Review of Economic Studies (2023) **90**, 1642–1668 https://doi.org/10.1093/restud/rdac057

Advance access publication 18 August 2022

Wealth Dynamics in Communities

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First version received July 2021*; Editorial decision June* 2022*; Accepted August* 2022 (*Eds.*)

This article develops a model to explore how favour exchange influences wealth dynamics. We identify a key obstacle to wealth accumulation: wealth crowds out favour exchange. Therefore, households must choose between growing their wealth and accessing favour exchange. We show that low-wealth households rely on favour exchange at the cost of having tightly limited long-term wealth. As a result, initial wealth disparities persist and can even grow worse. We then explore how communities and policymakers can overcome this obstacle. Using simulations, we show that community benefits and place-based policies can stimulate both saving and favour exchange, and in some cases, can even transform favour exchange into a force that accelerates wealth accumulation.

Key words: Favour exchange, Wealth dynamics, Under-investment, Inequality.

JEL Codes: C73, D15, D31, O17

1. INTRODUCTION

Rising economic tides do not lift all households equally. Even in growing economies, some communities are left behind, with persistently lower wealth than surrounding areas. Such left-behind communities can be found in both rich and developing countries, and in both rural and urban areas.[1]

Faced with limited wealth, members of left-behind communities rely on one another for practical support (e.g. Kranton, 1996; Ali and Miller, 2016). Community members engage in all kinds of favour exchange, from the trade of food, lodging, and childcare within poor

1. Desmond (2012) and Hendrickson, Muro and Galston (2018) document left-behind communities in rich countries. Hoff and Sen (2006), Jakiela and Ozier (2016), and Munshi and Rosenzweig (2016) document such communities in developing countries.

The editor in charge of this paper was Andrea Galeotti.

neighbourhoods in Milwaukee (Desmond, 2012, 2016) to the exchange of rice and kerosene among villagers in India (Jackson, Rodriguez-Barraquer and Tan, 2012). By allowing households to procure goods and services without spending money, in-kind favour exchange frees up resources and therefore has the potential to lead to faster wealth accumulation. Yet in practice, favour exchange does not readily translate into growing wealth. Households instead struggle to "get by" (Warren, Thompson and Saegert, 2001), even when they have access to high-return savings opportunities like making productive investments or paying off high-interest debts (Ananth, Karlan and Mullainathan, 2007; Stegman, 2007; Bernheim, Ray and Yeltekin, 2015). Given that favour exchange frees up money that can then be saved and given the presence of high-return savings opportunities, why does community support not translate into growing wealth?

This article develops a model to study how favour exchange shapes wealth dynamics. While favour exchange could, in principle, encourage saving, it suffers from a commitment problem: households can renege on promised favours and instead use money alone to meet their needs. We show that this commitment problem prevents favour exchange from encouraging saving. Even worse, wealth actually crowds out favour exchange, so that households must keep their wealth artificially low in order to access favour exchange. The result is a persistent wealth gap between left-behind communities and the rest of the economy. We then explore how communities and policymakers can mitigate this tension between favour exchange and saving, and potentially even transform favour exchange into a force that encourages wealth accumulation.

The foundation of our analysis is a model that introduces endogenous wealth dynamics into favour–exchange relationships. A household faces a standard consumption–saving problem, with the twist that it can "purchase" consumption using not only money but also promises of future in-kind favours. The household cannot commit to following through on these promises, so they must be credible in the context of an ongoing favour–exchange relationship. In contrast to the literature on informal lending (e.g. Bulow and Rogoff, 1989; Ligon, Thomas and Worrall, 2000), favours are in-kind, so they add directly to the consumption utility of the household.

Using this model, we show that wealth undermines the trust that is essential for favour exchange. The reason is that even after losing access to favour exchange, households can use money to buy consumption. Wealthier households therefore have less to lose from not reciprocating favours; namely, they have better outside options to favour exchange. These households therefore have a weaker incentive to return favours. Recognizing this, community members are less willing to do favours for households that are expected to become wealthy in the future. In short, households that accumulate wealth become "too-big-for-their-boots" and lose access to community support.

