

Marriage, Markets and Money: A Coasian Theory of Household Formation*

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Abstract

This paper integrates search-based models of marriage and money. We think about households as organizations, the way Coase thinks about firms, as alternatives to markets that become more attractive when transactions costs increase. In the model, individuals consume market- and home-produced goods, and home production is facilitated by marriage. Market frictions, including taxes, search and bargaining problems, can increase the propensity to marry. The inflation tax, in particular, encourages marriage when being single is cash intensive. Micro data confirm that singles use cash more than married people. We then use macro data, over many countries and years, to see how marriage responds to inflation, taxation and other variables.

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1 Introduction

This is an essay on search-theoretic models of partnership formation – e.g., marriage, although the ideas also apply to cohabitation, living with one’s parents, taking on roommates, etc. A contribution over existing search-based analyses of partnership formation is that we embed this process into a general equilibrium model that incorporates goods markets with explicit frictions. The result is a framework that, despite having many ingredients, is very tractable. In particular, it delivers sharp analytic predictions concerning how partnership formation depends on frictions in the marketplace. We take these predictions to the data.

For us, a household is an institution for organizing economic and other activity. To understand this it helps to recall how economists contemplate other institutions, like firms. In a genuinely classic paper, Coase (1937) asks why the economy has some activity organized within firms, as opposed to exclusively self-employed individuals who contract with one another as needs arise. Production could in principle be carried on without organizations like firms, he says, with all activity orchestrated by the market. Why do entrepreneurs hire people into production teams? When does this dominate contracting out individual tasks? If markets are efficient, it should not be preferable to hire people into a firm, rather than purchase goods and services when they are necessary.

Coase argues, however, that there are transactions costs in markets, related to the frictions embodied in modern search-and-bargaining theory:

The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism. The most obvious cost of ‘organizing’ production through the price mechanism is that of discovering what the relevant prices are. ... The costs of negotiating and concluding a separate contract for each exchange transaction which takes place on a market must also be taken into account.

In addition, he emphasizes the effects of various policy interventions:

Another factor that should be noted is that exchange transactions on a market and the same transactions organized within a firm are often treated differently by Governments or other bodies with regulatory powers. If we consider the operation of a sales tax, it is clear that it is a tax on market transactions and not on the same transactions organised within the firm. Now since these are alternative methods of ‘organisation’ – by the price mechanism or by the entrepreneur – such a regulation would bring into existence firms which otherwise would have no *raison d’être*. ... Similarly, quota schemes, and methods of price control which imply that there is rationing, and which do not apply to firms producing such services for themselves ... encourage the growth of firms.

Thus, firms help avoid costs and inconveniences associated with markets. There are limits to what can be produced internally, perhaps, due to decreasing returns, so markets still have a role – but firms’ very existence indicates that markets are not frictionless, and that these institutions ameliorate search, bargaining, taxation and other imperfections in markets. For instance, an entrepreneur may sometimes need legal, accounting or secretarial services, all of which are available on the market – one can try to find independent contractors to perform such duties, but that involves transactions costs. When these costs are high, it is worthwhile to bring some of this activity *in house*, by setting up a legal team, accounting department or secretarial pool. This is the genesis of a firm.¹

Coase (1992) suggests his approach might help us understand other organizations. Here we study households, with families as a leading example. Now, a narrow reading of Coase might suggest the theory does not apply to families, because he said it was important for a firm to have an “employee and employer” relationship resembling a “slave and master” relationship: workers are not independent contractors, but subject to direction and control by firms. Still, we think households can

¹Coase considered other candidates for a theory of firms, including specialization, risk allocation, and the idea that entrepreneurs have better knowledge or judgement, but dismissed these since in principle they can be handled by markets: “What has to be explained is why one integrating force (the entrepreneur) should be substituted for another integrating force (the price mechanism).” Alchian and Demsetz (1972) subsequently argued team production is more efficient than individuals working at arm’s length through markets, but success depends on managing opportunistic behavior, which is more effective if the monitor is residual claimant. Monitoring is not incorporated here, but that might be an interesting extension.

be profitably analyzed using Coasian logic, even if they better resemble happy families or partnerships than “slave-master” relationships. As with legal, accounting or secretarial services for entrepreneurs, many goods and services individuals demand can be provided by the market or within the household, including cooking, cleaning, child care and even companionship. If the costs of using markets are high, then individuals, like entrepreneurs, are inclined to bring more activity *in house*, especially when market and home commodities are good substitutes, and when home production is enhanced by forming a household that operates as a team.

We are not proposing that a transitory blip in sales taxes will trigger a stampede to the altar, but it seems plausible that when people find themselves in a longer-term situation where the cost of using markets is high, they are more inclined to set up households and engage to a greater extent in home rather than market activity. This is not to deny the importance of love, but economic considerations are obviously also relevant – as Becker (1988) put it, “For centuries marriages, births, and other family behavior have been known to respond to fluctuations in aggregate output and prices.” When finding an acceptable partner takes time and other resources, as is standard in search theory, rational individuals use *reservation strategies*, stopping when the benefits of forming a partnership outweigh those of continued search. The goal is to characterize rigorously how these strategies depend on parameters related to market frictions. This requires a formal model with many elements, but each component in the setup presented below is incorporated for a reason.

First, for a theory about substitution between households and markets, it is important to use a general equilibrium framework where agents engage in more than just looking for partners. Second, our goods markets must have tax, search and bargaining frictions to accommodate the Coasian logic. Third, it is useful to have endogenous labor supply because that actually simplifies the analysis a lot. Fourth, although this is not needed in the baseline model, we develop a monetary version for the following reason: While many frictions influence partnership formation, taxation

is one for which data is more readily available. We have some data on sales and income taxes, but for the inflation tax there is far more information. To use this, we integrate the theory of marriage with a now-standard search-based model of monetary exchange. In this setting, money makes markets function better, but this is hindered by inflation.

There is evidence that items provided either in the home or by the market – e.g., food – are more likely purchased on the market by singles (Simon et al 2010; Wong 2012). While these goods are not always purchased with cash, they are purchased that way more than home goods, which are not even traded, let alone traded for money (with exceptions like paying kids for chores). Intuitively, singles go out more – e.g., on a date – which uses money more than activities like family dinners. This suggests being single is cash intensive (with exceptions like paying the nanny). We investigate this systematically, using several sources of micro data, and find they are very much consistent with this suggestion. Thus inflation, which is a tax on money balances, whether in your wallet or a low-interest checking account, makes the market less and marriage more attractive. We examine a panel of countries with considerable variability in tax and inflation rates, to see how marriage is affected by these and other macro variables. There is support for the hypothesis that taxation increases marriage rates, and fairly strong support that inflation does.²

We are not the first to notice a similarity between households and firms. Becker (1973) says “marriage can be considered a two-person firm with either member being the ‘entrepreneur’ who ‘hires’ the other,” and search theorists often use their equations almost interchangeably to discuss marriage or employment (Burdett and Coles 1997,1999). But it is novel to apply Coasian logic to household formation in general equilibrium, even if similar ideas appear elsewhere, usually in a less formal

²The inflation effect emerges in the model interpreted narrowly because it taxes money holdings, which are *ceteris paribus* higher for singles. More broadly, inflation can stand in for (is associated with) a variety of problems, including corruption, transportation costs, a poor legal system etc., that encourage substitution out of market and into household activity.

guise.³ The paper is also related to literatures on home production (Greenwood et al. 1995; Gronau 1997), quantitative macro models of marriage (Fernandez et al. 2005; Knowles 2007) and estimated micro models (Wong 2003; Jacquemet and Robin 2011). Also related is work on the effect of tax codes on marriage (Alm and Whittington 1999; Chade and Ventura 2002; Bick and Fuchs-Schundeln 2012; Guner et al. 2012). Other related research surveyed by Rupert (2008), Siow (2008) and Chiappori and Donni (2009). Without denying the importance of alternative factors, we want to put a Coasian position up for consideration.

As always of course there are limitations. First, the channel emphasized here concerns *the medium run* – it is not about business cycles, as decisions about living arrangements presumably focus less on high-frequency factors, nor the very long run, where demographic and social change may play a bigger role.⁴ Also, we only consider match-specific, not ex ante, heterogeneity, which precludes discussion of topics like assortative mating. While both appear in the literature, and either would work, we opt for match-specific heterogeneity mainly because is easier. Also, although we go into micro detail on some dimensions, the approach is closer to macro search (e.g., Mortensen and Pissarides 1994; Lagos and Wright 2005) or real business cycle theory (e.g., the Cooley 1995 volume), and so our specification for utility is closer to those models than structural econometric models. Indeed, our empirical strategy is firmly

³See, e.g., Ben-Porath (1980), Pollack (1985), Treas (1993) or Raz-Yurovich (2012). In gender studies, in particular, Jacobsen (2007) says: “household production activities are time-consuming to contract for separately. In order to duplicate the activities of one household member performing nonmarket activities, it may be necessary to hire a maid, cook, butler, plumber...” Moreover, “The ability to specialize and thereby increase per capita output available to household members is the factor most cited by economists in considering the economic rationale for household formation.” However, “it is not obvious...it is necessary for persons to live together in order to reap the benefits from specialization and trade. This model is also applied to trade between countries, but does not imply that countries should also merge.” We agree with these views, and want to pursue them, using more rigorous general equilibrium and search theory.

⁴This does not mean the approach cannot be used for higher- or lower-frequency issues. Salcedo et al. (2012), e.g., attribute secular declines in household size to income growth plus home (market) goods being inferior (superior). A Coasian view might instead stress reductions in transaction costs: it is easier to shop on line than in line. Relatedly, Greenwood and Guner (2008) suggest the price of durables has a strong effect on marriage trends, which can be integrated into our theory by making durables like home appliances part of the cost of setting up a household.

in the reduced-form camp, as a first step toward uncovering facts and organizing them through the lens of the theory. Finally, we focus on bilateral relationships, even if it would be feasible to extend this and study, say, decisions to have children, or to have them move out or back in. While children may well be the reason some people get married, we think the setup has enough, for now, without this.⁵

The rest of the paper is organized as follows. Sections 2 and 3 describe the environment and equilibrium. Sections 4 and 5 discuss baseline results and extensions. Section 6 presents the evidence. Section 7 concludes. To be clear, the objectives are: (1) to embed search-based marriage models in general equilibrium; (2) to derive analytic predictions that sharpen our intuition and make clear which assumptions drive which results; and (3) to see what the micro and macro data have to say.

2 The Model

The background environment builds on Lagos and Wright (2005). A key element in that setup involves alternating frictional and frictionless markets, where the former provide most of the action, while the latter keep the analysis tractable by making the asset distribution degenerate at the end of each period. Later there is an explicit role for money, and then this feature greatly simplifies the analysis. However, even in the benchmark version with perfect credit, and hence no role for money, it is useful as a way to simplify the distribution of debt, and more generally as a tractable way to integrate search and general equilibrium theory. We also find it natural, as it realistically has some economic activity taking place in relatively centralized situations, and some in more decentralized situations. Moreover, it is not hard to extend the framework to incorporate partnership formation.

⁵As a last remark on method, clearly similar effects of inflation can be derived in what some people call ‘simpler’ models, e.g., those with CIA constraints. We prefer monetary theory built explicitly on search and bargaining, as these are exactly the ingredients relevant for Coasian household formation. In any case, a frictionless goods market constitutes a special case, where arrival rates and bargaining power take on limiting values. Moreover, this part of our setup is now standard, as evidenced by the Handbook of Monetary Economics chapters by Wallace (2010) and Williamson and Wright (2010) or surveys by Nosal and Rocheteau (2011) and Lagos et al. (2014).

