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FAMILIES AS SHOCKS

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ABSTRACT

Families as Shocks*

In this Paper we show the quantitative importance of the process that determines changes in family composition to determine the main macroeconomic magnitudes. We do so by modelling family type as a stochastic process that affects households in a way similar to shocks to earnings. Agents respond to these processes by optimally choosing savings. We show that the size of savings differs dramatically depending on the details of the stochastic process. The model is quantitative: its fundamental parameters are estimated using US data.

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1 Introduction

There is a large literature both in macro and in applied micro (consumption, savings, labor) that considers shocks to earnings or to employment status under incomplete insurance markets as the major source of differential outcomes across households. However, besides changes in earnings, there are other events in people's lives that can also be thought as playing a major role in shaping economic performance, and, in particular, consumption and savings. We are thinking of marital status.[1] A measurement of the importance of shocks to earnings in shaping people's decisions is the size of precautionary savings (or wealth in excess of that that would exist absent idiosyncratic shocks to earnings). In this regard, Aiyagari (1994) obtained a point estimate for precautionary savings of 3%, and he also reports that a plausible range would include a value for precautionary savings of 14% under exceptional circumstances. More recently, and while more carefully accounting for earnings dispersion, Castañeda, Díaz-Giménez, and Ríos-Rull (2002) have found that shocks to earnings increase wealth by 5.5%.

In this paper we want to argue that the type of family structure in which an individual lives and its changes over time play a major role in shaping economic decisions. The argument is very simple: we treat family type as an exogenous event, as a shock generated by a stochastic process, and we show that the details of the process have dramatically different implications for the determination of economic aggregates such as aggregate savings.

The model that is needed for this purpose is an overlapping generations model with agents differing in sex and where their marital status is stochastic, that is embedded in a neoclassical growth model structure. Such a model is described in Section 2 and is a version of the model in Cubeddu, Nakajima, and Ríos-Rull (2001). Section 3 describes a baseline model economy where there are no changes in family status that is calibrated to match the main macroeconomic aggregates and some distributional features of the U.S. economy. This baseline model economy is a standard implementation of the U.S. economy within a life–cycle context in very much the way pioneered by Auerbach and Kotlikoff (1987) (and followed by many others like Altig and Carlstrom (1991) or Ríos-Rull (1996) to name a couple).

Next, in Section 4 we look at various economies where there are changes in agents' marital

[1]Family type is not alone in this regard, think of health.

status and we report their properties, especially those that pertain to the induced wealth to output ratios and the age profiles of assets for different marital status. We compare these economies with the baseline and show how different they are. Section 5 concludes.

2 The Model

The economy is populated by standard (as opposed to exponential population) overlapping generations of agents that is embedded into a standard neoclassical growth structure. At any point in time its living agents are indexed by: age, $i \in \{1, 2, \cdots, I\}$, sex, $g \in \{m, f\}$, we also use g^* to the denote the sex of the spouse; marital status, $z \in \{s_o, s_w, 1, 2, \cdots, I\}$, which includes being single without and with dependents and being married where the index denotes the age of the spouse, this characteristic is random, it follows a Markov process with transition $\pi_{i,g}$; and assets of the household to which the agent belongs $a \in A$. If we denote next period's values with primes, we have that $i' = i + 1$, that $g' = g$, and that the probability that an $\{i, g, z\}$ agent today has of moving to state z' is $\pi_{i,g}(z'|z)$. Assets vary both because of savings and because of changes in the composition of the household. Note that this specification implies that assets are not indexed by any circumstance associated to how they came to be. Once a couple is married all assets are shared. This is obviously a simplification since it is possible to have some protection of the assets brought to the marriage. The extent to which such a protection is effective is not clear, and may very well be small for the average household (those that are not very rich). We only look at economies in steady state which implies stationarity of aggregates. We next go over the details of this model.