Our main result characterizes how this "too-big-for-their-boots" mechanism constrains wealth accumulation and exacerbates long-term inequality. Equilibrium wealth dynamics are shaped by two forces. First, there is an initial *selection effect:* wealthy households opt out of favour exchange, while low-wealth households rely on it. Second, in response to the "too-big-for-their-boots" mechanism, households that rely on favour exchange engage in sharply constrained saving. Some households are so constrained that they even decrease their wealth over time. Consequently, for households that rely on favour exchange, long-term wealth remains substantially below what it would be without favour exchange. Together, the selection effect and the "too-big-for-their-boots" mechanism imply that initial wealth disparities between households persist and can even grow worse over time.

The "too-big-for-their-boots" mechanism resonates with sociological and ethnographic evidence on favour exchange in left-behind communities. Support for this mechanism dates back at least to Stack (1975)'s classic study of favour exchange in a low-wealth US community.

Stack (1975, p. 43) notes that the *wealthiest* members of that community are most at risk of being excluded from favour exchange:

> As people say, "The poorer you are, the more likely you are to pay back." This criterion often determines which kin and friends are actively recruited into exchange networks.

To explain why wealthier households are excluded, Stack (1975) suggests that everyone knows that these households can more easily leave the community and move to a nearby city. Portes and Sensenbrenner (1993), Briggs (1998), Dominguez and Watkins (2003), and others echo this tension between favour exchange and outside options. Our main result characterizes the dynamic implications of the "too-big-for-their-boots" mechanism for households' saving decisions.

Building on this result, we then explore how community leaders and policymakers can mitigate the "too-big-for-their-boots" mechanism. This mechanism arises because households cannot commit to repaying favours. We first prove that, if a household were able to commit, then favour exchange would unambiguously encourage wealth accumulation instead of discouraging it. This result suggests that easing the commitment problem can transform favour exchange into a force that accelerates wealth accumulation.

Using simulations, we show that communities can unlock this transformative effect by making non-favour-exchange benefits, such as participation in family, social, or religious activities, contingent on repaying past favours. For communities that provide these types of benefits, favour exchange can help at least some low-wealth households catch up to their wealthier peers. We link this analysis to examples of communities that appear to have successfully transformed favour exchange in this way.

Policymakers can similarly mitigate the "too-big-for-their-boots" mechanism using place-based policies, which provide benefits that are localized to a particular community (Austin, Glaeser and Summers, 2018). Using simulations, we show that these policies can relax the commitment problem and lead to higher long-term wealth in the community. While such policies cannot completely eliminate the wealth gap between low-wealth households and their wealthier peers, they can help left-behind communities by narrowing that gap.

A key feature of our model is that favour exchange is in-kind: community members trade consumption goods and services rather than borrowing and lending money. This distinction separates our article from the literature on informal lending (e.g. Bulow and Rogoff, 1989; Ligon *et al.*, 2000). We show that it is exactly this in-kind nature that allows favour exchange to flourish. Indeed, if favours were instead monetary, then favour exchange would be impossible in our setting. This impossibility result is almost identical to the impossibility result in Bulow and Rogoff (1989); it follows from the fact that when a household borrows money (i.e. receives monetary favours), it necessarily gets wealthier and so becomes less reliant on monetary favour exchange in the future. Monetary favour exchange is therefore self-defeating. In contrast, in-kind favour exchange is self-sustaining, because the household can engage in substantial favour exchange without becoming any wealthier.

1.1. *Related literature*

This article makes three contributions. First, we build a model that incorporates endogenous wealth dynamics into in-kind favour exchange. Second, we characterize the "too-big-for-their-boots" mechanism and demonstrate how it discourages saving and exacerbates wealth inequality. Third, we identify policies and community characteristics that can mitigate the "too-big-for-their-boots" mechanism and encourage wealth accumulation. We discuss the literature related to the first two contributions here, deferring the discussion of the third contribution to Section 5.

Our modelling approach draws from the literature on community enforcement and favour exchange (e.g. Hauser and Hopenhayn, 2008; Jackson *et al.*, 2012; Ambrus, Mobius and Szeidl, 2014; Ali and Miller, 2016, 2020; Miller and Tan, 2018; Sugaya and Wolitzky, 2021), and the literature on relational contracting (e.g. Levin, 2003; Malcomson, 2012). Our key departure from these papers is to introduce wealth as an endogenous state variable. This addition gives rise to the wealth dynamics that are at the core of our analysis.