Time is discrete and continues forever. The set of individuals has measure 1, half men and half women, but except for labels they are treated symmetrically (it would certainly be interesting to consider asymmetry in future work). There are two types of firms, producers and retailers. We need a retail market since this is where individuals can find alternatives to home-produced goods and services. The measure of retail firms is n . The measure of producers is irrelevant, as they are perfectly competitive and serve only to determine wages. All agents discount across periods at rate $\beta \in (0, 1)$. In each period, agents interact in three distinct markets: (1) a frictionless centralized market in the spirit of Arrow-Debreu, where they trade assets, goods and labor, plus settle debts; (2) a retail market where they trade different goods, incorporating frictions in the spirit of Kiyotaki-Wright; and (3) a marriage market where individuals search for partners in the spirit of Burdett-Coles. We refer to these markets as AD, KW and BC.⁶

The value functions of individuals in each market are V_1 , V_2 and V_3 , with subscripts indicating the order in which they convene. In AD, assume for ease of exposition that a single numeraire good x is produced one-for-one using labor ℓ , so from the producers' problem the real wage is 1. Good x can be purchased by individuals for consumption, or by retailers for conversion into another good y sold in KW. Following Berentsen et al. (2011), the retail KW market is modeled as follows: if a retailer makes an investment in AD of k units of numeraire he can sell $y \leq k$ in KW, and convert unsold inventories $k - y$ back into $\rho(k - y)$ units of x in the next AD market. Hence, the opportunity cost of selling y is

$$c(y, k) = \rho(k) - \rho(k - y). \quad (1)$$

Single individuals participate in the BC market, where η is the probability of meeting a potential partner. Upon meeting, a pair mutually decide whether to form

⁶Use of these labels is a mnemonic device, not meant to slight other contributions. On frictional goods markets, see fn. 5. On marriage, see Becker (1991) and references therein; for marriage papers emphasizing search, in addition to work we mention elsewhere, see Mortensen (1988), Eeckhout (1999), Shimer and Smith (2000), Burdett et al. (2004), Atakan (2006) or Smith (2007).

a relationship. While the theory applies to any relationship, let's call it marriage, and assume match-specific heterogeneity: when a man and woman meet they draw a payoff pair (z, z') describing the utility each gets if they marry. We focus on the simplest case where $z = z'$ with probability 1, so they always agree on how much they like each other; this is not crucial, but it avoids an intrafamily bargaining problem that complicates the analysis without affecting the main results. Draws of z are i.i.d. from a CDF denoted $F(z)$. In equilibrium, there is a reservation value R such that relationships form when $z \geq R$. Here z reflects home production, including not only the drudgery (or the joy) of cooking and cleaning, but also the joy of sex and companionship (or the drudgery, as the case may be). Individuals can engage in some home production on their own, too, but can potentially do more with a partner. For now z is constant until the couple breaks up at exogenous rate δ . Marital status is indexed by $z \in [\underline{z}, \bar{z}] \cup \{s\}$, where $z = s$ means single, and otherwise z gives the quality of the relationship.⁷

In sum, there are four commodities: as in Lagos and Wright (2005), x and ℓ are traded in AD while y is traded in KW; and to this we introduce a nontraded BC good z . Within-period utility $\mathcal{U}(x, y, z) - \ell$ is quasi-linear to simplify the analysis, but there should be no presumption that the insights hinge on this. To concentrate on interactions between home and retail goods, let $\mathcal{U}(x, y, z) = U(x) + u(y, z)$, so y and z are substitutes (or complements) when $u_{yz} < 0$ (or $u_{yz} > 0$). Also, although x plays no big role, other than numeraire, it is included to stay close to the related literature, and because there is very little cost. Indeed, we can replace x in utility

⁷This captures the notion that household production is facilitated by household formation, and stands in for a detailed description of household activity involving the allocation of time, e.g.,

$$z = z(\xi) = \max_{h, h'} \{ \chi(h, h', \xi) - h - h' \},$$

where h and h' are the partners hours of home work, $\chi(\cdot)$ is the home production function, and ξ is specific to the match. The FOC's $\chi_1(h, h', \xi) = 1$ and $\chi_2(h, h', \xi) = 1$ define $h = h(\xi)$ and $h' = h'(\xi)$, and $z(\xi) = \chi[h(\xi), h'(\xi), \xi] - h(\xi) - h'(\xi)$. Randomness in ξ generates randomness in z . Here z is exogenous, to focus on when partnerships form in the first place. Future work can delve into this more deeply, but all we need in this exercise is that z varies across pairs, reflecting how much they like each other, how well they work together, etc.

by $\mathbf{x} \in \mathbb{R}^n$, and in the budgets described below by $\mathbf{p}\mathbf{x}$, where $\mathbf{p} \in \mathbb{R}^n$, as in standard general equilibrium theory, without changing the relevant results.

To determine whether household formation per se is a substitute for markets, we cannot just look at a cross derivative, since it involves a discrete change from $z = s$ to $z \in [\underline{z}, \bar{z}]$. While results for a general $u(y, s)$ are given in Appendix A, to reduce the algebra here consider as a benchmark

$$u(y, s) = \varepsilon_0 v(y) \text{ and } u(y, z) = \varepsilon_1 v(y) + z \quad \forall z \neq s, \quad (2)$$

with $v(0) = 0$, $v' > 0$ and $v'' < 0$. Thus, having a partner affects payoffs in two ways: it changes the utility of y when $\varepsilon_0 \neq \varepsilon_1$; and it gives a flow utility z over and above what one gets while single, which is normalized to 0, without loss of generality. Then $\varepsilon_0 > \varepsilon_1$ means that having a partner reduces $v'(y)$, and so markets and relationships per se are substitutes. This is a simple way to capture the idea, but again, the general case is covered in Appendix A.

3 Equilibrium

The plan is to analyze the AD, KW and BC markets in turn, then define equilibrium. For individuals in AD, the state variables are marital status z and debt d brought in from the previous period. Given the real wage is 1, the AD value function satisfies

$$V_1(d, z) = \max_{x, \ell} \{U(x) - \ell + V_2(0, z)\} \text{ st } x = \ell(1 - \tau_\ell) - d + \Delta,$$

where τ_ℓ is a labor income tax, and Δ is other income from transfers, dividends etc. This imposes that individuals pay off all debt in the AD market, which is a big simplification, and is without loss in generality, given quasi-linear utility. Using the budget equation to eliminate ℓ , we get

$$V_1(d, z) = \max_x \left\{ U(x) - \frac{x + d - \Delta}{1 - \tau_\ell} + V_2(0, z) \right\}. \quad (3)$$

This implies $\partial V_1 / \partial d = -1 / (1 - \tau_\ell)$ is independent of (d, z) , another useful result due to quasi-linear utility.

Producers in AD are trivial. Retailers in AD solve $\max_k \{-k + \beta \Pi(k)\}$, where k is investment in numeraire and $\Pi(k)$ is expected revenue. Note that $\Pi(k)$ is discounted at β because revenues accruing in KW it can only be used in next period's AD market (by individuals owning the firm; this is part of Δ in their budget equations). The general retail problem is discussed in Appendix C, while here we focus on a special case where $\rho(k) = k/\beta$, so that (1) reduces to $c(y, k) = y/\beta$. This simplifies the analysis, without affecting the economic insights, basically by making retailers relatively passive, with a constant marginal cost.⁸

Let $A\alpha_0$ be the KW arrival rate of spending opportunities for singles and $A\alpha_1$ the arrival rate for married individuals, so A captures general matching efficiency while α_0 and α_1 are specific to marital status. Thus, $\alpha_0 > \alpha_1$ means marriage and markets are substitutes in terms of opportunities, just like $\varepsilon_0 > \varepsilon_1$ means they are substitutes in preferences – which is not critical, as the key results all apply if $\alpha_0 = \alpha_1$, but since that does not simplify the analysis much we use the general case. For retailers, the probability of meeting a single in KW is $\sigma A\alpha_0/n$, and the probability of meeting a married individual is $(1 - \sigma) A\alpha_1/n$, where σ is the equilibrium measure of singles, and again n is the measure of retailers. In KW meetings, for now, individuals in marital state z get y_z in exchange for debt commitment d_z (later they might pay with cash). Their value function solves

$$V_2(0, z) = z + A\alpha_z [\varepsilon_z v(y_z) + V_3(d_z, z)] + (1 - A\alpha_z) V_3(0, z). \quad (4)$$

Moving to the BC market, for singles

$$V_3(d, s) = \eta \int_R^{\bar{z}} \beta V_1(d, z) dF(z) + [1 - \eta + \eta F(R)] \beta V_1(d, s). \quad (5)$$

⁸More generally, retailers' problem has FOC $1 = \beta \Pi'(k)$. From the expression for $\Pi(k)$ in Appendix C and the bargaining solution discussed below, this becomes

$$1 = \beta \rho'(k) - \beta \frac{(1 - \theta) A}{n} [\sigma \alpha_0 c_k(y_0, k) + (1 - \sigma) \alpha_1 c_k(y_1, k)].$$

The first term on the RHS is a standard return on investment, while the second captures the expected cost reduction from bigger k , multiplied by $1 - \theta$, where θ is buyers' bargaining power.

Thus, with probability η singles meet and form a relationship if $z \geq R$, while with probability $1 - \eta + \eta F(R)$ they stay single. For those in relationships,

$$V_3(d, z) = \delta \beta V_1(d, s) + (1 - \delta) \beta V_1(d, z). \quad (6)$$

Thus, with probability δ they break up and the individuals enter next period single, while with probability $1 - \delta$ they stay together.

This completes the description of payoffs. For the KW terms of trade, consider for now generalized Nash bargaining.⁹ Suppose an individual with marital status z and a retailer meet. For the former the trading surplus is

$$S_z = S(z) = \varepsilon_z v(y) + V_3(d, z) - V_3(0, z) = \varepsilon_z v(y) - \frac{\beta d}{1 - \tau_\ell}, \quad (7)$$

where $\varepsilon_z = \varepsilon_1$ if $z \in [\underline{z}, \bar{z}]$ and $\varepsilon_z = \varepsilon_0$ if $z = s$; and for the latter it is

$$\Sigma_z = \Sigma(z) = \beta(1 - \tau_c)d - y,$$

given $c(y, k) = y/\beta$, where τ_c is a sales tax. Below we use either notation S_z or $S(z)$, and Σ_z or $\Sigma(z)$, depending on convenience. Nash bargaining solves

$$(y_z, d_z) = \arg \max_{(y, d)} S_z^\theta \Sigma_z^{1-\theta} \text{ st } y \leq k. \quad (8)$$

The FOC's for an interior solution to (8) are:

$$1 = (1 - \tau_c)(1 - \tau_\ell) \varepsilon_z v'(y_z) \quad (9)$$

$$(1 - \tau_c) \beta d_z = (1 - \theta)(1 - \tau_c)(1 - \tau_\ell) \varepsilon_z v(y_z) + \theta y \quad (10)$$

For singles, with $\varepsilon_z = \varepsilon_0$, denote the outcome by (y_0, d_0) . For married, with $\varepsilon_z = \varepsilon_1$, denote it by (y_1, d_1) . Notice we get efficiency, $\varepsilon_z v'(y_z) = 1$, iff $\tau_c = \tau_\ell = 0$. Also, for

⁹For this we let sellers know buyers' marital status, which as a referee pointed out may not be so natural. However, it is not critical, and can be avoided by setting bargaining power to $\theta = 1$ (or by using Walrasian pricing or directed search). But we want to check the effect of varying θ , and in general it is easier to make marital status common knowledge than entertain bargaining with private information. To be clear, the only results we lose by setting $\theta = 1$ and avoiding the issue entirely concern $\partial R / \partial \theta$. For the record, with $\theta < 1$ marital status affects bargaining only by its impact on the utility of y , and higher marginal utility increases both the amount purchased and the amount paid. Given (2), marriage per se affects the outcome, but the quality of marriage does not; for general utility, $\partial y_z / \partial z \geq 0$ iff $u_{yz} \geq 0$ (see Appendix A).

future reference, notice that (7) can be simplified to

$$S_z = \frac{\theta [(1 - \tau_c) (1 - \tau_\ell) \varepsilon_z v(y_z) - y_z]}{(1 - \tau_c) (1 - \tau_\ell)}. \quad (11)$$

It is now routine to show:

Lemma 1 *Given $\alpha_0 \geq \alpha_1$ and $\varepsilon_0 \geq \varepsilon_1$, with at least one inequality strict, we have $y_0 > y_1$, $d_0 > d_1$, $S_0 > S_1$ and $A\alpha_0 S_0 > A\alpha_1 S_1$.*

This Lemma pertains to the case where home and market are substitutes in preferences and opportunities; for complements, reverse all inequalities. The natural case involves substitutes, based not only on introspection, but on prior empirical work: using different methods and data, Rupert et al. (1995), McGrattan et al. (1997), Chang and Schorfheide (2003) and Aguiar and Hurst (2007) find substitution elasticities for home and market goods from 1.5 to 2.3. The assumptions $\alpha_0 > \alpha_1$ and $\varepsilon_0 > \varepsilon_1$ imply that singles get a higher expected KW surplus than married individuals because they trade more on the extensive and intensive margins.