Simplest Demographics. To avoid unnecessary complications, we assume that there is no population growth or early death. These two features add notational complexity without being quantitatively relevant (see (Ríos-Rull 1996)). Let $\mu_{i,g,z}$ denote the measure of type $\{i, g, z\}$ individuals. The assumptions that we have made imply

$$\mu_{i+1,g,z'} = \sum_z \pi_{i,g}(z'|z) \;\; \mu_{i,g,z} \tag{1}$$

There is an additional restriction on matrix π that has to be satisfied for internal consistency: the measure of age i males married to age j females equals the measure of age j females married to age i males, $\mu_{i,m,j} = \mu_{j,f,i}$.

Preferences and Endowments. Agents' preferences are standard and can be written as $E\left\{\sum_{i=1}^{I}\beta^{i-1}\, u_{i,g,z}(c)\right\}$, where the subindices of the utility function refer to the fact the household type affects the relation between consumption expenditures and consumption enjoyment. We assume the simplest form of equivalence scales: $u_{i,g,z}(c) = u\left(\frac{c}{\eta_{i,g,z}}\right)$.

Every period agents are endowed with $\varepsilon_{i,g,z}$ units of efficient labor. Note that in addition to age and sex, we are indexing this endowment by marital status. For most of the paper, earnings are independent of marital status, but in one example we let marital status affect earnings.

Technology. There is an aggregate neoclassical production function that uses aggregate capital (the only for of wealth holding) and efficient units of labor (that come from adding those of all agents). Capital depreciates geometrically.

Markets. Agents can save and those assets will be associated to whatever household the agent belongs to. What agents cannot do is to ensure themselves against the realizations of the marital status shocks. These markets do not exist in the world, perhaps for obvious moral hazard reasons. We also do not allow agents to borrow. This last assumption is essentially irrelevant as only the youngest households are typically interested in borrowing.

Distribution of assets of prospective spouses. When agents consider the event of getting married they have to understand what type of spouse they may get. Transition matrix π has the information about the age distribution, but this is not enough. Agents have to know the probability distribution of assets by agents' types, an endogenous object that we denote by $\phi_{i,g,z}$. This is a much taller order than that required in standard models with no marital status changes. Consequently, $\mu_{i,g,z}\ \phi_{i,g,z}(B)$ is the measure of agents type $\{i, g, z\}$ with assets in Borel set $B \subset A = [0, \overline{a}]$, where $\overline{a}$ is a non binding upper bound on asset holdings. Conditional on getting married to an age $j + 1$ person that is currently single without dependents, the probability that an age i, sex g single agent faces of receiving assets that are at most equal $\widehat{a}$ from its new spouse is given by

$$\int_A \chi_{y_{j,g^*,s_o}(a) \leq \widehat{a}} \quad \phi_{j,g^*,s_o}(da) \tag{2}$$

where χ is the indicator function, and where $y_{j,g^*,s_o}(a)$ is the savings of a type $\{j, g^*, s_o\}$ with wealth a. If either of the two agents is currently married the expression is more complicated because we have to distinguish the cases of keeping the same or changing spouse (see Cubeddu, Nakajima, and Ríos-Rull (2001) for details).

Single agent's problem. Given this specifications we can now pose the problem of a single agent, $z \in \{s_o, s_w\}$

$$v_{i,g,z}(a) = \max_{c \geq 0, y \in A} u_{i,g,z}(c) + \beta E\{v_{i+1,g,z'}(a')|z\} \qquad \text{s.t.} \tag{3}$$

$$c + y = (1+r)\, a + w\, \varepsilon_{i,g,z} \tag{4}$$

$$a' = \begin{cases} y & \text{if } z' \in \{s_o, s_w\}, \\ y + y_{z',g^*} & \text{if } z' \in \{1, .., I\}. \end{cases} \tag{5}$$

The one feature in this problem that is not standard is that if the agent gets married, the assets of the household become the sum of those brought by the two members of the couple. From the point of view of a single agent, the assets that are brought by its future spouse are a random variable with the probability distribution described above.

Married Couple's Problem. The household itself does not have an objective function. Its decisions are the outcome of a process that takes into account the assessment of the choices of the two spouses. Note that there is no agreement between the two spouses since they have different outlooks (in case of divorce they have different future earnings, and their life horizons may be different). Hence, a choice about how this decision is made has to be done. I make the following assumptions about the internal workings of a family

1. Spouses are constrained to enjoy equal consumption.

2. The household solves a joint maximization problem with weights: $\xi_{i,m,j} = 1 - \xi_{j,f,i}$.

3. Upon divorce, assets are divided, a fraction $\psi_{i,g,j}$: goes to the age i sex g agent and a fraction $\psi_{j,g^*,i}$ goes to the spouse. These two fractions may add to less than 1 because of divorce costs.

