Reconciling Jaimovich-Rebello Preferences, Habit in Consumption and Labor Supply*

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Abstract

This note studies a form of a utility function of consumption with habit and leisure that (a) is compatible with long-run balanced growth, (b) hits a steady state observed target for hours worked and (c) is consistent with micro-econometric evidence for the inter-temporal elasticity of substitution and the Frisch elasticity of labor supply. Employing Jaimovich-Rebello preferences our results highlight a constraint on the preference parameter needed to target the steady-state Frisch elasticity. This leads to a lower bound for the latter that cannot be reconciled empirically with external habit, but the introduction of a labor wedge solves the problem. We also propose a dynamic Frisch inverse elasticity measure and examine its business cycle properties.

Keywords: Jaimovich-Rebello Preferences, Habit in Consumption, Labor Supply, Dynamic Frisch Elasticity, Labor Wedge

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1 Introduction

Whether it is in the context of the equity-premium puzzle (see, for example, Abel, 1999), the savings-growth relation (Carroll and Weil, 2000) or monetary policy - business cycle analysis (Christiano *et al.*, 2005), researchers have used the concept of relative preferences to advance their various agendas. In particular, RBC-DSGE models in which a consumer's utility level not only depends on her consumption level but also how that level compares to a standard set either by her own past consumption levels (internal habit-formation) or the levels of those in her peerage (catching-up with the Joneses' or external habit) are now ubiquitous in the literature.

At the same time to achieve co-movement of output, hours, consumption and investment modellers turn to preferences proposed by Jaimovich and Rebello (2008) (henceforth JR) that control short-run wealth effects. This note discusses this form of this utility function, $U(C, L)$, where C is consumption modified by habit and $L = 1 - H$ is leisure, as the proportion of the day, H being hours. The objective is to choose a form (a) compatible with long-run balanced growth, (b) that hits a steady state observed target for H and (c) is consistent with micro-econometric evidence for the inter-temporal elasticity of substitution and the Frisch inverse elasticity of labor supply.

2 The Household Problem

We write the JR utility function as:

$$U_t = U(C_t, H_t, X_{t-1}) = \frac{(C_t - \varrho H_t^{1+\psi} C_t^\gamma X_{t-1}^{1-\gamma})^{1-\sigma}}{1-\sigma}; \quad (1)$$

$$X_t = C_t^\gamma X_{t-1}^{1-\gamma}; \quad \gamma \in [0, 1], \psi > 0. \quad (2)$$

We suppose that the household's problem at time t is to choose paths for consumption (C_t), labor supply ($H_t = 1 - L_t$, where L_t is leisure), capital (K_t), investment (I_t) and bond holdings (B_t) to maximize:

$$V_t = V_t(B_{t-1}, K_{t-1}, X_{t-1}) = \mathbb{E}_t \left[\sum_{s=0}^{\infty} \beta^s U(C_{t+s}, H_{t+s}, X_{t+s-1}) \right],$$

subject to the budget constraint:

$$B_t = R_{t-1}B_{t-1} + r_t^K K_{t-1} + W_t H_t - C_t - I_t - T_t,$$

and the law of motion for capital:

$$K_t = (1 - \delta)K_{t-1} + \left(1 - S\left(\frac{I_t}{I_{t-1}}\right)\right) I_t,$$

where felicity U is given by the JR preferences in (1) and (2), r_t^K is the rental rate of capital, W_t is the wage rate, R_t is the gross interest rate and T_t are lump-sum taxes. All variables are real throughout. We further assume that the investment adjustment costs $S\left(\frac{I_t}{I_{t-1}}\right)$ satisfy $S', S'' \geq 0$; $S(1) = S'(1) = 0$.