We now come to the heart of the model: determining the reservation value R , which solves $V_1(d, R) = V_1(d, s)$, and is independent of d because V_1 is linear in d . From (3)-(4), $V_1(d, R) = V_1(d, s)$ reduces to

$$A\alpha_1 S(R) + V_3(0, R) + R = A\alpha_0 S(s) + V_3(0, s). \quad (12)$$

Before substituting in V_3 , integrate by parts and insert $\partial V_1 / \partial z$ to get

$$\begin{aligned} \int_R^{\bar{z}} V_1(0, z) dF(z) &= [1 - F(R)] V_1(0, R) + \int_R^{\bar{z}} \frac{\partial V_1(0, z)}{\partial z} [1 - F(z)] dz \\ &= [1 - F(R)] V_1(0, R) + \int_R^{\bar{z}} \frac{[1 - F(z)] dz}{\beta(r + \delta)}. \end{aligned}$$

Given this, (12) reduces to

$$R = A\alpha_0 S_0 - A\alpha_1 S_1 + \frac{\eta}{r + \delta} \int_R^{\bar{z}} [1 - F(z)] dz, \quad (13)$$

where S_0 and S_1 are defined by (11).

To interpret (13), consider the reservation wage equation from elementary job-search theory (e.g., Rogerson et al. 2005),

$$R = b_0 - b_1 + \frac{\eta}{r + \delta} \int_R^{\bar{w}} [1 - F(w)] dw, \quad (14)$$

where b_0 (b_1) is the value of leisure plus transfers if unemployed (employed). This equates the flow value of working at wage R to the cost, given by the difference $b_0 - b_1$, plus the opportunity cost as measured by the appropriately capitalized return to continued search for a better offer. Similarly, (13) equates the value of a reservation partner R to the difference between the values of entering retail markets without and with a partner, $A\alpha_0 S_0 - A\alpha_1 S_1$, plus a similar opportunity cost.

The probability a single marries, or the *hazard* rate, is $H = H(R) = \eta [1 - F(R)]$. The steady state measure of unmatched singles is

$$\sigma = \sigma(R) = \frac{\delta}{\delta + H(R)}. \quad (15)$$

The *marriage flow* is $\phi = \phi(R) = \sigma(R) H(R)$. Putting this together, we have:¹⁰

Definition 1 *A (steady state) equilibrium is a list (R, y_z, d_z, σ) such that: R solves (13); (y_z, d_z) solves (9)-(10) $\forall z$; and σ solves (15).*

4 Results

It is easy to check that the RHS of (13) is decreasing in R , so there is at most one solution. To ensure existence of an interior $R \in (\underline{z}, \bar{z})$, a sufficient condition is that the best (worst) possible partner is better (worse) than being single: $\bar{z} + A\alpha_1 S_1 > A\alpha_0 S_0 > \underline{z} + A\alpha_1 S_1$. Given this, one can easily show $\partial R / \partial \eta > 0$, $\partial R / \partial r < 0$ and $\partial R / \partial \delta < 0$. Thus, increasing the arrival rate, or decreasing the rate at which people discount relationships in terms of r or δ , makes them more picky about partners. One can also show how σ and ϕ change with r . It is ambiguous what happens to

¹⁰Implicit in this definition of equilibrium is the FOC for x and the market-clearing condition from the AD market, but we do not need these to analyze the other variables of interest.

σ and ϕ when δ or η increase, however, without side conditions like log-concavity (Burdett 1981). These all mimic textbook results in job-search theory.

More novel are the effects of the Coasian frictions, including parameters describing search (A, α_z) , bargaining θ , and taxation (τ_c, τ_ℓ) , as well as ε_z , which determines whether marriages and markets are substitutes in preferences. Letting $D = 1 + H/(r + \delta) > 0$, we have:

$$\begin{aligned}\frac{\partial R}{\partial A} &= \frac{\alpha_0 S_0 - \alpha_1 S_1}{D}, \quad \frac{\partial R}{\partial \alpha_0} = \frac{AS_0}{D}, \quad \frac{\partial R}{\partial \alpha_1} = -\frac{AS_1}{D}, \\ \frac{\partial R}{\partial \theta} &= \frac{A(\alpha_0 S_0 - \alpha_1 S_1)}{D\theta}, \\ \frac{\partial R}{\partial \tau_c} &= \frac{\theta A(\alpha_1 y_1 - \alpha_0 y_0)}{D(1 - \tau_c)^2(1 - \tau_\ell)}, \quad \frac{\partial R}{\partial \tau_\ell} = \frac{\theta A(\alpha_1 y_1 - \alpha_0 y_0)}{D(1 - \tau_c)(1 - \tau_\ell)^2}, \\ \frac{\partial R}{\partial \varepsilon_0} &= \frac{\theta A \alpha_0 v(y_0)}{D}, \quad \frac{\partial R}{\partial \varepsilon_1} = -\frac{\theta A \alpha_1 v(y_1)}{D}.\end{aligned}$$

The next result follows immediately from these expressions and Lemma 1:

Proposition 1 *Given $\alpha_0 \geq \alpha_1$ and $\varepsilon_0 \geq \varepsilon_1$, with at least one inequality strict, $\partial R/\partial A > 0$, $\partial R/\partial \alpha_0 > 0$, $\partial R/\partial \alpha_1 < 0$, $\partial R/\partial \theta > 0$, $\partial R/\partial \tau_c < 0$, $\partial R/\partial \tau_\ell < 0$, $\partial R/\partial \varepsilon_0 > 0$ and $\partial R/\partial \varepsilon_1 < 0$. Also, σ moves in the same direction as R , while H and ϕ move in the opposite direction.*

Intuitively, decreasing α_0/α_1 makes the retail market worse for singles relative to married people, which lowers R and thus makes individuals more inclined to marry. Slightly more subtly, decreasing overall search efficiency A lowers R because singles are more invested in the retail market – they consume more on the extensive margin when $\alpha_0 > \alpha_1$, and more on the intensive margin when $\varepsilon_0 > \varepsilon_1$. This is typical Coasian logic: individuals facing greater frictions in markets are more inclined to move economic activity *in house*. Decreasing θ or increasing taxes τ_c and τ_ℓ similarly lower R . All of this happens because markets and households are alternative ways to satisfy individual needs, just as markets and firms are alternatives for entrepreneurs in Coase’s original thesis.

Our results are fairly robust, although some do rely on specification (2) – e.g., for an arbitrary $u(y, z)$ in Appendix A we can still sign the impact of arrival rates but not taxes, in general, although everything in Proposition 1 goes through as long as α_1 is not too big. The results are also robust wrt KW pricing mechanisms. Since we need it later, consider Kalai’s bargaining solution, which has recently become quite popular in related research (see Nosal and Rocheteau 2011). This entails

$$\max_{y,d} S_z \text{ st } S_z = (1 - \theta)(S_z + \Sigma_z) \text{ and } y \leq k. \quad (16)$$

The FOC for y_z is the same as it was for Nash, but the FOC for d_z changes to

$$[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]\beta d_z = (1 - \tau_\ell)[(1 - \theta)\varepsilon_z v(y_z) + \theta\beta c(y_z, k)], \quad (17)$$

which is different except in special cases like $\tau_c = \tau_\ell = 0$ or $\theta = 1$. Proposition 1 holds with Kalai bargaining (Appendix B). It also holds in a version with Walrasian pricing when KW has multilateral, not bilateral, meetings (details on request).

5 Extensions

Appendix E analyzes dating/learning, plus a notion of love discussed by Becker (1974) in terms of caring (internalizing utilities) and sharing (consolidating budgets). These generalizations affect the equilibrium condition for R , but not the derivatives of R wrt parameters.¹¹ An extension requiring more attention is the introduction of money. As is standard – e.g., see Dong (2012) for an extended discussion – consider making individuals anonymous, and hence ruling out credit, in some KW meetings.

¹¹ Another application is to discuss divorce more deeply. Even if δ is exogenous, the flow $\delta(1 - \sigma)$ is endogenous. When R decreases, one might expect the number of divorces $\delta(1 - \sigma)$ falls, but it actually rises, since in steady state the flows in and out are equal. Thus, even if the divorce hazard falls, the flow $\delta(1 - \sigma)$ may not. The is also true if we endogenize δ by having couples learn or change their minds about each other over time, as in Burdett and Wright (1998). More generally, increasing the desire to be in a relationship may not reduce divorce. Imagine people who really want a job. They may accept every offer, to try it out, then quit if they learn it is a bad match, and iterate until they find a good one. People desperate for a job may instead hold out for an obviously great offer and hence never quit. Similarly, divorce can go up when people are more desirous of relationships if they try a lot of partners before finding a good one.

Specifically, let μ be the probability that credit is unavailable and therefore money is essential.¹² Let the money supply M grow at rate $\pi > \beta$, accomplished by lump-sum transfers, so that π is the inflation rate in stationary equilibrium. What is important is that in money meetings buyers cannot hand over more cash than they brought out of the previous AD market, and π effectively taxes this.

The results are simply sketched, since except for the BC market this is off-the-shelf monetary economics (see fn. 5). The AD value function now satisfies

$$V_1(m, d, z) = \max_{x, \ell, \hat{m}} \{U(x) - \ell + V_2(\hat{m}, 0, z)\} \text{ st } x + \psi \hat{m} = \ell(1 - \tau_\ell) + \psi m - d + \Delta,$$

where ψ is the price of cash in terms of x , and the new choice variable is $\hat{m}$, cash taken into the next period. The FOC $\partial V_2 / \partial \hat{m} = \psi / (1 - \tau_\ell)$ implies $\hat{m}$ is independent of m and d , again due to quasi-linear utility. In KW, for a single

$$\begin{aligned} V_2(\hat{m}, 0, s) &= (1 - A\alpha_0)V_3(\hat{m}, 0, s) + A\alpha_0(1 - \mu)[\varepsilon_0 v(y_s) + V_3(\hat{m}, d_s, s)] \\ &\quad + A\alpha_0\mu[\varepsilon_0 v(\hat{y}_s) + V_3(0, 0, s)], \end{aligned}$$

where y_s is the again quantity in credit trade, $\hat{y}_s$ is now the quantity in money trade and we use two standard results: buyers always cash out in money meetings; and they may as well use only credit in credit meetings. The KW equation for married is similar, but in general $\hat{m}_1 \neq \hat{m}_0$. The BC equations are also similar.

New conditions concern the terms of trade in money meetings, where we now use Kalai bargaining (mainly to reduce the algebra; Appendix D derives results with Nash). If a buyer in state z has $\hat{m}_z$, in the next AD market this is worth $\beta\psi_+ \hat{m}_z / (1 - \tau_\ell)$, which represents real balances in terms of utility, adjusted for discounting and taxation. Then Kalai bargaining implies $\hat{y}_z$ solves $\beta\psi_+ \hat{m}_z / (1 - \tau_\ell) = g(\hat{y}_z)$ where

$$g(\hat{y}_z) \equiv \frac{(1 - \theta)\varepsilon_z v(\hat{y}_z) + \theta\hat{y}_z}{\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta}, \quad (18)$$

¹²We emphasize that with probability $1 - \mu$ individuals can still use credit in KW. A referee suggested that it would be interesting to have this differ wrt marital status, e.g., to give singles less access to credit, $\mu_0 > \mu_1$. Intuitively, $\mu_0 > \mu_1$ strengthens our results by giving singles another reason to hold more cash, in addition to $\alpha_0 > \alpha_1$ and $\varepsilon_0 > \varepsilon_1$ as reported in Proposition 2 below; it is slightly complicated, however, to put this in the formal model (details on request).

as is standard in the literature (again see fn. 5). As usual, to simplify the expressions, define the nominal rate interest i by the Fisher equation, $1 + i = \pi/\beta$. Then the new equilibrium condition can be written

$$i = A\alpha_z\mu\varepsilon_z\lambda(\hat{y}_z), \quad (19)$$

where $\lambda(\hat{y}_z) \equiv v'(\hat{y}_z)/g'(\hat{y}_z) - 1$.¹³ A stationary monetary equilibrium entails a solution to (19) with $\hat{y}_z > 0$. It exists iff i is not too big, and is unique.