With these assumptions, the problem solved by the household is

$$\max_{c\geq 0, y\in A} \quad u_{i,g,j}(c) + \beta\,\xi_{i,g,j}\, E\{v_{i+1,g,z'_g}(a'_g)|j\} + \beta\,\xi_{j,g^*,i}\, E\{v_{j+1,g^*,z'_{g^*}}(a'_{g^*})|i\} \tag{6}$$

$$\text{s.t.} \quad c + y = (1+r)\,a + w(\varepsilon_{i,g,j} + \varepsilon_{j,g^*,i}) \tag{7}$$

$$a'_g = a'_{g^*} = y, \qquad \text{if no divorce,} \tag{8}$$

$$\left.\begin{aligned} a'_g &= \psi_{i,g,j}\ \ y, \\ a'_{g^*} &= \psi_{j,g^*,i}\ \ y, \end{aligned}\right\} \quad \begin{cases}\text{if divorce and}\\ \text{no remarriage,}\end{cases} \tag{9}$$

$$\left.\begin{aligned} a'_g &= \psi_{i,g,j}\ \ y + y_{z'_g,g^*}, \\ a'_{g^*} &= \psi_{j,g^*,i}\ \ y + y_{z_{g^*},g}. \end{aligned}\right\} \quad \begin{cases}\text{if divorce and}\\ \text{remarriage,}\end{cases} \tag{10}$$

This problem yields a solution that is $y_{i,g,j}(a) = y_{j,g^*,i}(a)$ and together with the distribution of prospective spouses it also yields the distribution of next period assets $a'_{i+1,g,z}$, and next period value functions, $v_{i+1,g,z'}(a')$.

Equilibrium. In addition to factor prices being factor's marginal productivities, equilibrium requires that agents solve their problem given factor prices and distribution of wealth ϕ,[2] and that there is consistency between the wealth distribution and individual behavior:

$$\phi_{i+1,g,z'}(B) = \sum_{z\in Z} \pi_{i,g}(z'|z) \int_{a\in A} \chi_{a'_{i,g,z}(a)\in B}\ \ \phi_{i,g,z}(da), \tag{11}$$

where again χ is the indicator function.

3 A baseline economy without demographic change

We now turn to describe the baseline model economy. Recall that it is an economy where all agents maintain the same marital status all their lives. In a sense this is the typical overlapping generations economy used often except for the fact that there are various types of households: an eighth of the agents are single with one dependent and high earning, another eighth are single without dependents and also high earnings, then there is a quarter of single low earnings agents half of which with dependants and half without. The remaining half of agents live as married couples with a spouse of the same age. Note that the high

[2] Recall that they use this distribution to assess the assets brought to the household by their prospective spouses.

earning agents are males and the low earnings are females which is the only feature that separates the sexes. The married agents have an age dependent number of children that peaks at age 43. There is no early mortality, no population growth, and no productivity growth, features that are not needed to study the possible importance of changes in marital status.

In this economy, earnings are independent of marital status and the economies of scale in consumption are standard (those of the OECD). Preferences of the CRRA class with a standard risk aversion coefficient of 1.5. The production function is Cobb-Douglas. This leaves three parameters to determine, the depreciation rate, the coefficient of capital in the production function and the discount rate. We set them so that the wealth to output ratio is 4.14, the investment to output ratio of 25% and labor share of 64%.