2.1 Solution of the Household Problem

To solve the household problem we form a Lagrangian:

$$\begin{aligned} \mathcal{L} = \mathbb{E}_t & \left[\sum_{s=0}^{\infty} \beta^s \left(U(C_{t+s}, H_{t+s}, X_{t+s-1}) \right. \right. \\ & + \lambda_{t+s} [R_{t+s-1}B_{t+s-1} + W_{t+s}H_{t+s} + r_{t+s}^K K_{t+s-1} \\ & - C_{t+s} - I_{t+s} - T_{t+s} - B_{t+s}] \\ & + \lambda_{t+s} Q_{t+s} [(1 - \delta)K_{t+s-1} + (1 - S(I_{t+s}/I_{t+s-1})) I_{t+s} - K_{t+s}] \\ & \left. \left. + \mu_{t+s} [X_{t+s} - C_{t+s}^\gamma X_{t+s-1}^{1-\gamma}] \right) \right]. \end{aligned}$$

Defining the stochastic discount factor as $\Lambda_{t,t+1} \equiv \beta \frac{\lambda_{t+1}}{\lambda_t}$ the first order conditions are:

$$\text{Euler Consumption : } 1 = R_t \mathbb{E}_t [\Lambda_{t,t+1}], \quad (3)$$

$$\text{Labor Supply : } -U_{H,t} = \lambda_t W_t, \quad (4)$$

$$\begin{aligned} \text{Investment FOC : } 1 = & Q_t (1 - S(I_t/I_{t-1}) - (I_t/I_{t-1})S'(I_t/I_{t-1})) \\ & + \mathbb{E}_t [\Lambda_{t,t+1} Q_{t+1} S'(I_{t+1}/I_t) (I_{t+1}/I_t)^2], \end{aligned}$$

$$\text{Capital Supply : } 1 = \mathbb{E}_t [\Lambda_{t,t+1} R_{t+1}^K],$$

where $\lambda_t = U_{C,t} - \gamma \mu_t C_t^{\gamma-1} X_{t-1}^{1-\gamma}$, $\mu_t = \beta \mathbb{E}_t [(1 - \gamma) \frac{X_{t+1}}{X_t} \mu_{t+1} - U_{X,t+1}]$, and R_t^K , the gross return on capital, is given by $R_t^K = \frac{[r_t^K + (1 - \delta)Q_t]}{Q_{t-1}}$.

The zero-growth steady-state of the above first-order conditions is:

$$\begin{aligned} R &= R^K = \frac{1}{\beta}; \quad X = C; \quad \Lambda = \beta \\ \lambda &= U_C - \gamma\mu; \quad \mu = -\frac{\beta}{1 - \beta(1 - \gamma)}U_X; \quad Q = 1 \\ W &= -\frac{U_H}{\lambda}; \quad r^K = \frac{1}{\beta} - 1 + \delta. \end{aligned}$$

2.2 Deriving Labour Supply Parameter Bounds

If we define $\kappa_t \equiv (C_t - \varrho H_t^{1+\psi} C_t^\gamma X_{t-1}^{1-\gamma})^{-\sigma}$, we have $U_{C,t} = (1 - \gamma\varrho H_t^{1+\psi} C_t^{\gamma-1} X_{t-1}^{1-\gamma})\kappa_t$, $U_{H,t} = -\varrho(1 + \psi)H_t^\psi C_t^\gamma X_{t-1}^{1-\gamma}\kappa_t$ and $U_{X,t} = -(1 - \gamma)\varrho H_t^{1+\psi} C_t^\gamma X_{t-1}^{-\gamma}\kappa_t$. The steady state then becomes:

$$\begin{aligned} \mu &= \frac{\beta(1 - \gamma)}{1 - \beta(1 - \gamma)}\varrho H^{1+\psi}\kappa, \\ \lambda &= \left(1 - \frac{\gamma\varrho H^{1+\psi}}{1 - \beta(1 - \gamma)}\right)\kappa, \\ W &= \frac{\varrho(1 + \psi)H^\psi C}{1 - \frac{\gamma\varrho H^{1+\psi}}{1 - \beta(1 - \gamma)}}. \end{aligned}$$

With these preferences and the steady-state capital share $\alpha = 1 - \frac{WH}{Y}$ we arrive at

$$\varrho H^{1+\psi} = \frac{(1 - \alpha)}{(1 + \psi)c_y + \frac{\gamma}{1 - \beta(1 - \gamma)}(1 - \alpha)}, \quad (5)$$

where $c_y \equiv \frac{C}{Y}$. For a given c_y and H (determined in a general equilibrium with a supply side), this pins down ϱ given the remaining parameters.