In monetary equilibrium $\hat{y}_0 > \hat{y}_1$ iff $\hat{m}_0 > \hat{m}_1$, a sufficient condition for which is $\varepsilon_0 \geq \varepsilon_1$ and $\alpha_0 \geq \alpha_1$, with one strict, by virtue of (19). Hence, if household and market goods are substitutes, in addition to buying more KW goods on credit, singles also buy more with cash. So higher π , which means higher i , by the Fisher equation, is a tax on being single. This logic shows up formally in

$$R = A\alpha_0\mathbb{E}S_0 - A\alpha_1\mathbb{E}S_1 + \frac{\eta}{r + \delta} \int_{\bar{R}} [1 - F(z)] dz - i(g_0 - g_1), \quad (20)$$

which is like (13) but for two differences: The last term on the RHS indicates that, compared to a pure-credit economy, individuals have to take into account the carrying cost of real balances when single and married, given by $g_0 = g(\hat{y}_0)$ and $g_1 = g(\hat{y}_1)$. And in the first term on the RHS, the KW surplus $\mathbb{E}S_z = (1 - \mu)S_z + \mu\hat{S}_z$ now averages across credit and money meetings, where

$$S_z = \varepsilon_z v(y_z) - \frac{\beta d_z}{1 - \tau_\ell} \text{ and } \hat{S}_z = \varepsilon_z v(\hat{y}_z) - \frac{\beta \psi_+ \hat{m}_z}{1 - \tau_\ell}$$

are the analogs of (7) in the baseline model.¹⁴

¹³On the LHS of (19), i is the marginal cost of carrying cash. The RHS, sometimes called a *liquidity premium*, is the expected marginal benefit of relaxing the constraint that buyers cannot hand over more than they have in money meetings. To derive (19), first combine the FOC for $\hat{m}$ from the AD market with the envelope condition for $\partial V_2/\partial \hat{m}$ to get

$$\psi = A\alpha_z\mu\beta\psi_+\varepsilon_z v'(\hat{y}_z)/g'(\hat{y}_z) + (1 - A\alpha_z\mu)\beta\psi_+,$$

after using $\partial \hat{y}_z/\partial \hat{m} = \beta\psi_+/(1 - \tau_\ell) g'(\hat{y}_z)$ from the bargaining solution. The rest is algebra.

¹⁴For the analogs of (11), simplify to get

$$S_z = \frac{\theta[(1 - \tau_c)(1 - \tau_\ell)\varepsilon_z v(y_z) - y_z]}{(1 - \tau_c)(1 - \tau_\ell)} \text{ and } \hat{S}_z = \frac{\theta[(1 - \tau_c)(1 - \tau_\ell)\varepsilon_z v(\hat{y}_z) - \hat{y}_z]}{\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta}.$$

The former is the same as in the pure-credit model; the latter differs, in general, because of the constraint in money meetings. If $i = 0$ then $y_z = \hat{y}_z$, and again $\varepsilon_z v'(y_z) = 1$ iff $\tau_c = \tau_\ell = 0$.

Appendix B shows the results in Proposition 1 still hold, plus there is a new result that we highlight as follows:

Proposition 2 *Given $\alpha_0 \geq \alpha_1$ and $\varepsilon_0 \geq \varepsilon_1$, with at least one inequality strict, in stationary monetary equilibrium $\partial R / \partial i < 0$. Also, σ moves the same direction as R , while H and ϕ move in the opposite direction.*

In terms of economics, the conclusion is this: Suppose marriages and markets are substitutes, as we think is the relevant case, and $\mu > 0$, so that money is used in at least some retail trade. Then being single is cash intensive and inflation makes people more inclined to move economic activity out of the market and into the home, thus increasing the marriage stock σ and flow ϕ .

6 Evidence

While households can generally involve roommates and other such arrangements, for empirical work, consider measuring them by marriage. Similarly, while transaction costs are many and varied, consider measuring them by taxation, including sales and income taxes, as well as the inflation tax. The first thing to check is whether singles use money more than married individuals in the micro data. The second is to relate marriage rates to inflation, taxation and other variables in the macro data.

6.1 Micro

In terms of prior work, consider first Klee's (2008) study of grocery scanner data. As these data do not include demographics, she compares payment patterns across census tracts. Controlling for the number and value of items purchased, income, age, etc., she finds that being in a census tract with more married people significantly decreases (increases) the probability of using cash (credit). Also, the probability of using cash (credit) increases (decreases) on Friday and Saturday, and one might

think that single people go out more on weekends. Klee considers different explanations for a weekend effect (e.g., people get paid on Friday) but concludes “the type of items bought on Friday and Saturday – beer and cigarettes in particular – are more likely to be purchased with cash.” This suggests that going out and hence being single is relatively cash intensive. Relatedly, Duca and Whitesell (1995) find, after controlling for other factors, married people are significantly more likely to have credit cards and have lower money demand as measured by checking deposits. This is very relevant because, even without modeling banking, it speaks to the idea that money in theory can be more than coins and currency.¹⁵

To begin our own analysis, consider the Italian Survey of Household Income and Wealth, which has information on cash holding and spending from individuals every two years from 1993 and 2004 (Lippi and Secchi 2009). Tables 1 and 2 report summary statistics (all tables are at the end). Table 1 reports currency holdings each year for households with $N = 1$ adult, which we take to be singles, and those with $N = 2$ and $N = 3$. Currency averages 54% higher for individuals in households with $N = 1$ than $N = 2$. Although our theory focused on $N = 1$ or 2, it can be generalized to $N > 2$, so we also report that adults in households with $N = 1$ hold about double the cash of those with $N = 3$. These numbers do not control for expenditure, however, so Table 2 corrects this by dividing currency per adult by expenditure per adult. This is around 23% higher for people in households with $N = 1$ than $N = 2$, and 28% higher for those with $N = 1$ than $N = 3$. In Italy, this simple look at the numbers indicates singleness is cash intensive.¹⁶

¹⁵In related work, Liu (2008) regresses cash holdings on income, expenditure and demographic variables, and finds a dummy for married significantly negative. Stavins (2001) finds married people are significantly more likely to use electronic payments, controlling for other factors. Fusaro (2008) finds singles have higher ATM withdrawals, controlling for income. This is all consistent with the idea that being single is cash intensive. See also Wang and Wolman (2014).

¹⁶We do not go beyond summary statistics with these data because they have less information than the data studied below. Also, we are not interested in nominal units in Tables 1-2, only ratios, for which the results are generally highly significant (this is also true below). In terms of robustness, we tried several variations (dividing by cash expenditure instead of total expenditure, eliminating people without bank accounts etc.) without changing the results much.

Consider now Boston Fed’s 2009 Survey of Consumer Payment Choice (Schuh and Stavins 2010). This is especially nice because it has information on not only on wallet cash – i.e., in people’s purse, pocket or wallet – but on total cash – e.g., in the cookie jar, under the mattress etc. – and the latter is considerably more. Table 3 reports statistics for single, divorced/separated, widowed, nonmarried (the sum of the previous three), and married (legally or common law). Column 1 shows that wallet cash for nonmarried is 1.2 times wallet cash for married, but this does not control for anything. Column 2 adjusts wallet cash by household income, but that over corrects by dividing individual cash by household income. Column 3 rectifies this by dividing household income by the number of adults, giving wallet cash per adult over income per adult. By this metric, nonmarried have 1.68 times the wallet cash of married. Columns 4-6 redo 1-3 with total cash. In Column 6, after controlling for household size and income, nonmarried have 2.27 times the total cash of married individuals. Being single is cash intensive in the US, too.¹⁷

Consider next Bank of Canada’s 2009 Methods of Payment Survey (Arango and Welte 2012). In Table 4, columns 1-3 are cash holdings, cash holdings over annual household income and cash holdings over household income adjusted for the number of adults. The Canadian data have only wallet, not total, cash. However, they have cash spending in addition to holding, reported in Columns (4)-(6). The numbers again indicate nonmarried people use more cash, although the differences are somewhat smaller: controlling for household size and income, they carry 7% more and spend 32% more than married people. We redid this after eliminating individuals with wallet cash or total cash over a \$1,000 (not shown). This mattered less in the American data, but here it implies that nonmarried people have 40% more and spend 48% more cash. The Bank of Canada has Diary data, which in

¹⁷As a subsidiary result, concerning the levels of wallet and total cash, without controlling for anything nonmarried average \$77 for the former and \$318 for the latter, while common law or married average \$65 for the former and \$284 for the latter. Remarkably, total cash is over 4 times what people have in their purse, pocket or wallet.

principle can be more reliable than the Survey, although the sample size is cut in half. Using the Diary data (not shown), nonmarried have about 1/3 more and spend 2/3 more cash, controlling for household income and size. Singleness is also cash intensive in Canada.

While the above evidence is useful, it is important to go beyond summary statistics, to control for age, education, employment and other variables than may be correlated with marital status. Tables 5-7 report OLS regression results on the Boston Fed data, the Bank of Canada Survey data and the Bank of Canada Diary data. In Table 5 the LHS uses either the log of wallet cash or the log of total cash, after adding 1, to deal with observations of 0. We also ran all regressions in levels rather than logs (not shown), with similar results. In Tables 6-7 the LHS uses either the log of cash holdings or the log of cash spending, again adding 1, for the same reason. These variables are adjusted for household size (e.g., cash per adult over number of adult members), or, in some runs, not adjusted because RHS dummies are included for size. Other RHS variables include age, education etc., plus dummies for marital status. For this exercise marital status is grouped into two categories: single, divorced, separated and widowed; or common law and legally married.

The coefficient on marital status is positive and significant in all 18 runs, and significant at the 1% level in 16 of them. The point estimates are fairly consistent, averaging around 0.32 in the American and 0.26 in the Canadian data. To understand units, consider the following example: In 2009 the average married woman in the Canadian Diary sample had \$77 in wallet cash and an annual income of \$27,349. Consider a coefficient on the nonmarried dummy of 1.5, which is near the mean of the estimates for the regressions on levels, which we find somewhat easier to interpret, but the results are not too dependent on this. If the same women were unmarried she would hold an additional \$40, over 50% more wallet cash. There are other interesting findings here, e.g., *ceteris paribus* the unemployed and less educated use cash more. However, it is important to emphasize that the results on

marital status are not driven by a correlation between being single and being unemployed or less educated, because the unmarried coefficient is positive and usually highly significant when unemployment and education are included on the RHS.¹⁸

The conclusion from all this is that single people have more wallet and more total cash. However, even total cash is not all that big, say around \$300, and hence one might think that a moderate inflation does not entail a huge cost. On this there are several relevant points: First, if single people also have more demand deposits, as Duca and Whitesell (1995) report, the size of the tax base on which inflation operates is much bigger. Second, in some of the countries and episodes considered below, inflation was anything but moderate, and it seems reasonable to think a very big inflation can have an economically significant effect. Third, Buckles et al. (2011) document empirically that relatively small changes in the costs or benefits can lead to significant changes in marriage rates.¹⁹ Fourth, as mentioned in fn. 2, conceived broadly inflation could proxy for a variety of market imperfections that encourage substitution into household and out of market activity. While future work can explore all of this in more detail, for now, we simply submit that based on a preponderance of evidence inflation is a tax on being single.

6.2 Macro

The next step is to check how different macro variables affect marriage rates. Table 8 summarizes our sources. We have information from 1948 to 2013 for all countries in the United Nations Common Database (UNCDB), of which there are 275 in total – more than there are at any point in time since they come into or go out of existence over the period. Given missing observations and other issues, at most half these countries are usable, and often far fewer, depending on what is included

¹⁸Other subsidiary findings include the result that males use cash more, while the results are mixed for the age dummies, but older people seem to use cash more at least in Canada.

¹⁹They consider the staggered repeal of marriage blood test requirements in 34 states, 1980-2008. They argue that the monetary value of this change, including the waiting time and disutility of testing, was small, but still increased the marriage rate by 6.1%, controlling for other factors.

on the RHS. We started by computing a simple flow as marriages per capita (i.e., per 1,000 population). However, in response to comments by a referee to the effect that medium-run trends in marriage rates are sensitive to the age structure of the population, we also considered parsing the population by marital status, age, sex and urban/rural residence. Some but not all of the results are sensitive to this, but generally speaking, using groups that can reasonably be considered relatively marriageable provides more support for the theory. In the interests of space, we concentrate on two groupings: marriages over the total population; and marriages over the population of single males aged 15-34.²⁰

For inflation, we consider both CPI and GDP deflator measures from different sources (see Table 8). The later covers around 236 countries starting in 1961, while former sample starts earlier but has fewer countries, and so we report results for both. Data on other forms of taxation are harder to come by. We have OECD consumption tax rates every four years before 1990, and every two years up to 2000. Since this leaves a lot of gaps, we also use the tax series constructed by Mendoza et al. (1997), hereafter the Mendoza data. This includes labor and capital tax rates, as well as consumption taxes, but only for 18 countries.²¹ Also, although we did not have output growth or unemployment in the model, we use these empirically for the following reason: whatever relation there is between marriage and inflation, e.g., it could be dismissed by claiming inflation is correlated with changes in output or unemployment, which are really driving marriage. So we control for these effects. Output is from International Financial Statistics (IFS). For unemployment, there are various sources that differ in terms of countries and years (see Table 8). We tried them all, but as the conclusions were similar, we report only the IFS results.