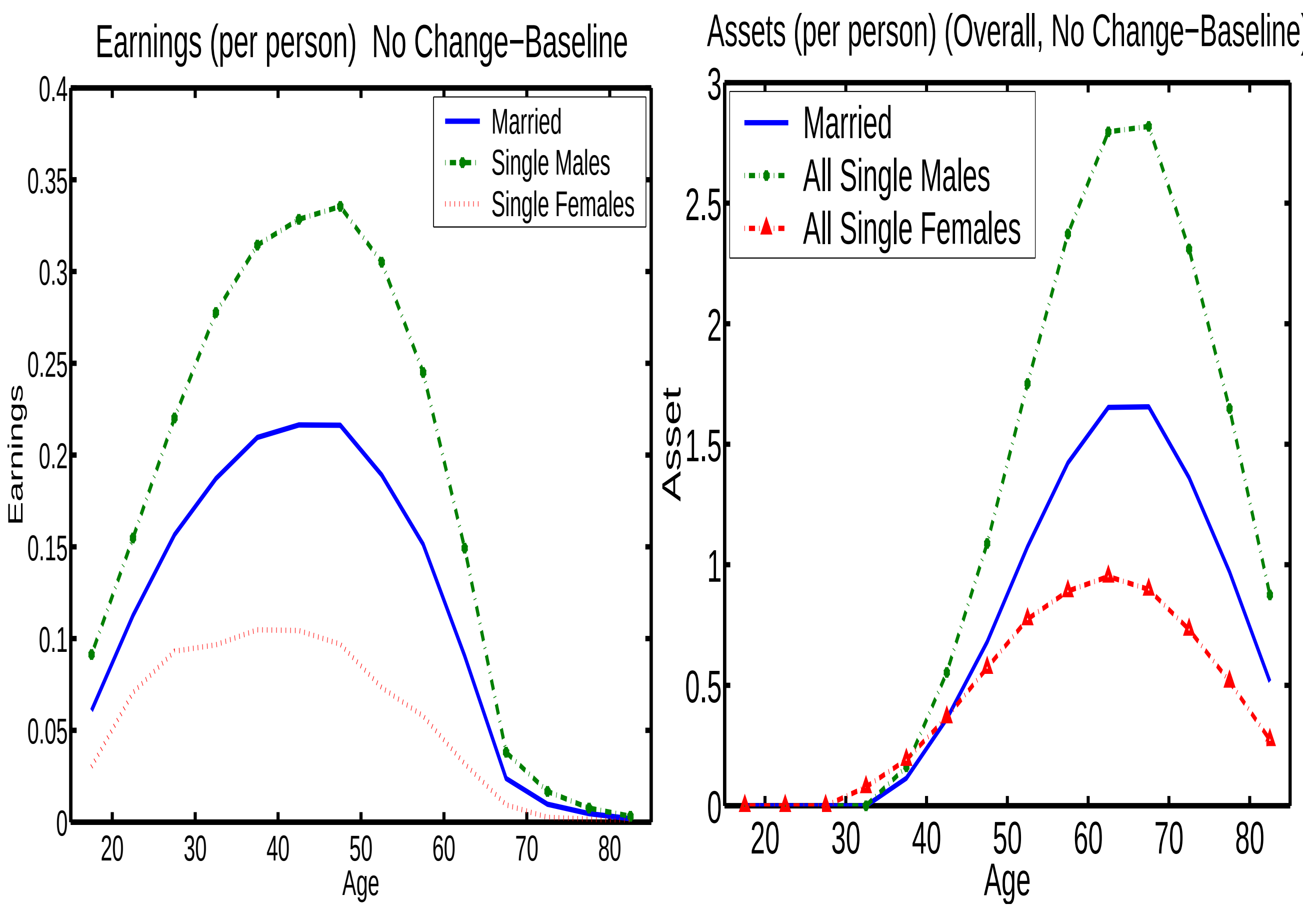

Figure 1: Earnings and assets per person for each type of household

Figure 1 shows the earnings per person of all household types in the left panel and the distribution of assets in the right panel. Note that while earnings are exogenous, assets held are endogenous. The shape of the assets are absolutely standard, with the traditional inverse u shape that arises in the absence of social security and any feature (such as leisure or early death) that dumpens consumption at later ages.