3 The Frisch Elasticity of Labor Supply

We now derive a steady-state Frisch inverse elasticity. Log-linearizing around the steady-state, we have:

$$\begin{aligned} \hat{u}_{H,t} &\equiv \log \frac{U_{H,t}}{U_H} = \frac{U_{HC}C}{U_H}\hat{c}_t + \frac{U_{HH}H}{U_H}\hat{h}_t + \frac{U_{HX}X}{U_H}\hat{x}_{t-1} \\ \hat{\lambda}_t &\equiv \log \frac{\lambda_t}{\lambda} = \frac{\lambda_C C}{\lambda}\hat{c}_t + \frac{\lambda_H H}{\lambda}\hat{h}_t + \frac{\lambda_\mu \mu}{\lambda}\hat{\mu}_t + \frac{\lambda_X X}{\lambda}\hat{x}_{t-1} \\ \hat{w}_t &= -\hat{u}_{H,t} - \hat{\lambda}_t. \end{aligned}$$

Hence in the region of the steady state, by eliminating $\hat{c}_t$ we have:

$$\hat{w}_t = \delta_F \hat{h}_t + \text{terms in } \hat{\lambda}_t + \text{terms in } \hat{\mu}_t + \text{terms in } \hat{x}_{t-1},$$

where δ_F is a constant Lagrange multiplier (shadow prices of wealth and habit stock) inverse elasticity of labor supply, given by:

$$\delta_F = \frac{U_{HC}H}{U_H} \left(-\frac{\lambda_H}{\lambda_C} + \frac{U_{HH}}{U_{HC}} \right), \quad (6)$$

where:

$$\frac{\lambda_H}{\lambda_C} = \frac{U_{CH}}{U_{CC} + \gamma(1-\gamma)\mu C^{\gamma-2}X^{1-\gamma}} = \frac{U_{CH}}{U_{CC} + \gamma(1-\gamma)\mu C^{-1}}. \quad (7)$$

δ_F is a generalization of the constant marginal utility of consumption Frisch elasticity proposed by Bilbiie (2011) for KPR preferences. The derivatives (derived below in Section 3.5) now functions of γ . Evaluating these at the steady state we arrive at the steady-state Frisch elasticity:

$$\begin{aligned} \delta_F = \delta_F(\psi, \gamma) = & \left(-\gamma + \sigma \frac{A(\psi, \gamma)}{A(\psi, 1)} \right) \left(\frac{\sigma(1+\psi)B(\psi) + \psi A(\psi, 1)}{\sigma A(\psi, \gamma) - \gamma A(\psi, 1)} \right. \\ & \left. - \frac{(1+\psi)B(\psi)(\sigma A(\psi, \gamma) - \gamma A(\psi, 1))}{\sigma A(\psi, \gamma)^2 - \gamma(1-\gamma)B(\psi)A(\psi, 1)(1+1/(1-\beta(1-\gamma)))} \right) \end{aligned} \quad (8)$$

where we emphasize the dependency on the reference parameters ψ, γ and we have defined $A(\psi, \gamma) \equiv (1 - \gamma \varrho H^{1+\psi})$ and $B(\psi) \equiv \varrho H^{1+\psi}$. Note that wealth effects parameterized by γ enter directly through (8) and indirectly through its impact on steady-state hours $H = H(\gamma)$ as in (5). Two special cases are worth noting:

$$\text{KPR } (\gamma = 1) : \delta_F(\psi, 1) = \psi + \frac{(1+\psi)\varrho H^{1+\psi}(2\sigma - 1)}{\sigma(1 - \varrho H^{1+\psi})},$$

$$\text{GHH } (\gamma = 0) : \delta_F(\psi, 0) = \psi,$$

where KPR preferences are those proposed by King *et al.* (1988), and GHH preferences are those proposed by Greenwood *et al.* (1988). Note that although $\delta(\psi, 1) > \delta(\psi, 0)$ for $\sigma > \frac{1}{2}$, $\delta(\psi, \gamma)$ is not monotonically decreasing owing to the term $\gamma(1-\gamma)$ in (8) which peaks at $\gamma = \frac{1}{2}$.

3.1 The Lower Bound on the Steady State Frisch Elasticity

A necessary condition for the utility to be well-defined and an equilibrium to exist is that $\varrho H^{1+\psi} < 1$. This places the following lower bound on ψ

$$\psi > \underline{\psi} \equiv \frac{(1-\alpha)(1-\beta)(1-\gamma)}{c_y(1-\beta(1-\gamma))} - 1 \quad (9)$$

For $\gamma = 0$ this becomes $\psi > \frac{1-\alpha}{c_y} - 1$ whereas for $\gamma = 1$ (KPR preferences) we have $\psi > -1$ and the constraint disappears. Since we restrict ourselves to $\psi > 0$ this implies a threshold for γ , γ^* say, below which the bound is relevant. This is given by:

$$\gamma^* = \frac{(1-\beta)(1-\alpha-c_y)}{(1-\alpha)(1-\beta) + \beta c_y} \quad (10)$$

For our calibration below we find that $\gamma^* = 0.0017$. The bound therefore only matters for values of γ very close to the GHH case.

Theorem 1

In the GHH case, $\delta_F(\psi, 0)$ is bounded below at a value $\psi = \underline{\psi}$ given by (9).

A sting in the tail arises if we introduce *external habit* with C_t in the utility function replaced by $C_t - \chi C_{t-1}$. Then c_y is replaced with $c_y(1-\chi)$ pushing the constraint on ψ into an implausible range. This we now show can be mitigated by making habit *internal rather than external*.

3.2 External versus Internal Habit

With external habit in consumption, household j has a single-period utility

$$U_t^j = \frac{(C_t^j - \chi C_{t-1}^j - \varrho(H_t^j)^{1+\psi} X_t^j)^{1-\sigma}}{1-\sigma}; \quad \chi \in [0, 1)$$

$$X_t^j = (C_t^j - \chi C_{t-1}^j)^\gamma (X_{t-1}^j)^{1-\gamma}; \quad \gamma \in [0, 1]$$

where C_{t-1} is aggregate per capita consumption whereas with internal habit we have

$$U_t^j = \frac{(C_t^j - \chi C_{t-1}^j - \varrho(H_t^j)^{1+\psi} X_t^j)^{1-\sigma}}{1-\sigma}; \quad \chi \in [0, 1)$$

$$X_t^j = (C_t^j - \chi C_{t-1}^j)^\gamma (X_{t-1}^j)^{1-\gamma}; \quad \gamma \in [0, 1]$$

Now defining $\kappa_t \equiv (C_t - \chi C_{t-1} - \varrho H_t^{1+\psi} (C_t - \chi C_{t-1})^\gamma X_{t-1}^{1-\gamma})^{-\sigma}$, in a symmetric equilibrium the household first-order conditions are as before with marginal utility

$$U_{C,t} = \left(1 - \gamma \varrho H_t^{1+\psi} (C_t - \chi C_{t-1})^{\gamma-1} X_{t-1}^{1-\gamma}\right) \kappa_t$$

and for external habit and internal habit respectively we have

$$\begin{aligned} \lambda_t &= U_{C,t} - \frac{\gamma \mu_t X_t}{(C_t - \chi C_{t-1})} \\ \lambda_t &= U_{C,t} - \beta \chi \mathbb{E}_t[U_{C,t+1}] \\ &\quad - \gamma \left(\frac{\mu_t X_t}{(C_t - \chi C_{t-1})} - \beta \chi \mathbb{E}_t \left[\frac{\mu_{t+1} X_{t+1}}{(C_{t+1} - \chi C_t)} \right] \right) \end{aligned}$$

