving motive.

There is a set of papers that study the precautionary saving over the business cycle. Carroll et al. (1992) and subsequently Carroll et al. (2012) invoke the precautionary saving motive to explain the tendency of saving to increase during recession. The last paper formulates a simple version of the PIH model with a role for income uncertainty and credit constraints and shows that saving reacts positively to a worsening in economic circumstances (such as an increase in the unemployment risk). Specifically, these papers show that the changes in the net wealth and labor income uncertainty can explain most of the business cycle fluctuations in personal saving, during and after the information technology and credit bubbles of 2001 and 2007. Using a model similar to Carroll et al. (2012), Mody et al. (2012) show that at least two-fifths of the increase in households’ saving rate during the Great Recession (2007-2009) are explained by the increased uncertainty about labor income prospects. Unlike a certainty-equivalence model, Challe and Ragot (2016) show that a model with a role for precautionary saving is able to replicate the observed volatility of aggregate consumption. Finally, McKay (2016) incorporates a time-varying income risk, using the income process estimated by Guvenen et al. (2014), within an Aiyagari (1994) type of model. He shows that such a time-varying risk has an important effect on consumption and saving dynamics.15

15. He shows that market incompleteness raises the volatility of aggregate consumption by roughly 40%. Around half of this increase is due to changes in the income risk over the business cycle.
Policies and precautionary saving

This section presents a number of works that study the effects of fiscal and monetary policies within frameworks with a role for the precautionary saving motive.

Given the concepts discussed above, we should expect that the aggregate consumption reaction to a fiscal stimulus depends on the distribution of individuals across wealth levels and on their respective MPCs. Heathcote (2005) studies the effects of tax cuts within an Aiyagari (1994) type of model where private borrowing is not permitted. Among other things, he shows that a debt-financed transfers policy directed to all households has real effects in this economy, especially on consumption. This is because of the existence of a large fraction of individuals that are wealth-poor, i.e., they are pretty close to the borrowing limit, and hence have a high MPC. An important implication follows: the Ricardian equivalence does not hold in an economy with a role for precautionary saving and binding borrowing constraints.16 Following this line of reasoning, Oh and Reis (2012) show that a targeted lump-sum transfers policy (where the transfers are directed to wealth-poor individuals) can have large expansionary effects for the aggregate demand. Finally, McKay and Reis (2016) focus on the role of fiscal automatic stabilizers and show that tax-and-transfers programs can have important effects on aggregate volatility.

There are some papers that focus on the effects of increases in government consumption, as opposed to monetary transfers, within various versions of the Aiyagari (1994) model. Among others, Brinca et al. (2016), using a life-cycle model show that differences in the distribution of wealth across countries generate differences in their respective aggregate responses to government expenditures.17 Ercolani and Pavoni (2014), focusing on Italy, show that government expenditures in health can act as a form of consumption insurance for individuals subject to health shocks, thereby influencing their level of precautionary saving and, in turn, the size of fiscal multipliers.

Another stream of papers focuses on the role of public debt within an Aiyagari (1994) type of model. Aiyagari and McGrattan (1998) show that public debt can act as if it relaxed the household borrowing constraint. That is, higher levels of public debt result in higher interest rates making assets more attractive to hold and, hence, enhancing households’ self-insurance possibilities. Challe and Ragot (2011) show that this channel can have important consequences for the effects of fiscal policy. They show that a debt-financed government spending policy could crowd in private

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16. While Heathcote (2005) sets the borrowing constraint to zero, permitting borrowing does not generally invalidate such a conclusion unless the borrowing constraint is set at the natural borrowing limit (see chapter 9 of Ljungqvist and Sargent 2004, for details on this).

17. This result finds support in Carroll et al. (2014) who show that the MPC varies across countries.
consumption depending on the extent to which the fiscal policy influences the level of precautionary saving. Antunes and Ercolani (2016) focus on the endogeneity of the household borrowing constraint. They show that debt-financed government spending policies generate an upward pressure for the borrowing cost, hence favoring a tightening in the household borrowing limit which, in turn, affect the households’ reactions to the policies.

Recently, some papers focus on the role of precautionary saving and household wealth heterogeneity conditional on the occurrence of monetary policy shocks. For example, Challe et al. (forthcoming) formulate and estimate a tractable model with heterogeneous agents, nominal frictions and uninsurable unemployment risk. In this context, a cut in the policy rate boosts aggregate demand which encourages job creation and lowers the perceived unemployment risk. Agents respond by decreasing their precautionary wealth which generates a rise in the consumption level. Further, Algan and Ragot (2010) show that the presence of binding borrowing constraint within an economy where the precautionary saving motive is active can invalidate the long-run neutrality of inflation on capital accumulation.

Conclusions

This article has described some theories, empirical exercises and policy implications associated to the precautionary saving motive. We have seen that such a form of saving has relevant empirical implications, both in explaining some empirical puzzles and in forming a non-negligible part of total saving. We have also seen that the precautionary saving motive interacts with the effects of monetary and fiscal policies.

An important lesson follows. When doing policy evaluations, research should seriously consider using models with a role for precautionary saving. These models need to have incomplete financial markets. But, this is not the end of the story. For example, Kaplan and Violante (2010) show that there is more insurance beyond self-insurance.\footnote{This statement primarily refers to the insurance against the income shocks that have a permanent nature.} Hence, even other mechanisms — like intra-household insurance, public insurance schemes or government redistribution — should be considered when studying the potential effects of fiscal and monetary policies.
References