4 Other economies with changes in marital status

We now turn to explore the properties of four other economies that only differ in the properties of demographic process that drives marital status. All these economies generate the same aggregate number of marriages than the baseline and some of them the same distribution of marriages by age, while differing only in the process. For good measure we add an economy calibrated in detail to the U.S. in the nineties (see Cubeddu, Nakajima, and Ríos-Rull (2001)) to show that these economies are like the ones we are interested in in terms of their quantitative properties. Specifically they are *2)* an economy where all people start as singles (half with and half without dependents) and they all marry at age 47 (there is no divorce and the same marriages as in base); *3)* an economy where all people start married and they all divorce. One half ends up with dependents and one half without. Females keep 60% of assets, and males 40%; *4)* an economy where all people alternate, being one period married and one single (again 50% married, 25% singles with and 25% without); *5)* an economy where marital status is i.i.d and *6)* an economy like the U.S. in the nineties. Figure 2 depicts the population structure of all the model economies considered. As we can see, economies 1 through 5 have the same distribution of households by marital status, while economies 1, 4 and 5 have in addition the same joint distribution by age and marital status.

To compute the steady states of these economies there are two additional items that have to be specified, the relative weights of the spouses in the household decision problem and the sharing rule of assets upon divorce. In these economies all parties have the same weight in the maximization problem that the married household solves (note that since the weights enter the objective function this formulation imply that agents weighted marginal utilities are equal, but not that agents weighted utilities are equal).

We study these economies with and without assets destruction during divorce. When there is no asset destruction, the female gets a share of 60% and the male of 40%, while in