The zero-growth steady state then becomes $U_C = (C(1 - \chi) - \varrho H^{1+\psi} X)^{-\sigma}$, $\lambda = U_C - \frac{\gamma \mu X}{(C(1-\chi))}$ for external habit and $\lambda = U_C(1 - \beta \chi) - \frac{\gamma(1-\beta \chi) \mu X}{(C(1-\chi))}$ for internal habit. These results lead to:

Theorem 2

The results of Theorem 1 apply to habit in consumption with c_y replaced with $c_y(1 - \chi)$ for external habit and $c_y \frac{1-\chi}{1-\beta \chi}$ for internal habit

3.3 Empirical Estimates of the Frisch Elasticity

Microeconomic and macroeconomic estimates of the Frisch elasticity differ significantly, the former typically ranging from 0 to 0.5 and the latter from 2 to 4 (Peterman, 2016). Estimations of the elasticity of labor supply found using microeconomic data depend on factors such as gender, age, marital status and dependants. Keane (2011) offers a survey of labor supply, restricting the sample to men, finding a range of between 0 to 0.7 with an average of 0.31. Reichling and Whalen (2017) give a thorough review of the estimates found in the literature based on microeconomic data, finding that estimates typically range from 0 to over 1. The higher estimates corresponding to married women with children, whereas the labor supply of men is far lower. Combining the results, Reichling and Whalen (2017) propose a range of between 0.27 and 0.53, with a central point estimate of 0.4. This corresponds to a Frisch coefficient, δ , between 1.89 and 3.7, with a point estimate of 2.5.

(a) No Habit

(b) External Habit

Figure 1: The lower bound on ψ with $\gamma = 0.001$.

3.4 Numeral Illustration

Table 1 illustrates the analysis so far. Parameter values are $\alpha = 0.3$, $c_y = 0.6$, $\beta = .99$, $\sigma = 2.0$, $\chi = 0.75$ and stated values for γ .¹ We can now assess the empirical plausibility of JR preferences with habit in consumption. From our discussion in 3.3 we wish to calibrate ψ to hit an inverse elasticity $\delta_F \in [1.89, 3.70]$ with a central value 2.50. From

¹In fact $\gamma > 0$ is required for balanced growth, but γ can be very small.

γ	No Habit	External Habit	Internal Habit	External Habit and Labor Wedge
1	1.750 ($\psi = 0$)	7.000 ($\psi = 0$)	1.803 ($\psi = 0$)	4.900 ($\psi = 0$)
0.75	1.079 ($\psi = 0$)	2.307 ($\psi = 0$)	1.103 ($\psi = 0$)	2.008 ($\psi = 0$)
0.5	0.580 ($\psi = 0$)	0.911 ($\psi = 0$)	0.589 ($\psi = 0$)	0.853 ($\psi = 0$)
0.25	0.239 ($\psi = 0$)	0.320 ($\psi = 0$)	0.241 ($\psi = 0$)	0.309 ($\psi = 0$)
0	0.167 ($\psi = \underline{\psi}$)	3.667 ($\psi = \underline{\psi}$)	0.202 ($\psi = \underline{\psi}$)	2.267 ($\psi = \underline{\psi}$)

Table 1: Lower Bound $\delta_F(\underline{\psi})$ with Habit and Constraints on JR Preferences

our numerical results for the lower bound $\delta_F(\underline{\psi})$, this rules out external habit for the KPR and GHH extremes.²

However we can resolve the problem by introducing a labor wedge into the household problem. Then (13) becomes $\frac{U_{H,t}}{\lambda_t} = -W_t(1 - \tau)$ where $\tau \in [0.27, 0.37]$ is the wedge (as in Shimer (2009) and $1 - \alpha$ in (10) is replaced with $(1 - \alpha)(1 - \tau)$).

