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Risk aversion, risk premia, and the labor margin with generalized recursive preferences

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A flexible labor margin allows households to absorb shocks to asset values with changes in hours worked as well as changes in consumption. This ability to absorb shocks along both margins alters the household's attitudes toward risk, as shown by Swanson (2012). In the present paper, I extend that analysis to the case of generalized recursive preferences, as in Epstein and Zin (1989) and Weil (1989), including multiplier preferences, as in Hansen and Sargent (2001). Understanding risk aversion for these preferences is important because they are a primary mechanism being used to bring macroeconomic models into closer agreement with asset prices. Traditional, fixed-labor measures of risk aversion show no stable relationship to the equity premium in a standard macroeconomic model, while the closed-form expressions I derive here match the equity premium closely.

1. Introduction

A growing macro-finance literature focuses on bringing standard macroeconomic models into better agreement with basic asset pricing facts, such as the equity premium.[2] In asset pricing models, a crucial parameter is risk aversion, the compensation that households require to hold a risky payoff. At the same time, a key feature of standard macroeconomic models is that households have some ability to vary their labor supply. A fundamental difficulty with this line of research,

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[2] For example, Boldrin et al. (2001), Tallarini (2000), Rudebusch and Swanson (2008, 2012), Uhlig (2007), van Binsbergen et al. (2012), Backus et al. (2008), Gourio (2012, 2013), Palomino (2012), Andreasen (2012a, 2012b), Colacito and Croce (2013), Dew-Becker (2014), Kung (2012), and Swanson (2017) all consider asset pricing in dynamic macroeconomic models with a variable labor margin.

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then, is that much of what is known about risk aversion has been derived under the assumption that household labor is exogenously fixed.[3]

Swanson (2012) addresses this problem when households have standard expected utility preferences. In the present paper, I extend that analysis to generalized recursive preferences, as in Epstein and Zin (1989) and Weil (1989), including multiplier preferences, as in Hansen and Sargent (2001) and Strzalecki (2011). These preferences are a primary mechanism being used to bring macroeconomic models into better agreement with asset prices, so understanding risk aversion in this framework is very important for the macro-finance field.[4] In fact, there is no conventional wisdom as to what the formula for risk aversion should be for these preferences when labor supply can vary, with different authors using different ad hoc generalizations of the traditional, fixed-labor measure. In the present paper, I undertake a systematic and rigorous analysis of this important question.

Intuitively, a flexible labor margin allows households to absorb shocks to asset values with changes in hours worked as well as changes in consumption, which can greatly alter the household's attitudes toward risk. For example, with expected utility and period utility function $u(c_t, l_t) = c_t^{1-\gamma}/(1-\gamma) - \eta l_t$, the quantity $-c\,u_{11}/u_1 = \gamma$ is often referred to as the household's coefficient of relative risk aversion, but in fact the household is *risk neutral* with respect to gambles over asset values or wealth (Swanson, 2012). Intuitively, the household is indifferent at the margin between using labor or consumption to absorb a shock to asset values, and the household in this example is clearly risk neutral with respect to gambles over hours.[5] In the present paper, I rigorously derive closed-form expressions for wealth-gamble risk aversion in dynamic equilibrium models with generalized recursive preferences and arbitrary period utility function u, taking into account the effects of the household's flexible labor margin, and I show that those effects can be significant.

I also show, theoretically and numerically, that risk premia on assets in a macroeconomic model are unrelated to traditional, fixed-labor measures of risk aversion unless labor is, in fact, fixed. By contrast, the closed-form expressions for wealth-gamble risk aversion I derive here match risk premia in a standard (flexible-labor) real business cycle model closely. Thus, taking the household's labor margin into account is necessary for there to be a stable relationship between wealth-gamble risk aversion and risk premia in the model.

1.1. Related literature

Arrow (1965) and Pratt (1964) define absolute and relative risk aversion, $-u''(c)/u'(c)$ and $-c\,u''(c)/u'(c)$, in terms of the household's aversion to a fair gamble over a single good in a static, one-period model. When there are multiple goods, the literature has taken two different approaches to generalizing their definition. The first approach, which I follow in this paper, is to consider the household's aversion to a fair gamble over *money* or *wealth*.[6] This approach is taken by Stiglitz (1969) in a static, multiple-good setting, and by Constantinides (1990), Campbell and Cochrane (1999), and others in a dynamic, single-good setting (in which the multiple goods are a single good consumed at different points in time). As shown in Swanson (2012) and in Section 3, below, this approach implies that the household's coefficient of "wealth-gamble risk aversion" is related to the curvature of the household's *indirect* utility function (in the static case) or *value* function (in the dynamic case).

The alternative approach, taken by Kihlstrom and Mirman (1974, 1981) and Nocetti and Smith (2011a, 2011b), defines a household's attitudes toward risk solely as a function of its preferences over consumption and its total consumption bundle. Thus, other features of the economic environment that affect the household's value function but *not* its utility function have no effect on the household's attitudes toward risk in this approach. When there are multiple goods, the household's Kihlstrom–Mirman attitudes toward risk are complicated and multi-dimensional, and cannot be summarized by a single "coefficient of risk aversion" except in very special cases. For example, in Kihlstrom and Mirman (1974), one agent cannot be said to be more or less risk averse than another unless both agents have identical ordinal preferences over all nonstochastic consumption bundles. Similarly, in Kihlstrom and Mirman (1981), increasing, constant, and decreasing relative risk aversion are only defined if the agent has preferences that are homothetic.

For clarity, I will use the phrase "wealth-gamble risk aversion" in this paper to emphasize that I am using the former definition of risk aversion and not the latter. The reason for focusing on wealth gambles is asset pricing: a household's aversion to a wealth gamble is always well-defined under the technical assumptions I make below (e.g., twice-differentiability) and is highly relevant for understanding the household's aversion to holding a risky asset with monetary payoffs, such as

[3] For example, Arrow (1965) and Pratt (1964) define absolute and relative risk aversion, $-u''(c)/u'(c)$ and $-c\,u''(c)/u'(c)$, in a static model with a single consumption good (and no labor). Similarly, Epstein and Zin (1989) and Weil (1989) define risk aversion for generalized recursive preferences in a dynamic model without labor (or, equivalently, in which labor is fixed).

[4] The vast majority of studies cited in footnote 2 take this approach, the exceptions being Boldrin et al. (2001), Rudebusch and Swanson (2008), and Palomino (2012). One of the main advantages of generalized recursive preferences is that they allow risk aversion to be modeled independently from the household's other preference parameters, such as the intertemporal elasticity of substitution.

[5] More generally, when $u(c_t, l_t) = c_t^{1-\gamma}/(1-\gamma) - \eta l_t^{1+\chi}/(1+\chi)$, the household's wealth-gamble risk aversion equals $(\gamma^{-1} + \chi^{-1})^{-1}$, a combination of the parameters on the household's consumption and labor margins, reflecting the fact that the household absorbs shocks along both margins.

[6] Both Arrow (1965) and Pratt (1964) explicitly worked with a "utility function for money" (Pratt, 1964, p. 122) or wealth: "Let Y = wealth, $U(Y)$ = total utility of wealth Y" (Arrow, 1965, pp. 91–92), and defined risk aversion in terms of a fair gamble over money or wealth.