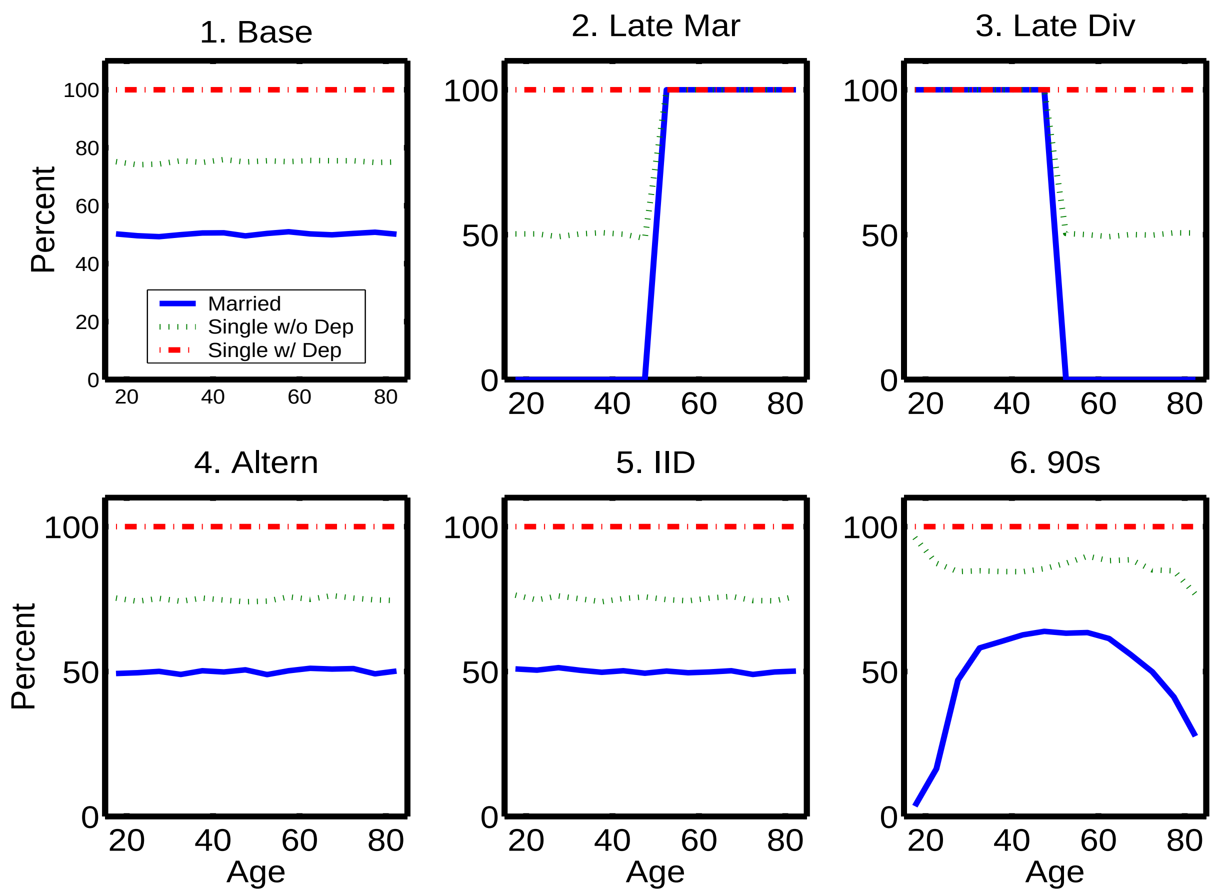

Figure 2: Population Structure of all economies, only females

the case of assets destruction we pose shares of 40% and 20%, assuming that the divorce costs amount to 20% of assets. The reason for the female getting more is as a compromise for the lack of modelling child support. While 20% of assets destruction may seem high, it should be noted that divorce occurs mostly at ages when agents have few assets.

There are two equilibrium properties of interest, aggregate wealth holdings and their distribution by age and marital status. Table 1 shows aggregate statistics, total wealth relative to the baseline model economy and the wealth to output ratio both with the interest rate fixed to that of the baseline (that we denote open economy) and with the interest rate adjusting to ensure that aggregate assets held by household equal aggregate capital (that we denote closed economy).[3] Obviously the differences with the baseline economy in the open

[3] Wealth of Economy 6 is not shown. Since the distribution of earnings is not the same due to the fact that in this economy marital status affects earnings, the only statistics shown are those that can be compared.

	Open Economy		Closed Economy		
	Wealth Relative		Wealth Relative		
Economy	to Baseline	W/Y	to Baseline	W/Y	r
1. Baseline	1.00	4.14	1.00	4.14	2.48%
2. Late Marriage	0.67	3.13	0.73	3.39	4.17%
3. Late Divorce	1.21	4.65	1.16	4.56	1.75%
4. Alternation	0.32	1.70	0.47	2.45	6.90%
5. i.i.d. Marital Status	0.64	3.01	0.70	3.25	4.40%
6. U.S. in the nineties	–	2.74	–	3.24	4.55%

Table 1: Aggregate statistics when there is no asset destruction during divorce

economies are larger than in the closed economies due to the adjustment in the interest rate.

The obvious message told by this table is that the effects of the specifics patterns that determine marital status can be huge, much larger than what is typically imputed to precautionary savings due to earnings uncertainty. We also see that the effects of marital status turnover do not always go in the same direction: while more changes typically induce a reduction in wealth, the economy with late divorce induces an increase. Females' lower earnings and higher share of assets upon divorce makes them want to save (equal weights in decisions). Future marriages create a free riding problem that produces a serious disincentive to savings, especially when marriage occurs at later ages. On the other hand, future divorces induce a desire to save more since future consumption goes down as a result of the loss of economies of scale provided by the marriage. The parameters of the weighting function and the asset sharing rule also play a role (as well as the differential time horizons in Economy 6).

Table 2 describes the same main aggregates when divorce generates asset destruction. As we see, whenever the economy has divorce, asset destruction reduces assets held. This effect is sufficient to overturn the increase in assets induced by late divorce in the economy without assets destruction. We also see that asset destruction can be quite large. Not only in the relative extreme cases that we have studied where they approach 5% of GDP but also in economies calibrated to match the U.S. (economy 6).

	Open Economy			Closed Economy		
	Wealth Relt			Wealth Relt		
Economy	to Baseline	W/Y	Destr.	to Baseline	W/Y	r
1. Baseline	1.00	4.14	0.0%	1.00	4.14	2.48%
2. Late Marriage	0.67	3.13	0.0%	0.73	3.39	4.17%
3. Late Divorce	0.92	3.91	4.4%	0.93	3.97	2.82%
4. Alternation	0.20	1.11	4.7%	0.28	1.73	10.85%
5. i.i.d. Marital Status	0.42	2.21	4.6%	0.52	2.70	6.31%
6. U.S. in the nineties	–	2.61	0.6%	–	3.13	4.86%

Table 2: Aggregate statistics when there is asset destruction during divorce

The bottom line of these two Tables is that, in general, marital instability is a serious disincentive to save. Divorce is a form of risk that may produce an incentive to increase savings. The actual net contribution of marital risk depends on the subtle properties of the model economy such as relative decision weights, rules to split the assets, time horizons and subsequent marriage patterns (all these features are explored in detail in Cubeddu, Nakajima, and Ríos-Rull (2001) and in Cubeddu, Hong, and Ríos-Rull (2002)).