As first pass, Table 9 reports GLS regressions of marriages per capita on the GDP

²⁰We considered age groups 15-34, 15-39, 15-44, 20-34, 20-39 and 20-44. Most of the results are not very sensitive to this choice.

²¹They are US, UK, Austria, Australia, Belgium, Denmark, France, Germany, Italy, New Zealand, Netherlands, Norway, Sweden, Switzerland, Canada, Japan, Finland and Spain.

and CPI inflation rates in Columns (1)-(4) and Columns (5)-(8), resp. In each case the first Column has inflation and inflation squared on the RHS, the second adds output growth, the third adds unemployment, and the fourth adds output growth plus unemployment. Inflation squared is included because we expect a nonlinear relationship, since there are observations of very high inflation, and marriage rates are bounded. Table 9 does not include taxes, so we can use the largest sample, with as many as 4,240 observations across 136 countries. Nor does it include dummies for time or country, but we come back to this shortly. In terms of results, in Table 9, the coefficients on inflation are positive and highly significant in 7 of 8 runs, but quite small. Table 10 redoes Table 9 using marriages per single male age 15-34, rather than per capita. This ostensibly small change improves the results considerably – the coefficients on inflation are positive and highly significant in all runs, but now they are a lot bigger.²²

Table 11 goes back to marriages per capita but adds consumption taxes on the RHS, using the OECD sample, with 510-587 observations across 33 countries. The results are strong – the coefficients on inflation are positive and highly significant in all runs, and so are the coefficients on taxes, as theory predicts. Table 12 redoes Table 11 using marriages per single male age 15-34. The relevant coefficients are again positive and highly significant in all runs, but here the difference between marriages per single male age 15-34 and marriages per capita are less dramatic. The next pass adds labor and capital taxes, as well as consumption taxes, using marriages per capita in Table 13 and marriages per single male age 15-34 in Table 14, on the Mendoza sample, with even fewer but perhaps more reliable observations. Again the results are strong – the coefficients on inflation are always positive and highly significant, as are those on labor and capital tax rates, although those on

²²Before expanding the analysis in various ways, we mention a few details. In all cases in Tables 9-10 the coefficients on inflation squared are tiny, but they take the expected negative sign and are usually highly significant. In other runs below they are negative and highly significant but not so tiny. Other subsidiary findings include the strong positive effect on marriage of output growth and unemployment; the latter effect does not always persist below, but the former does.

consumption tax rates are now negative if not always very significant. Also, it does not matter that much which LHS variable we use, but the results are typically somewhat stronger using marriages per single male age 15-34.

To check whether differences between Tables 13-14, on the one hand, and the earlier results, on the other, are due to adding income taxes or looking at particular countries, in Tables 15-16 we use the Mendoza countries without. The coefficients on inflation are now bigger than in Tables 13-14, and bigger than the large sample without taxes in Tables 9-10. Both including taxes and restricting attention to the Mendoza sample matter. Here again the LHS does not matter too much, but the results are somewhat stronger using marriages per single male age 15-34. As another sensitivity check, Tables 17 redoes Table 13 after removing the cyclic component from the data with an HP filter, in the spirit of thinking the theory applies more to the medium than short run. This does not have a huge impact, but it increases the coefficients on inflation and taxation somewhat. Because it focuses on the medium run, has taxes on the RHS and uses the Mendoza sample, with a smaller but perhaps more reliable set of countries, we think Table 17 is especially relevant. In Table 17, the coefficients are positive and highly significant on inflation, labor and capital taxation, which is good for the theory, and negative but not generally significant on the consumption tax.

Table 18 redoes Table 17 with country dummies.²³ These are generally significant, and with their inclusion, the coefficients on inflation decrease but are still positive and highly significant in all runs. The coefficients on capital taxes change slightly, too, but are still positive and highly significant, while those on consumption taxes change for the better and those on labor taxes change a bit for the worse.

²³Tables 18-20 use marriages per capita since we do not have enough observations on marriages per single male 15-34. We can use marriages per population 15-34 from different data, but that does not affect the results too much and is inconsistent with Tables 9-17. The reason we can use single males 15-34 in those runs is we had much bigger samples and/or were not filtering. Filtering requires dropping some observations, due to large gaps, and other data problems. So we content ourselves here with marriages per capita, but this matters less in the Mendoza sample.

Table 19 redoes Table 17 with time dummies. These are often but not always significant, and with their inclusion the coefficients on inflation are still good, while those on labor taxes go back to being positive and those on consumption taxes go back to being negative. Finally, Table 20 includes country and time dummies. The coefficients on inflation are positive and highly significant in all 8 runs, while those for taxation are not too bad, in the sense that we lose some significance, but the signs are positive on 22 of 24 coefficients across all runs. In particular, in Columns (4) and (8) of Table 20, with filtered Mendoza data and all explanatory variables on the RHS, including time and country dummies, the coefficients on inflation and taxation all look quite good from the perspective of Coasian economics.

7 Conclusion

The thesis in this project has been that households are institutions that, like firms, provide an alternative to the market as a way of organizing economic activity. If home production is facilitated by household formation, and agents are somewhat willing to substitute between home- and market-produced goods and services, frictions in the marketplace encourage household formation, and in particular marriage. We used dynamic equilibrium theory to study how taxation, inflation, bargaining and search costs impact reservation strategies for forming partnerships. The framework is very tractable, and delivered sharp analytic predictions. Micro data confirmed that being single is currency intensive. Macro data on marriage, inflation, taxation and other aggregates across countries and time appeared consistent with the predictions of theory. More can be done empirically, such as looking at individual countries in detail. More can be done theoretically, too, such adding physical or human capital, life-cycle considerations, asymmetric treatment of men and women, and households with at more than two members, including children. While there is left for future research, we think the results of this project constitute progress.

Appendix A: Consider general utility $u(y, z)$, rather than (2), in the baseline nonmonetary model. In KW, the value functions and trading surpluses are

$$\begin{aligned} V_2(0, s) &= A\alpha_0 [u(y_s, s) + V_3(d_s, s)] + (1 - A\alpha_0) [u(0, s) + V_3(0, s)] \\ V_2(0, z) &= A\alpha_1 [u(y_z, z) + V_3(d_z, z)] + (1 - A\alpha_1) [u(0, z) + V_3(0, z)] \\ S(z) &= u(y, z) - u(0, z) - \frac{\beta d}{1 - \tau_\ell} \\ \Sigma(z) &= \beta(1 - \tau_c)d - y. \end{aligned}$$

From Nash bargaining (Kalai is similar), we get

$$\begin{aligned} 1 &= (1 - \tau_c)(1 - \tau_\ell) u_y(y, z) \\ (1 - \tau_c)\beta d &= (1 - \theta)(1 - \tau_c)(1 - \tau_\ell) [u(y, z) - u(0, z)] + \theta y. \end{aligned}$$

From this one can check $\partial y / \partial z \simeq u_{yz}(y, z)$, where ‘ $a \simeq b$ ’ means ‘ a and b take the same sign.’

To derive the reservation equation, use $V_1(0, R) = V_1(0, s)$ to get

$$A\alpha_1 S(R) + V_3(0, R) + u(0, R) = A\alpha_0 S(s) + V_3(0, s) + u(0, s).$$

As always,

$$\begin{aligned} V_3(0, R) &= \delta \beta V_1(0, s) + (1 - \delta) \beta V_1(0, R), \\ V_3(0, s) &= [1 - \eta + \eta F(R)] \beta V_1(0, s) + \eta \beta \int_R^{\bar{z}} V_1(0, z) dF(z), \end{aligned}$$

where integration by parts yields

$$\int_R^{\bar{z}} V_1(0, z) dF(z) = [1 - F(R)] V_1(0, R) + \int_R^{\bar{z}} \frac{A\alpha_1 S'(z) + u_z(0, z)}{\beta(r + \delta)} [1 - F(z)] dz.$$

Combining these expressions, we get the analog of (13)

$$u(0, R) + A\alpha_1 S(R) = u(0, s) + A\alpha_0 S(s) + \frac{\eta}{r + \delta} \int_R^{\bar{z}} [u_z(0, z) + A\alpha_1 S'(z)] [1 - F(z)] dz$$

where

$$S(z) = \frac{\theta \{(1 - \tau_c)(1 - \tau_\ell) [u(y_z, z) - u(0, z)] - y_z\}}{(1 - \tau_c)(1 - \tau_\ell)}.$$

Then $R \in (\underline{z}, \bar{z})$ if $u(0, \bar{z}) + A\alpha_1 S(\bar{z}) > u(0, s) + A\alpha_0 S(s) > u(0, \underline{z}) + A\alpha_1 S(\underline{z})$, and generalizing Proposition 1 we get

$$\begin{aligned}\frac{\partial R}{\partial \alpha_0} &= \frac{AS_s}{D[u_z(0, R) + A\alpha_1 S'(z)]} \\ \frac{\partial R}{\partial \alpha_1} &= \frac{-AS(R) + \frac{\eta A}{r+\delta} \int_R^{\bar{z}} S'(z) [1 - F(z)] dz}{D[u_z(0, R) + A\alpha_1 S'(R)]}.\end{aligned}$$

Inserting $S'(z)$, the term multiplying $D > 0$ in the denominator simplifies to $u_z(0, R) + A\alpha_1 S'(R) = (1 - A\alpha_1 \theta) u_z(0, R) + A\alpha_1 \theta u_z(y_R, R) > 0$. Hence, $\partial R / \partial \alpha_0 > 0$. As for $\partial R / \partial \alpha_1$, since $S'(z) \simeq u_{yz}(y, z)$, it is negative at least when y and z are substitutes. Also,

$$\begin{aligned}\frac{\partial R}{\partial A} &= \frac{\alpha_0 S(s) - \alpha_1 S(R) + \frac{\eta \alpha_1}{r+\delta} \int_R^{\bar{z}} S'(z) [1 - F(z)] dz}{D[u_z(0, R) + A\alpha_1 S'(R)]} \\ \frac{\partial R}{\partial \theta} &= \frac{A[\alpha_0 S(s) - \alpha_1 S(R)] + \frac{\eta A \alpha_1}{r+\delta} \int_R^{\bar{z}} S'(z) [1 - F(z)] dz}{D[u_z(0, R) + A\alpha_1 S'(R)] \theta} \\ \frac{\partial R}{\partial \tau_c} &= \frac{\theta A(\alpha_1 y_R - \alpha_0 y_s) + \frac{\theta \eta A \alpha_1}{r+\delta} \int_R^{\bar{z}} u_{yz}(y_z, z) \frac{\partial y_z}{\partial \tau_c} [1 - F(z)] dz}{D[u_z(0, R) + A\alpha_1 S'(R)] (1 - \tau_c)^2 (1 - \tau_\ell)} \\ \frac{\partial R}{\partial \tau_\ell} &= \frac{\theta A(\alpha_1 y_R - \alpha_0 y_s) + \frac{\theta \eta A \alpha_1}{r+\delta} \int_R^{\bar{z}} u_{yz}(y_z, z) \frac{\partial y_z}{\partial \tau_\ell} [1 - F(z)] dz}{D[u_z(0, R) + A\alpha_1 S'(R)] (1 - \tau_c) (1 - \tau_\ell)^2},\end{aligned}$$

where in the last two expressions

$$\begin{aligned}\frac{\partial y_z}{\partial \tau_c} &= \frac{-(1 - \tau_\ell) u_y(y_z, z)}{(1 - \tau_c) (1 - \tau_\ell) u_{yy}(y_z, z)} < 0 \\ \frac{\partial y_z}{\partial \tau_\ell} &= \frac{-(1 - \tau_c) u_y(y_z, z)}{(1 - \tau_c) (1 - \tau_\ell) u_{yy}(y_z, z)} < 0,\end{aligned}$$

implying that the integrands have the opposite sign of u_{yz} . Even given the sign of u_{yz} , we cannot sign these expressions, in general, but the specification in (2) with $u_{yz} = 0$ implies Proposition 1 holds. It also holds for any $u(y, z)$ when $\alpha_1 \rightarrow 0$.