In our model, the "too-big-for-their-boots" mechanism arises because market exchange acts as an endogenous outside option to favour exchange. Thus, our analysis builds on papers that study the role of outside options in relationships (e.g. Baker, Gibbons and Murphy, 1994; Kovrijnykh, 2013), as well as papers that study how favour and market exchange interact (e.g. Kranton, 1996; Banerjee and Newman, 1998; Gagnon and Goyal, 2017; Banerjee, Chandrasekhar, Duflo and Jackson, 2020; Jackson and Xing, 2020). Unlike those papers, the outside option in our setting evolves based on the household's saving decisions. This dynamic feedback is what leads to the "too-big-for-their-boots" mechanism. More distantly related are papers that study other types of distortions in communities, such as those that arise from signalling (e.g. Austen-Smith and Fryer, 2005) or hold-up (e.g. Hoff and Sen, 2006).

Our main result shows how persistent wealth inequality arises from the combination of a selection effect and the "too-big-for-their-boots" mechanism. The selection effect says that wealthy households opt out of favour exchange. By identifying how the value of favour exchange varies with wealth, this effect relates to papers that consider the costs and benefits of being part of a close-knit community (e.g. Kranton, 1996; Banerjee and Newman, 1998) and the role of wealth in migration decisions (e.g. Munshi and Rosenzweig, 2016). On its own, however, the selection effect is silent about how favour exchange influences saving decisions *within* communities. The "too-big-for-their-boots" mechanism addresses this gap by identifying a hidden cost of saving, which is that it undermines favour exchange.

Our analysis provides an explanation for the well-documented fact that poverty can persist even in the presence of high-return savings opportunities (e.g. Ananth *et al.*, 2007; Karlan, Mullainathan and Roth, 2019). In contrast to other explanations of under-saving, our mechanism does not rely on fixed costs of investment (e.g. Nelson, 1956; Advani, 2019), monopolistic credit markets (e.g. Mookherjee and Ray, 2002; Liu and Roth, 2022), or behavioural preferences (e.g. Banerjee and Mullainathan, 2010; Bernheim *et al.*, 2015). Thus, while we share Advani (2019)'s emphasis on favour exchange and Liu and Roth (2022)'s focus on outside options, our mechanism leads to persistently low wealth even in the absence of frictions like fixed-cost investments (in contrast to Advani, 2019) or monopolistic credit markets (in contrast to Liu and Roth, 2022). By connecting a household's saving decisions to its ability to engage in favour exchange, our mechanism leads to novel empirical predictions and policy prescriptions.

2. MODEL

A long-lived *household* ("it") has initial wealth $w_0 \geqslant 0$ and discount factor $\delta \in (0,1)$. The household starts in a community. At the beginning of each period $t \in \{0,1,...\}$, if the household still lives in the community, then it can choose to either stay or move to a city. Once it moves to the city, it remains there forever.

If the household is in the community in period t, then it plays the following *community game* with a short-lived *neighbour t* ("she"), who is another member of the community:

1. The household requests a consumption level $c_t \geqslant 0$ and offers a payment $p_t \geqslant 0$ in exchange.[2] The payment cannot exceed the household's wealth, $p_t \leqslant w_t$.
2. Neighbour t either accepts or rejects this exchange, $d_t \in \{1,0\}$. If she accepts ($d_t = 1$), then she receives p_t and incurs the cost of providing c_t. If she rejects ($d_t = 0$), then no trade occurs.
3. The household decides how much of a favour, $f_t \geqslant 0$, to perform for neighbour t. The household incurs the cost of providing f_t.
4. The household invests its remaining wealth, $w_t - p_t d_t$, to generate w_{t+1}. Let $R(\cdot)$ denote the return on investment, so that $w_{t+1} = R(w_t - p_t d_t)$.

Let $U(\cdot)$ be the household's consumption utility in the community. The household's period-t payoff in the community is $\pi_t = U(c_t d_t) - f_t$. Neighbour t's payoff is $(p_t - c_t)d_t + f_t$. The community is tight-knit and so all actions are observed by all neighbours.