Figure 3 depicts the age distribution of assets for households (top 6 graphs), males (next 6 graphs) and females (bottom 6 graphs). The baseline economy is standard, we see that in the economy with late marriages, there is very little saving while the agents are single since the incentives to save are too little (the spouse will both come with assets and will take have of those that an agent save). The economy with late divorce, however, shows a large amount of assets when agents are married, this is because it is when the agents have more income relative to consumption given the economies of scale when marrying. In the economies that where marital status is either i.i.d. or alternates assets holdings are quite low, and we see that the favorable divorce rules for women makes them relatively better off.

Figure 4 poses the saving rates by household, the counterpart to the depictions of the assets held by households. This Figure exacerbates what we have said. We see that married household save a lot more than singles. That a forecast of divorce increases savings, that alternating marital status dumpens savings dramatically so much that singles with dependents just do not save: it is the wrong time to do so.

5 Conclusion

In this paper we have argued that changes in marital status is an important determinant of aggregate economic variables. I have shown so by comparing a variety of economies that only differ in the process that determines marital status but they have the same cross-sectional composition of households. The baseline economy is a standard overlapping generations model calibrated to the main aggregates of the U.S. economy and where agents maintain their marital status all through their lives. The other economies are economies where agents change marital status (they marry late, they divorce late, they alternate and they suffer an i.i.d. process) plus an economy calibrated to the U.S. in the nineties. All these economies show enormous differences in their aggregate capital as well as in their savings patterns. The quantitative implications are of equal or larger magnitude by those implied by earnings uncertainty which are the central issue in studies of wealth dispersion and others where heterogeneity is central. With this paper we hope to have make the case for an increase concern about economists including macroeconomists of the role played by household formation in shaping the answers to the main questions that we address.

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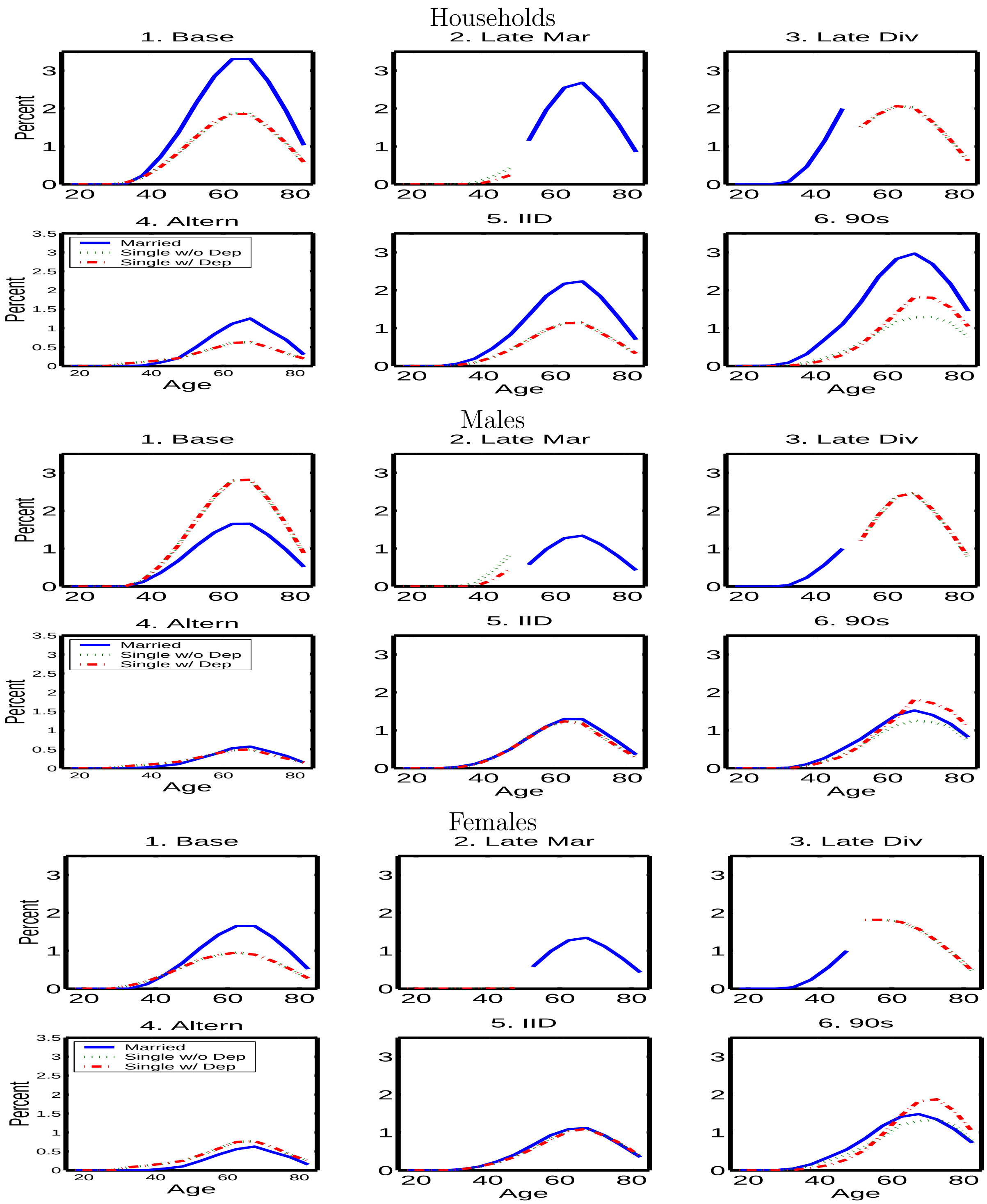