For completeness we derive $\partial R / \partial i$ for a general $u(y, z)$ in monetary economy, using Kalai bargaining, and setting $\mu = 1$, to reduce notation. Here R satisfies

$$\begin{aligned}u(0, R) + A\alpha_1 S(R) &= A\alpha_0 S(s) + u(0, s) + ig(\hat{y}_R, R) - ig(\hat{y}_s, s) \\ &\quad + \frac{\eta}{r+\delta} \int_R^{\bar{z}} [A\alpha_1 S'(z) - ig_z(\hat{y}_z, z) + u_z(0, z)] [1 - F(z)] dz.\end{aligned}$$

where

$$g(\hat{y}, z) \equiv \frac{(1 - \theta) [u(\hat{y}, z) - u(0, z)] + \theta \hat{y}}{\theta (1 - \tau_c) (1 - \tau_\ell) + 1 - \theta},$$

and $\hat{y}_z$ solves (19). Then

$$\frac{\partial R}{\partial i} = \frac{g(\hat{y}_R, R) - g(\hat{y}_s, s) + \frac{\eta}{r+\delta} \int_R^{\bar{z}} \{ [A\alpha_1 u_{yz} - (i + A\alpha_1)g_{yz}] \frac{d\hat{y}_z}{di} - g_z \} [1 - F(z)] dz}{D [A\alpha_1 S'(R) - ig_z(\hat{y}_R, R) + u_z(0, R)]}.$$

The sign of $\partial R/\partial i$ is ambiguous, in general, but using (2), or taking $\alpha_1 \rightarrow 0$, the results hold.

Appendix B: In the baseline nonmonetary model with Kalai bargaining, the effects of (A, α_z) are the same, while:

$$\begin{aligned} \frac{\partial R}{\partial \theta} &= \frac{A(\alpha_0 S_0 - \alpha_1 S_1)}{D\theta[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \varepsilon_0} &= \frac{\theta(1 - \tau_c)(1 - \tau_\ell) A\alpha_0 v(y_0)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \varepsilon_1} &= -\frac{\theta(1 - \tau_c)(1 - \tau_\ell) A\alpha_1 v(y_1)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]}, \\ \frac{\partial R}{\partial \tau_c} &= \frac{\theta\beta A(\alpha_1 d_1 - \alpha_0 d_0)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \tau_\ell} &= \frac{\theta\beta A(\alpha_1 d_1 - \alpha_0 d_0)(1 - \tau_c)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta](1 - \tau_\ell)}. \end{aligned}$$

In the monetary model with Kalai bargaining, again with $\mu = 1$, the effects of (A, α_z) are the same, while:

$$\begin{aligned} \frac{\partial R}{\partial \theta} &= \frac{A(\alpha_0 S_0 - \alpha_1 S_1) + i(S_0 - S_1)}{D\theta[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \varepsilon_0} &= \frac{[A\alpha_0\theta(1 - \tau_c)(1 - \tau_\ell) - i(1 - \theta)]v(\hat{y}_0)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \varepsilon_1} &= -\frac{[A\alpha_1\theta(1 - \tau_c)(1 - \tau_\ell) - i(1 - \theta)]v(\hat{y}_1)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \tau_c} &= (1 - \tau_\ell) \frac{\theta A(\alpha_1 g_1 - \alpha_0 g_0) + i\theta(g_1 - g_0)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \\ \frac{\partial R}{\partial \tau_\ell} &= (1 - \tau_c) \frac{\theta A(\alpha_1 g_1 - \alpha_0 g_0) + i\theta(g_1 - g_0)}{D[\theta(1 - \tau_c)(1 - \tau_\ell) + 1 - \theta]} \end{aligned}$$

The signs of all these are as stated in the text.

Appendix C: To derive retail profit in the baseline nonmonetary model, start with

$$\begin{aligned} \Pi(k) &= \left[1 - \frac{\sigma A\alpha_0}{n} - \frac{(1 - \sigma)A\alpha_1}{n} \right] \rho(k) + \frac{\sigma A\alpha_0}{n} [d_s(1 - \tau_c) + \rho(k - y_s)] \\ &\quad + \frac{(1 - \sigma)A\alpha_1}{n} \int_R^{\bar{z}} [d_z(1 - \tau_c) + \rho(y_z - k)] \frac{dF(z)}{1 - F(R)}. \end{aligned}$$

The first term is revenue in AD for retailers who do not trade in KW; the second is revenue for those who trade with single individuals; the last is revenue for those who traded with married individuals. This reduces using (1) to:

$$\Pi(k) = \rho(k) + \frac{\sigma A \alpha_0}{n} [(1 - \tau_c) d_s - c(y_s, k)] + \frac{(1 - \sigma) A \alpha_1}{n} \int_R \frac{(1 - \tau_c) d_z - c(y_z, k)}{1 - F(R)} dF(z)$$

This simplifies to the expression used in the text when $\rho(k)$ is linear.

Appendix D: Consider the monetary model with Nash bargaining and again set $\mu = 1$. The analogs to (18) and (19) are

$$\begin{aligned} g(\hat{y}_z) &= \frac{\theta y_z \varepsilon_z v'(\hat{y}_z) + (1 - \theta) \varepsilon_z v(\hat{y}_z)}{(1 - \tau_c)(1 - \tau_\ell) \theta \varepsilon_z v'(\hat{y}_z) + 1 - \theta} \\ \lambda(\hat{y}_z) &= \frac{\theta [(1 - \tau_c)(1 - \tau_\ell) \varepsilon_z v'(\hat{y}_z) - 1] v'(\hat{y}_z) \Xi + \Gamma}{[(1 - \tau_c)(1 - \tau_\ell) \theta \varepsilon_z v'(\hat{y}_z) + 1 - \theta] \varepsilon_z v'(\hat{y}_z) - \Gamma}, \end{aligned}$$

where

$$\begin{aligned} \Gamma &= \theta(1 - \theta) [(1 - \tau_c)(1 - \tau_\ell) \varepsilon_z v(\hat{y}_z) - \hat{y}_z] \varepsilon_z v''(\hat{y}_z) \\ \Xi &= [(1 - \tau_c)(1 - \tau_\ell) \theta \varepsilon_z v'(\hat{y}_z) + 1 - \theta]. \end{aligned}$$

One can still show $\partial R / \partial i < 0$ iff $g_0 > g_1$, and $g_0 > g_1$ still holds under the assumption that households and markets are substitutes, but there is a technicality: we cannot sign $\lambda'(y)$, in general, which makes the effects of some parameters and even the uniqueness of R more complicated. The reason we use with Kalai bargaining in the benchmark monetary model is that it guarantees $\lambda'(y) < 0$. Still, the main results can be proved with Nash bargaining using the method in Wright (2010).

Appendix E: Dating and Love

We now reverse the order of the BC and KW markets, and interpret KW as dating, by which we mean learning about z . For simplicity, suppose people learn in one period (it might be interesting to let them learn slowly). When two singles meet in BC, now z is not observed but it is revealed after participating in KW as a couple, and enjoyed, next period. Once z is known the couple decide whether to form a household. For a single in AD who did not date, or dated but realizes $z < R$, the problem is the same as before. For an individual that realizes $z \geq R$,

$$V_1(d, z) = z + \max_{x, \ell} \{U(x) - \ell + V_2(0, z)\} \text{ st } x = \ell(1 - \tau_\ell) - d + \Delta.$$

The generalized BC equations are

$$V_2(0, s) = \eta \mathbb{E}V_3(0, \tilde{z}) + (1 - \eta)V_3(0, s)$$

$$V_2(0, z) = (1 - \delta)V_3(0, z) + \delta V_3(0, s),$$

where the expectation operator is here because $\tilde{z}$ is random. The KW equations are

$$V_3(0, s) = A\alpha_0 [\varepsilon_0 v(y_s) + \beta V_1(d_s, s)] + (1 - A\alpha_0)\beta V_1(0, s) \quad (21)$$

$$\mathbb{E}V_3(0, \tilde{z}) = A\alpha_1 [\varepsilon_1 v(y_{\tilde{z}}) + \beta \mathbb{E}V_1(d_{\tilde{z}}, \tilde{z})] + (1 - A\alpha_1)\beta \mathbb{E}V_1(0, \tilde{z}) \quad (22)$$

$$V_3(0, z) = A\alpha_1 [\varepsilon_1 v(y_z) + \beta V_1(d_z, z)] + (1 - A\alpha_1)\beta V_1(0, z). \quad (23)$$

Following the earlier procedure, the reservation equation becomes

$$R = (1 - \eta - \delta)(A\alpha_0 S_0 - A\alpha_1 S_1) + \frac{\eta}{r + \delta} \int_R^{\tilde{z}} [1 - F(z)] dz. \quad (24)$$

This is not the same as (13), but the derivatives of R wrt parameters have the same signs.

Now consider love, meaning caring (internalizing utility) and sharing (consolidating budgets). Using the timing in the dating extension, for a single that did not meet anyone in the BC market the AD problem is as before. For a single that was on a date, but realizes $z < R$, the AD problem is

$$V_1(\bar{d}, z) = \max_{x, \ell} \{U(x) - \ell + V_2(0, s)\} \text{ st } x = \ell(1 - \tau_\ell) - \bar{d} + \Delta,$$

where $\bar{d} = (d + d')/2$ averages one's debt d and that of one's date d' . For those entering partnerships, we average utilities and budgets

$$V_1(\bar{d}, z) = z + \max_{x, x', \ell, \ell'} \left\{ \frac{U(x) + U(x')}{2} - \bar{\ell} + V_2(0, z) \right\} \text{ st } \bar{x} = \bar{\ell}(1 - \tau_\ell) - \bar{d} + \bar{\Delta},$$

where $\bar{\ell} = (d + d')/2$, $\bar{x} = (x + x')/2$ and $\bar{\Delta} = (\Delta + \Delta')/2$.

In the KW market, for a single who is not dating, the problem is also the same as before. For a single on a date,

$$\begin{aligned} \mathbb{E}V_3(0, \tilde{z}) &= (A\alpha_1)^2 [\varepsilon_1 v(y_1) + \beta \mathbb{E}V_1(d_1, \tilde{z})] + (1 - A\alpha_1)^2 \beta \mathbb{E}V_1(0, \tilde{z}) \\ &\quad + A\alpha_1(1 - A\alpha_1) \left[\frac{\varepsilon_1 v(y_1)}{2} + \beta \mathbb{E}V_1\left(\frac{d_1}{2}, \tilde{z}\right) \right] \\ &\quad + (1 - A\alpha_1)A\alpha_1 \left[\frac{\varepsilon_1 v(y_1)}{2} + \beta \mathbb{E}V_1\left(\frac{d_1}{2}, \tilde{z}\right) \right], \end{aligned}$$

assuming pairs search for retailers independently. Thus,

$$\mathbb{E}V_3(0, \tilde{z}) = A\alpha_1 [\varepsilon_1 v(y_1) + \beta \mathbb{E}V_1(d_1, \tilde{z})] + (1 - A\alpha_1)\beta \mathbb{E}V_1(0, \tilde{z}). \quad (25)$$

For an individual with a partner in the KW market, a similar calculation leads to almost the same result, the only difference being that z is known,

$$V_3(0, z) = A\alpha_1 [\varepsilon_1 v(y_1) + \beta V_1(d_1, z)] + (1 - A\alpha_1)\beta V_1(0, z). \quad (26)$$

Notice (25)-(26) are identical to (22)-(23), and hence the models generate the same predictions. This confirms the intuition in Becker (1974, fn. 9) that “when the degree of caring becomes sufficiently great, behavior becomes similar to that when there is no caring.” For our purposes, what is relevant is that the Propositions in the text still hold.

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Table 1: Italy, Cash per Adult

	1993	1995	1998	2000	2002	2004	weighted avg
$N = 1$	292.580 (7.165)	297.610 (5.602)	317.030 (8.434)	326.060 (6.631)	312.930 (9.628)	317.780 (6.120)	311.567
obs	1220	1274	1131	1446	1757	1837	
$N = 2$	196.530 (2.830)	226.670 (3.060)	202.830 (3.455)	194.260 (2.833)	190.730 (3.343)	199.470 (3.101)	201.711
obs	3243	3195	2834	3249	3147	3280	
$N = 3$	146.970 (3.099)	165.970 (3.298)	147.670 (3.649)	142.460 (3.197)	148.220 (3.463)	152.830 (3.980)	150.828
obs	1430	1452	1207	1384	1363	1239	
$N = 1/N = 2$	1.489	1.313	1.563	1.678	1.641	1.593	1.545
$N = 1/N = 3$	1.991	1.793	2.147	2.289	2.111	2.079	2.066

Notes: $N = j$ for $j = \{1, 2, 3\}$ is # adults in a household. Standard errors in parentheses.