3.5 Wealth Effects and the Dynamic Frisch Elasticity

Up to now we have constructed a Frisch inverse elasticity of labor supply in the steady state. However the wealth effect and therefore the Frisch elasticity are in fact time varying in the type of models we are considering.

This subsection constructs a dynamic Frisch elasticity by decomposing the substitution and wealth effects in a standard RBC model with JR household preferences. We adopt a full general equilibrium analysis (as opposed to the partial equilibrium illustration in Jaimovich and Rebello (2008)). The supply side of the model is a that of a standard

²Values for the lower bound of the Frisch inverse elasticities outside or very close to the boundary of empirical estimates are highlighted in bold, see also Figure 1.

RBC model.

$$\text{Output : } Y_t = F(A_t, H_t, K_{t-1}) \quad (11)$$

$$\text{Labour Demand : } F_{H,t} = W_t \quad (12)$$

$$\text{Capital Demand : } F_{K,t} = r_t^K$$

$$\text{Equilibrium : } Y_t = C_t + G_t + I_t$$

where (11) is a production function which in the simulations we assume to be Cobb-Douglas with capital share $\alpha = 0.3$. A_t and G_t and exogenous technology and demand processes.

To compute the substitution effect without wealth effects consider notional hours supplied by households, H_t^s , as given by the system

$$\begin{aligned} \frac{U_{H,t}}{\lambda} &= -W_t \\ \lambda_t &= U_{C,t} - \gamma \mu_t \frac{X_t}{C_t} \\ \mu_t &= -U_{X,t} + \beta(1 - \gamma) \mathbb{E}_t \frac{\mu_{t+1} X_{t+1}}{X_t} \\ X_t &= C_t^\gamma X_{t-1}^{1-\gamma} \end{aligned} \quad (13)$$

where $U_{H,t} = U_{H,t}(C_t, H_t^s, X_{t-1})$ and $U_{C,t} = U_{C,t}(C_t, H_t^s, X_{t-1})$. Actual hours (with wealth plus substitution effects) and the supply side of the model then that of a standard RBC model.

We now construct a dynamic Frisch inverse elasticity in a similar fashion to how the static one was constructed. However, rather than log-linearizing around the steady-state, we now log-linearize around the current value, giving:

$$\begin{aligned} \hat{u}_{H,t}^* &\equiv \log \frac{U_{H,t}}{U_{H,t}} = \frac{U_{HC,t} C_t}{U_{H,t}} \hat{c}_t^* + \frac{U_{HH,t} H_t}{U_{H,t}} \hat{h}_t^* + \frac{U_{HX,t} X_t}{U_{H,t}} \hat{x}_{t-1}^* \\ \hat{\lambda}_t^* &\equiv \log \frac{\lambda_t}{\lambda_t} = \frac{\lambda_{C,t} C_t}{\lambda_t} \hat{c}_t^* + \frac{\lambda_{H,t} H_t}{\lambda_t} \hat{h}_t^* + \frac{\lambda_{\mu,t} \mu_t}{\lambda_t} \hat{\mu}_t^* + \frac{\lambda_{X,t} X_t}{\lambda_t} \hat{x}_{t-1}^* \\ \hat{w}_t^* &= -\hat{u}_{H,t}^* - \hat{\lambda}_t^*, \end{aligned}$$

where partial derivatives are now indexed by time to indicate they are evaluated at the current values. By construction, all of the variables with *s must always equal zero, however this remains a helpful representation for what-if analysis. Proceeding as before