Figure 3: Asset Holdings of Households, 1st panel, Males, 2nd panel, and Females, 3rd panel

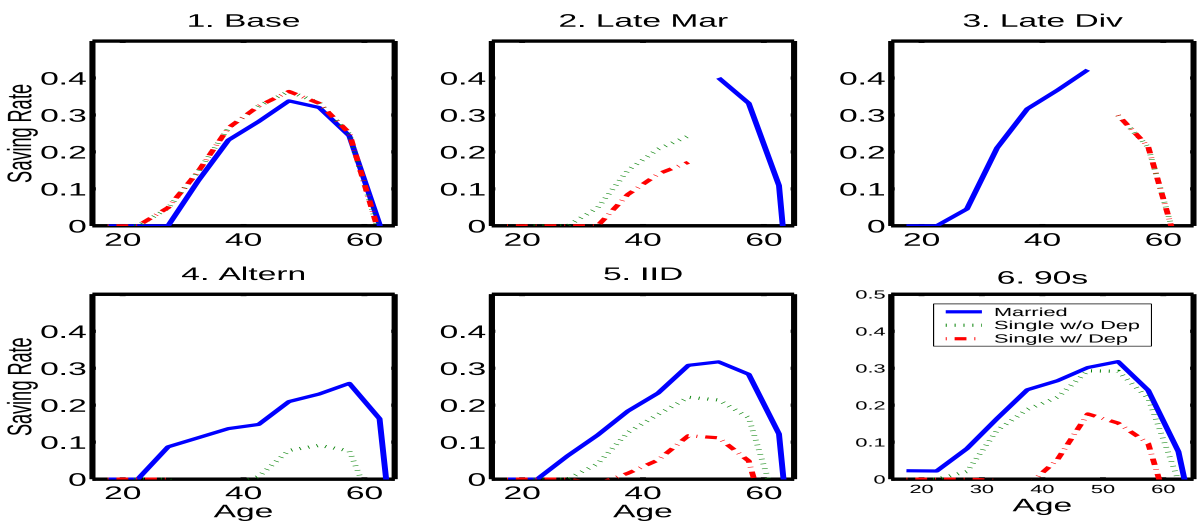

Figure 4: Age profile of saving rates