Table 2: Italy, Cash per Adult $\div$ Expenditure per Adult

	1993	1995	1998	2000	2002	2004	weighted avg
$N = 1$	11.330 (0.298)	10.927 (0.210)	11.496 (0.276)	11.391 (0.242)	11.410 (0.543)	9.720 (0.193)	10.978
obs	1220	1274	1131	1446	1757	1837	
$N = 2$	8.688 (0.138)	9.790 (0.138)	9.474 (0.170)	8.658 (0.139)	8.763 (0.254)	8.400 (0.144)	8.949
obs	3243	3195	2834	3249	3147	3280	
$N = 3$	8.324 (0.185)	8.874 (0.182)	8.675 (0.232)	8.379 (0.220)	8.679 (0.241)	8.301 (0.236)	8.541
obs	1430	1452	1207	1384	1363	1239	
$N = 1/N = 2$	1.304	1.116	1.213	1.316	1.302	1.157	1.227
$N = 1/N = 3$	1.361	1.231	1.325	1.360	1.315	1.171	1.285

Notes: Same as Table 1

Table 3: Boston Fed Survey

	cash in wallet			total cash holding		
	(1)	(2)	(3)	(4)	(5)	(6)
single	83.151 (12.848)	3.439 (0.562)	9.067 (2.110)	337.760 (127.994)	13.114 (4.084)	42.123 (16.455)
divorced or separated	63.896 (8.240)	3.020 (0.517)	5.151 (1.334)	190.207 (25.129)	8.858 (2.075)	15.188 (4.699)
widowed	85.740 (10.527)	2.610 (0.405)	3.284 (0.453)	411.389 (82.674)	11.216 (1.940)	13.636 (2.167)
nonmarried	76.909 (7.665)	3.195 (0.355)	7.028 (1.251)	318.393 (70.899)	11.434 (2.329)	29.482 (9.118)
married or common law	64.340 (3.258)	1.802 (0.548)	4.179 (1.132)	284.912 (29.284)	5.633 (0.830)	12.996 (1.786)
obs	2132	2125	2125	2062	2056	2056

Notes: (1) cash in wallet (USD); (2) cash in wallet over household income (1,000s); (3) cash in wallet over household income adjusted for # adults; (4) total cash; (5) total cash over household income; (6) total cash over household income adjusting for # adults. Standard errors in parentheses.

Table 4: Bank of Canada Survey

	cash in wallet			cash spending		
	(1)	(2)	(3)	(4)	(5)	(6)
single	69.699 (5.501)	1.848 (0.132)	3.621 (0.382)	93.502 (9.029)	2.149 (0.153)	4.455 (0.601)
divorced or separated	73.007 (6.799)	2.737 (0.451)	3.984 (0.707)	75.627 (4.682)	2.627 (0.239)	3.895 (0.521)
widowed	95.745 (15.004)	2.996 (0.378)	4.301 (0.740)	104.259 (17.573)	2.982 (0.396)	4.289 (0.829)
nonmarried	72.513 (4.207)	2.177 (0.155)	3.764 (0.322)	89.291 (6.138)	2.343 (0.125)	4.291 (0.425)
married or common law	83.229 (11.908)	1.506 (0.337)	3.514 (1.012)	87.746 (6.058)	1.440 (0.121)	3.252 (0.353)
obs	6183	6183	5038	4995	4995	4108

Notes: (1) cash in wallet (in CAD); (2) cash in wallet over household income in 1,000's; (3) cash in wallet over household income adjusted by # adults; (4) weekly cash spending; (5) weekly cash spending over household income; (6) weekly cash spending over household income adjusted for # adults. Standard errors in parentheses.

Table 5: OLS Results – Boston Fed Survey

	(1) CW1	(2) CH1	(3) CW1	(4) CH1	(5) CW1_s	(6) CH1_s
constant	0.948*** (0.038)	1.588*** (0.052)	0.719*** (0.210)	1.233*** (0.297)	0.181 (0.163)	0.498** (0.243)
nonmarried	0.295*** (0.090)	0.258*** (0.122)	0.262*** (0.081)	0.226* (0.117)	0.432*** (0.099)	0.477*** (0.147)
male			0.140* (0.075)	0.202* (0.111)	0.093* (0.051)	0.153* (0.082)
unemployed			0.327*** (0.121)	0.302** (0.135)	0.246*** (0.075)	0.224** (0.094)
less than college			0.282*** (0.053)	0.265*** (0.077)	0.204*** (0.037)	0.198*** (0.057)
age 25-34			-0.208 (0.250)	-0.035 (0.355)	-0.029 (0.150)	0.181 (0.244)
age 35-44			-0.102 (0.242)	-0.120 (0.338)	0.044 (0.144)	0.061 (0.226)
age 45-54			-0.122 (0.232)	-0.052 (0.334)	0.023 (0.132)	0.121 (0.225)
age 55-64			-0.153 (0.235)	-0.029 (0.331)	0.027 (0.129)	0.207 (0.214)
age 65-			-0.098 (0.268)	0.135 (0.346)	0.156 (0.146)	0.475** (0.219)
household size 2					0.119 (0.103)	0.113 (0.142)
household size 3					0.118 (0.114)	0.117 (0.156)
household size 4					-0.134 (0.139)	0.122 (0.332)
household size 5+					0.408* (0.247)	0.331 (0.272)
obs	2120	2051	1930	1870	1930	1870

Notes: Dependent variable in (1)-(4): log wallet cash + 1 (CW1) or log total cash + 1 (CH1) over household income adjusted for household size. Dependent variable in (5)-(6): log wallet cash + 1 (CW1_s) or log total cash + 1 (CH1_s) over household income not adjusted for household size. Base group: married, female, employed, college plus, age 18-24, household size 1 if dummy included in regression. Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, * p<0.1..

Table 6: OLS Results – Bank of Canada Survey

	(1) CW1	(2) CS1	(3) CW1	(4) CS1	(5) CW1_s	(6) CS1_s
constant	0.908*** (0.027)	0.983*** (0.028)	0.471*** (0.057)	0.633*** (0.087)	0.301*** (0.070)	0.400*** (0.099)
nonmarried	0.170*** (0.043)	0.208*** (0.052)	0.220*** (0.045)	0.196*** (0.057)	0.244*** (0.044)	0.240*** (0.055)
male			0.121*** (0.040)	0.159*** (0.047)	0.067** (0.028)	0.100*** (0.033)
unemployed			0.168*** (0.055)	0.148*** (0.053)	0.145*** (0.043)	0.128*** (0.041)
less than college			0.160*** (0.041)	0.294*** (0.042)	0.116*** (0.028)	0.215*** (0.029)
age 26-35			0.040 (0.056)	0.029 (0.093)	0.121*** (0.028)	0.125* (0.075)
age 36-45			0.143* (0.080)	-0.050 (0.086)	0.207*** (0.064)	0.079 (0.065)
age 46-55			0.273*** (0.064)	0.084 (0.097)	0.276*** (0.046)	0.158** (0.072)
age 56-65			0.336*** (0.062)	0.054 (0.087)	0.361*** (0.049)	0.168** (0.069)
age 66-75			0.354*** (0.094)	-0.018 (0.103)	0.389*** (0.076)	0.123 (0.086)
household size 2					-0.136** (0.056)	-0.136** (0.060)
household size 3					-0.109 (0.077)	-0.159* (0.086)
household size 4					-0.292*** (0.058)	-0.227** (0.098)
household size 5+					-0.170 (0.114)	-0.271* (0.143)
obs	5026	4098	4500	3707	4500	3707

Notes: Dependent variable in (1)-(4): log wallet cash + 1 (CW1) or log cash spending + 1 (CS1) over household income adjusted for household size. Dependent variable in (5)-(6): log wallet cash + 1 (CW1_s) log cash spending + 1 (CS1_s) over household income not adjusted for household size. Base group: married, female, employed, college plus, age 18-25, household size 1 if dummy included in the regression. Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, * p<0.1..

Table 7: OLS Results – Bank of Canada Diary

	(1) CW1	(2) CS1	(3) CW1	(4) CS1	(5) CW1_s	(6) CS1_s
constant	0.957*** (0.029)	1.045*** (0.042)	0.660*** (0.077)	0.527*** (0.118)	0.519*** (0.097)	0.426*** (0.158)
nonmarried	0.205*** (0.052)	0.217*** (0.080)	0.205*** (0.056)	0.184** (0.084)	0.229*** (0.050)	0.258*** (0.089)
male			0.040 (0.046)	0.064 (0.067)	0.020 (0.036)	0.042 (0.052)
unemployed			0.261*** (0.067)	0.184* (0.099)	0.216*** (0.055)	0.152* (0.079)
less than college			0.183*** (0.043)	0.404*** (0.063)	0.146*** (0.033)	0.324*** (0.047)
age 26-35			-0.146* (0.077)	-0.006 (0.118)	-0.027 (0.061)	0.056 (0.099)
age 36-45			-0.034 (0.077)	0.105 (0.133)	0.066 (0.062)	0.141 (0.117)
age 46-55			0.130 (0.092)	0.120 (0.137)	0.168 (0.071)	0.151 (0.116)
age 56-65			0.257*** (0.086)	0.332** (0.128)	0.287*** (0.069)	0.320*** (0.111)
age 66-75			0.255** (0.111)	0.403** (0.166)	0.300*** (0.093)	0.387*** (0.146)
household size 2					-0.206*** (0.072)	-0.170 (0.106)
household size 3					-0.280*** (0.087)	-0.248 (0.142)
household size 4					-0.375*** (0.094)	-0.429*** (0.118)
household size 5+					-0.623*** (0.086)	-0.839*** (0.157)
obs	2710	2722	2429	2438	2429	2438

Notes: Same as Table 6.

Table 8: Macro Data Sources

Data	Source	Time Period	# Countries
Marriages	UNCDB	1948 – 2012	275
Population	UNCDB	1948 – 2013	252
Output	IFS, The World Bank	1948 – 2012	236
CPI	UNCDB, IFS	1948 – 2009	193
GDP Deflator	The World Bank	1961 – 2012	236
Unemployment	LABORSTA	1969 – 2008	221
Unemployment	IFS	1948 – 2009	129
Unemployment	OECD	1951 – 2013	38
Consumption Tax	OECD	1976 – 2011	33
Consumption Tax	Mendoza et al.	1965 – 1991	18
Labor Income Tax	Mendoza et al.	1965 – 1992	18
Capital IncomeTax	Mendoza et al.	1965 – 1992	18

Table 9: Panel data GLS without taxes, mar $\div$ pop

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.000 (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.006*** (0.001)				
π_D^2	-0.000 (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)				
π_C					0.001*** (0.000)	0.009*** (0.001)	0.002*** (0.000)	0.004*** (0.001)
π_C^2					-0.000* (0.000)	-0.000*** (0.000)	-0.000** (0.000)	-0.000*** (0.000)
γ		0.059*** (0.005)		0.065*** (0.006)		0.073*** (0.006)		0.074*** (0.006)
u			0.228*** (0.009)	0.363*** (0.009)			0.241*** (0.009)	0.365*** (0.008)
Obs	4240	4189	2411	2377	4130	3172	2258	2143
NC	136	135	111	110	117	113	102	98

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 10: Panel data GLS without taxes, mar $\div$ single males 15-34

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.248*** (0.000)	0.236*** (0.003)	0.092*** (0.006)	0.093*** (0.004)				
π_D^2	-0.001*** (0.000)	-0.001*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)				
π_C					0.072*** (0.006)	0.188*** (0.006)	0.068*** (0.002)	0.123*** (0.004)
π_C^2					-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
γ		0.380*** (0.015)		0.383*** (0.010)		0.406*** (0.017)		0.237*** (0.016)
u			0.569*** (0.013)	0.498*** (0.012)			0.528*** (0.015)	0.531*** (0.013)
Obs	1017	1011	675	672	986	822	669	638
NC	101	100	62	61	85	77	58	57

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 11: Panel data GLS with OECD taxes, mar $\div$ pop

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.029*** (0.005)	0.037*** (0.006)	0.029*** (0.005)	0.033*** (0.005)				
π_D^2	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)				
π_C					0.031*** (0.005)	0.035*** (0.005)	0.029*** (0.004)	0.038*** (0.005)
π_C^2					-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
γ		0.027*** (0.007)		0.043*** (0.008)		0.043*** (0.007)		0.046*** (0.008)
u			-0.005 (0.012)	0.033** (0.012)			-0.012 (0.011)	0.040*** (0.012)
τ_c	0.252*** (0.004)	0.239*** (0.004)	0.254*** (0.006)	0.233*** (0.006)	0.262*** (0.003)	0.254*** (0.003)	0.259*** (0.006)	0.229*** (0.006)
Obs	587	587	510	510	533	522	519	510
NC	33	33	33	33	33	33	33	33