We assume that consumption utility $U(\cdot)$ and investment returns $R(\cdot)$ are strictly increasing, with $U''(\cdot)$ and $R'(\cdot)$ continuous, $U(0) = R(0) = 0$, $U(\cdot)$ strictly concave, $R(\cdot)$ concave, $\lim_{c \downarrow 0} U'(c) = \infty$, and $\lim_{c \to \infty} U'(c) = 0$. We say that investment *generates positive returns* at investment level w if $R'(w) \geqslant \frac{1}{\delta}$. We assume that $R'(w) > \frac{1}{\delta}$ for $w < \bar{w}$ and $R'(w) = \frac{1}{\delta}$ for $w \geqslant \bar{w}$, so that investment generates positive returns at all investment levels and strictly so below a threshold $\bar{w} > 0$. Investment returns are deterministic in this model; we discuss the case with stochastic returns in Section 7 and analyse this case in Supplementary Appendix C.

If the household has moved to the city by period t, then it plays the *city game* with a short-lived *vendor t* ("she"), who has the same actions and payoff as neighbour t. The city game is identical to the community game in all but two ways. First, each vendor observes only her own interaction with the household, so interactions are anonymous in the city. Second, the household's marginal utility of consumption is weakly higher in the city. Formally, the household's period-t payoff in the city is $\pi_t = \hat{U}(c_t d_t) - f_t$, where $\hat{U}(\cdot)$ satisfies the same regularity conditions as $U(\cdot)$, with $\hat{U}'(c) \geqslant U'(c)$ for all $c > 0$.

The household's continuation payoff at the beginning of period t is

$$\Pi_t = (1-\delta)\sum_{s=t}^{\infty} \delta^{s-t} \pi_s.$$

We characterize household-optimal equilibria, which are the perfect Bayesian equilibria that maximize the household's *ex ante* expected payoff. Without loss of generality, we assume that the household leaves the community if it is indifferent between staying and leaving.

The following assumption ensures that in equilibrium, households that stay in the community have access to strictly positive-return investments.

Assumption 1. *Define $\bar{c} > 0$ as the solution to $U'(\bar{c}) = 1$. Then, $R(\bar{w} - \bar{c}) > \bar{w}$.*

In the context of Stack (1975), the household and neighbours are members of a low-income Midwestern community called "the Flats". Members of this community regularly exchange food,

2. Restricting p_t to be non-negative means that the household cannot borrow money from neighbour t. This restriction is not important for our main result; Proposition 2 still holds if we allow $p_t < 0$, and the proof of this result goes through without change.

clothing, childcare, lodging, and other goods and services (c_t). To compensate one another, households can pay with money (p_t) and "pay" with future favours (f_t). For example, the recipient of childcare ($c_t > 0$) can reciprocate with future childcare ($f_t > 0$). These favours are in-kind, in the sense that they involve directly trading goods and services. Households accumulate wealth ($R(\cdot)$) by repaying high-interest debt or making other investments. The Flats is a tight-knit community and "everyone knows who is working, when welfare checks arrive, and when additional resources are available" (p. 37), as well as who has reneged on promised favours. Households in the Flats can move to a nearby city, Chicago, which harbours greater opportunities ($\hat{U}' \geqslant U'$) but separates them from their favour–exchange network.

In Supplementary Appendices D.1, D.2, and D.3, we prove that our main findings are robust to relaxing several modelling assumptions. While we assume that moving to the city is irreversible, a version of our main result holds even if the household can return to the community after leaving. Neither is it essential for the household's cost of providing f_t to be linear; we prove a similar result if the cost of providing f_t is convex.[3] Finally, we show that our analysis still holds if we replace the sequence of short-lived neighbours in the community with a single long-lived neighbour.

We model the city as an alternative location to the community. In Supplementary Appendix D.4, we prove that our main result holds if we eliminate the city and instead assume that deviations are punished by reversion to a Markov perfect equilibrium in the community. Note that Markov perfect equilibrium is not necessarily the harshest way to punish the household.[4] Subject to this caveat, we show that wealth crowds out favour exchange even in a model without the city, since wealthier households are better able to meet their needs using money alone. Given the equivalence between the two models, we include the city in our analysis in order to match our applications, which typically include mobility across locations, and to derive empirical and policy implications. In applications that do not have mobility across locations, one can interpret "leaving for the city" as opting out of favour exchange in the community.