(a) Partial Equilibrium, Real Wage Shock

(b) General Equilibrium, Technology Shock

Figure 2: Substitution and Wealth Effects; Dynamic Frisch Elasticity. The blue solid line is with $\gamma = 1$; the red dashed line with $\gamma = 0.1$; and the green dotted line with $\gamma = 0.001$.

by eliminating $\hat{c}_t^*$ we have:

$$\hat{w}_t^* = \delta_{F,t} \hat{h}_t^*,$$

where we have removed the extra unneeded zero terms, and where $\delta_{F,t}$ is our dynamic Frisch inverse elasticity of labor supply, given by:

$$\delta_{F,t} = \frac{U_{HC,t} H_t}{U_{H,t}} \left(-\frac{\lambda_{H,t}}{\lambda_{C,t}} + \frac{U_{HH,t}}{U_{HC,t}} \right), \quad (14)$$

where:

$$\frac{\lambda_{H,t}}{\lambda_{C,t}} = \frac{U_{CH,t}}{U_{CC,t} + \gamma(1-\gamma)\mu_t C_t^{\gamma-2} X_{t-1}^{1-\gamma}}. \quad (15)$$

Figure 2 (a) first carries out a partial equilibrium exercise similar to Jaimovich and Rebello (2008) (with the same qualitative results) to show the decomposition of hours supplied into substitution and wealth effects following a permanent exogenous wage shock. Then (12) is replaced with this exogenous process. We see from the impulse response function of the Figure that the Frisch inverse elasticity becomes time-varying as we move away from the GHH case where it remains constant at its steady-state value.

Then we proceed in (b) to the general equilibrium case with a exogenous technology AR(1) process for A_t with persistence parameter 0.78 and standard deviation 0.67% (see Dejong and Dave (2007), page 137). G_t is held fixed at its steady state. The impulse responses for different values of γ have been scaled so that the first period impacts coincide. The dynamic Frisch inverse elasticity is then pro-cyclical for the KPR case, but becomes counter-cyclical as we close down wealth effects by moving towards the GHH case. This is confirmed by second moments computed from second-order perturbation solutions in Table 2 where throughout this subsection we have calibrated the preference parameter at ψ to hit a steady state Frisch elasticity of $\delta_F = 2.0$ for the KPR case. But this calibration however comes at the expense of a implausibly low standard deviation of output. For $\gamma = 0.001$ this feature is mended but then the Frisch elasticity is in the low range only suggested by micro-econometric studies.

4 Conclusions

This note has reviewed a utility function commonly used in RBC-DSGE models due to Jaimovich and Rebello (2008) that is non-separable in habit-adjusted consumption and

γ	δ_F	sd (Y_t) (%)	sd ($\delta_{F,t}$)/sd (Y_t)	corr ($\delta_{F,t}, Y_t$)
1	2.0	0.82	0.29	0.22
0.5	0.67	0.78	0.33	-0.68
0.25	0.27	0.75	0.97	-0.80
0.1	0.03	0.87	8.22	-0.63
0.001	0.17	2.05	1.04	-0.48

Table 2: Business Cycle Properties of the Dynamic Frisch Inverse Elasticity

leisure, compatible with balanced growth and eliminates counterfactual wealth effects. Our main contributions are first, Theorems 1 and 2 that highlight a constraint on the preference parameter ψ needed to target the steady-state Frisch inverse elasticity. This leads to a lower bound for the latter that cannot be reconciled empirically with external habit at the KPR and GHH extremes. However the introduction of a labor wedge solves the problem for modest departures from the KPR case. Second, a proposed concept of a dynamic Frisch inverse elasticity. A numerical solution of a standard RBC model driven by a technology AR(1) shock process suggests this elasticity is pro-cyclical for the KPR case ($\gamma = 1$), but counter-cyclical as we move away from this extreme.

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