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 12: Panel data GLS with OECD taxes, mar $\div$ single males 15-34

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.039*** (0.006)	0.041*** (0.006)	0.032*** (0.006)	0.030*** (0.007)				
π_D^2	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)				
π_C					0.034*** (0.006)	0.035*** (0.006)	0.033*** (0.006)	0.031*** (0.007)
π_C^2					-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)	-0.000*** (0.000)
γ		0.035* (0.015)		0.031 (0.016)		0.037* (0.015)		0.030 (0.016)
u			0.001 (0.022)	0.007 (0.020)			-0.013 (0.018)	0.003 (0.019)
τ_c	0.253*** (0.007)	0.242*** (0.008)	0.267*** (0.012)	0.260*** (0.012)	0.259*** (0.008)	0.250*** (0.008)	0.264*** (0.011)	0.257*** (0.012)
Obs	288	288	245	245	258	252	251	245
NC	31	31	28	28	29	29	28	28

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 13: Panel data GLS with Mendoza taxes, mar $\div$ pop

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.132*** (0.031)	0.250*** (0.032)	0.119*** (0.032)	0.229*** (0.032)				
π_D^2	-0.005*** (0.001)	-0.007*** (0.001)	-0.004*** (0.001)	-0.006*** (0.001)				
π_C					0.105*** (0.026)	0.183*** (0.029)	0.093*** (0.024)	0.142*** (0.029)
π_C^2					-0.004*** (0.001)	-0.005*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)
γ		0.168*** (0.017)		0.171*** (0.018)		0.174*** (0.018)		0.163*** (0.017)
u			-0.037 (0.031)	0.049 (0.032)			-0.047 (0.028)	0.045 (0.032)
τ_c	-0.050*** (0.012)	-0.031 (0.017)	-0.046*** (0.013)	-0.046** (0.015)	-0.002 (0.015)	-0.028 (0.016)	-0.027* (0.012)	-0.037** (0.014)
τ_h	0.112*** (0.009)	0.056*** (0.008)	0.111*** (0.012)	0.053*** (0.010)	0.095*** (0.009)	0.067*** (0.008)	0.112*** (0.010)	0.066*** (0.010)
τ_k	0.071*** (0.007)	0.099*** (0.006)	0.068*** (0.008)	0.096*** (0.007)	0.060*** (0.008)	0.093*** (0.006)	0.056*** (0.008)	0.089*** (0.008)
Obs	334	334	294	294	329	313	300	294
NC	18	18	17	17	17	17	17	17

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 14: Panel data GLS with Mendoza taxes, mar $\div$ single males 15-34

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.303*** (0.062)	0.429*** (0.043)	0.322*** (0.058)	0.397*** (0.048)				
π_D^2	-0.010** (0.003)	-0.016*** (0.002)	-0.009** (0.003)	-0.013*** (0.003)				
π_C					0.248*** (0.064)	0.238*** (0.057)	0.219*** (0.051)	0.226*** (0.054)
π_C^2					-0.008 (0.004)	-0.007 (0.004)	-0.003 (0.003)	-0.005 (0.003)
γ		0.225*** (0.033)		0.196*** (0.033)		0.209*** (0.036)		0.212*** (0.035)
u			0.069 (0.048)	0.088** (0.033)			0.041 (0.024)	0.092** (0.033)
τ_c	-0.085*** (0.014)	-0.103*** (0.012)	-0.050** (0.018)	-0.080*** (0.017)	-0.058* (0.024)	-0.089*** (0.016)	-0.043* (0.020)	-0.078*** (0.017)
τ_h	0.107*** (0.012)	0.064*** (0.008)	0.056*** (0.013)	0.050*** (0.012)	0.100*** (0.012)	0.082*** (0.008)	0.071*** (0.010)	0.064*** (0.012)
τ_k	0.078*** (0.011)	0.104*** (0.007)	0.088*** (0.011)	0.092*** (0.008)	0.086*** (0.010)	0.104*** (0.007)	0.088*** (0.011)	0.094*** (0.009)
Obs	191	191	179	179	191	189	180	179
NC	17	17	16	16	16	16	16	16

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 15: Panel data GLS, Mendoza sample countries without taxes, mar ÷ pop

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.799*** (0.033)	0.937*** (0.033)	0.517*** (0.027)	0.560*** (0.026)				
π_D^2	-0.028*** (0.002)	-0.031*** (0.002)	-0.017*** (0.001)	-0.016*** (0.001)				
π_C					0.524*** (0.032)	0.854*** (0.036)	0.445*** (0.026)	0.521*** (0.027)
π_C^2					-0.017*** (0.002)	-0.029*** (0.002)	-0.013*** (0.001)	-0.014*** (0.001)
γ		0.229*** (0.020)		0.163*** (0.015)		0.255*** (0.021)		0.161*** (0.015)
u			0.425*** (0.018)	0.409*** (0.015)			0.459*** (0.017)	0.436*** (0.014)
Obs	878	878	690	690	1050	812	714	689
NC	18	18	18	18	18	18	18	18

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 16: Panel data GLS, Mendoza sample countries without taxes, mar ÷ single males 15-34

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.988*** (0.054)	1.112*** (0.054)	0.668*** (0.046)	0.644*** (0.048)				
π_D^2	-0.040*** (0.004)	-0.045*** (0.004)	-0.024*** (0.003)	-0.022*** (0.003)				
π_C					0.732*** (0.058)	1.084*** (0.063)	0.645*** (0.047)	0.694*** (0.050)
π_C^2					-0.027*** (0.004)	-0.046*** (0.005)	-0.027*** (0.003)	-0.027*** (0.004)
γ		0.324*** (0.034)		0.178*** (0.026)		0.314*** (0.035)		0.160*** (0.026)
u			0.411*** (0.025)	0.389*** (0.022)			0.431*** (0.026)	0.397*** (0.023)
Obs	483	483	397	397	545	462	409	396
NC	18	18	18	18	18	18	18	18

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 17: Panel data GLS with Mendoza taxes, HP filtered, $\text{mar} \div \text{pop}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.372*** (0.052)	0.312*** (0.031)	0.424*** (0.054)	0.277*** (0.030)				
π_D^2	-0.016*** (0.003)	-0.012*** (0.002)	-0.019*** (0.003)	-0.010*** (0.002)				
π_C					0.335*** (0.056)	0.265*** (0.031)	0.353*** (0.052)	0.261*** (0.033)
π_C^2					-0.015*** (0.003)	-0.008*** (0.002)	-0.017*** (0.003)	-0.009*** (0.002)
γ		0.364*** (0.025)		0.342*** (0.024)		0.398*** (0.024)		0.415*** (0.027)
u			-0.121*** (0.027)	-0.053** (0.019)			-0.085*** (0.025)	-0.059* (0.024)
τ_c	-0.017 (0.020)	-0.040** (0.014)	-0.036 (0.019)	-0.008 (0.014)	-0.014 (0.019)	-0.008 (0.015)	-0.064*** (0.015)	-0.012 (0.014)
τ_h	0.058*** (0.009)	0.060*** (0.006)	0.074*** (0.011)	0.061*** (0.007)	0.058*** (0.010)	0.042*** (0.007)	0.084*** (0.010)	0.051*** (0.009)
τ_k	0.102*** (0.008)	0.076*** (0.007)	0.108*** (0.008)	0.067*** (0.007)	0.104*** (0.008)	0.076*** (0.006)	0.110*** (0.008)	0.080*** (0.007)
Obs	335	335	295	295	330	314	301	295
NC	18	18	17	17	17	17	17	17

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 18: Panel data GLS with Mendoza taxes, HP filtered, country fixed effect, $\text{mar} \div \text{pop}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.185*** (0.037)	0.213*** (0.031)	0.289*** (0.043)	0.264*** (0.034)				
π_D^2	-0.006** (0.002)	-0.007*** (0.002)	-0.011*** (0.002)	-0.009*** (0.002)				
π_C					0.121** (0.038)	0.206*** (0.030)	0.230*** (0.041)	0.232*** (0.033)
π_C^2					-0.004 (0.002)	-0.006*** (0.002)	-0.010*** (0.002)	-0.008*** (0.002)
γ		0.320*** (0.022)		0.340*** (0.025)		0.321*** (0.024)		0.361*** (0.026)
u			-0.127*** (0.023)	-0.083*** (0.022)			-0.151*** (0.025)	-0.103*** (0.022)
τ_c	0.120*** (0.030)	-0.002 (0.025)	0.129*** (0.031)	-0.019 (0.029)	0.097** (0.033)	0.019 (0.021)	0.115*** (0.034)	-0.026 (0.026)
τ_h	-0.050*** (0.015)	-0.057*** (0.015)	-0.042* (0.019)	-0.036* (0.018)	-0.059*** (0.017)	-0.030 (0.016)	-0.045* (0.020)	-0.033 (0.019)
τ_k	0.059*** (0.011)	0.087*** (0.010)	0.074*** (0.012)	0.096*** (0.010)	0.069*** (0.012)	0.075*** (0.011)	0.087*** (0.012)	0.098*** (0.010)
Obs	335	335	295	295	330	314	301	295
NC	18	18	17	17	17	17	17	17

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 19: Panel data GLS with Mendoza taxes, HP filtered, time fixed effect, $\text{mar} \div \text{pop}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	1.084*** (0.066)	0.576*** (0.059)	0.154* (0.062)	0.161*** (0.048)				
π_D^2	-0.054*** (0.004)	-0.027*** (0.003)	-0.007* (0.003)	-0.004* (0.002)				
π_C					1.119*** (0.070)	0.633*** (0.054)	0.137* (0.055)	0.204*** (0.045)
π_C^2					-0.054*** (0.004)	-0.029*** (0.003)	-0.005 (0.003)	-0.006** (0.002)
γ		0.537*** (0.034)		0.373*** (0.037)		0.583*** (0.032)		0.379*** (0.036)
u			-0.002 (0.025)	0.044 (0.026)			-0.002 (0.025)	0.039 (0.024)
τ_c	-0.176*** (0.011)	-0.095*** (0.012)	-0.135*** (0.011)	-0.102*** (0.011)	-0.142*** (0.010)	-0.082*** (0.011)	-0.122*** (0.012)	-0.106*** (0.010)
τ_h	0.193*** (0.016)	0.086*** (0.012)	0.043** (0.015)	0.024 (0.013)	0.154*** (0.014)	0.067*** (0.011)	0.038* (0.017)	0.028* (0.013)
τ_k	0.057*** (0.006)	0.064*** (0.005)	0.102*** (0.009)	0.083*** (0.008)	0.074*** (0.006)	0.062*** (0.005)	0.100*** (0.009)	0.081*** (0.008)
Obs	335	335	295	295	330	314	301	295
NC	18	18	17	17	17	17	17	17

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.

Table 20: Panel data GLS with Mendoza taxes, HP filtered, country and time fixed effect, $\text{mar} \div \text{pop}$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
π_D	0.487*** (0.053)	0.352*** (0.042)	0.174*** (0.038)	0.269*** (0.028)				
π_D^2	-0.020*** (0.003)	-0.013*** (0.002)	-0.004** (0.002)	-0.008*** (0.001)				
π_C					0.429*** (0.051)	0.371*** (0.037)	0.106** (0.033)	0.277*** (0.028)
π_C^2					-0.015*** (0.003)	-0.013*** (0.002)	-0.003 (0.001)	-0.008*** (0.001)
γ		0.275*** (0.030)		0.334*** (0.023)		0.370*** (0.027)		0.339*** (0.024)
u			-0.008 (0.022)	0.031 (0.021)			-0.049* (0.019)	0.036 (0.018)
τ_c	-0.043 (0.028)	-0.061* (0.025)	0.070** (0.026)	0.046* (0.018)	0.054 (0.032)	0.009 (0.023)	0.039 (0.025)	0.037 (0.019)
τ_h	0.057** (0.019)	0.037* (0.018)	0.050* (0.021)	0.035* (0.015)	0.064** (0.021)	0.064*** (0.019)	0.044* (0.020)	0.045** (0.017)
τ_k	0.014 (0.008)	0.036*** (0.008)	0.021* (0.009)	0.034*** (0.007)	0.017 (0.009)	0.035*** (0.007)	0.026** (0.008)	0.030*** (0.008)
Obs	335	335	295	295	330	314	301	295
NC	18	18	17	17	17	17	17	17

Notes: Standard errors in parentheses; p-values: *** p<0.01, ** p<0.05, *p<0.1; NC= # of countries.