3. LIFE IN THE CITY

We begin by characterizing wealth dynamics in the city. The household faces a standard consumption-saving problem. It takes full advantage of investment opportunities and accumulates wealth.

Interactions are anonymous in the city, so $f_t = 0$ in equilibrium. Vendor t is therefore willing to accept an offer only if the payment covers her cost (i.e. $p_t \geqslant c_t$), and strictly prefers to do so if $p_t > c_t$. Consequently, every equilibrium entails $p_t = c_t$ in every $t \geqslant 0$, so that $w_{t+1} = R(w_t - c_t)$. For a household with wealth w, the resulting optimal payoff and consumption are given, respectively, by:

$$\hat{\Pi}(w) = \max_{c \in [0,w]} \Big((1-\delta)\hat{U}(c) + \delta \hat{\Pi}\left(R(w-c)\right) \Big) \text{ and}$$

$$\hat{C}(w) \in \arg\max_{c \in [0,w]} \Big((1-\delta)\hat{U}(c) + \delta \hat{\Pi}\left(R(w-c)\right) \Big).$$

Our first result shows that in any equilibrium of the city, the household consumes $\hat{C}(w_t)$ and its payoff is $\hat{\Pi}(w_t)$. Moreover, both consumption and wealth increase over time, with long-term wealth above $R(\bar{w})$.

3. As a special case, the cost of providing f_t could be $U^{-1}(f_t)$, in which case neighbours value the favour in the same way as the household values consumption.

4. Supplementary Appendix D.4 also presents an alternative model that allows us to dispense with the assumption that deviations are punished by reversion to Markov perfect equilibrium.

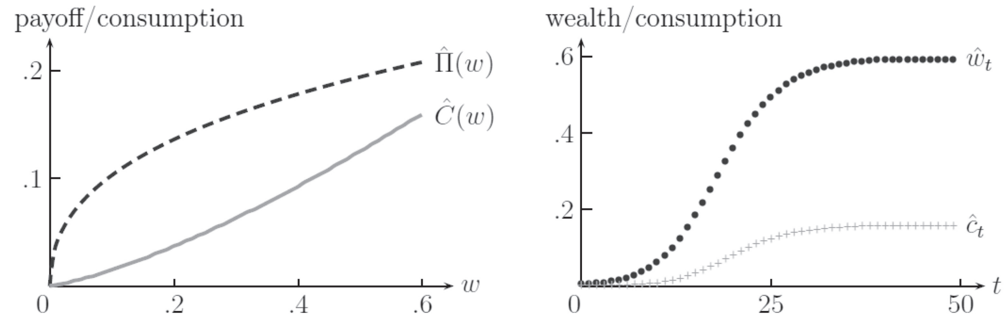

FIGURE 1

Left panel: The household's equilibrium payoff and consumption in the city as a function of w. Right panel: Consumption and wealth over time in the city, starting at $w_0 = 0.006$.

Proposition 1. *Both $\hat{\Pi}(\cdot)$ and $\hat{C}(\cdot)$ are strictly increasing, with $\hat{\Pi}(\cdot)$ continuous. In any equilibrium of the city, $\Pi_t = \hat{\Pi}(w_t)$ and $c_t = \hat{C}(w_t)$ in any $t \geqslant 0$, with $(w_t)_{t=0}^{\infty}$ increasing and*

$$\lim_{t\to\infty} w_t \geq R(\bar{w})$$

on the equilibrium path.

The proof of Proposition 1 is routine and relegated to Appendix B. Since $R'(w) > \frac{1}{\delta}$ for $w < \bar{w}$, the standard Euler equation,

$$\hat{U}'(\hat{C}(w_t)) = \delta R'(w_t - \hat{C}(w_t))\hat{U}'(\hat{C}(w_{t+1})), \forall t, \tag{Euler}$$

implies that the household's long-term wealth is at least $R(\bar{w})$ in the city. Figure 1 simulates equilibrium outcomes in the city.[5]

4. WEALTH DYNAMICS IN THE COMMUNITY

This section characterizes household-optimal equilibria for a household starting in the community. Section 4.1 presents our main result, which shows that households that rely on favour exchange have sharply limited long-term wealth. Section 4.2 discusses empirical implications of this result.

4.1. *Underinvestment and persistent inequality*

Our main result identifies two reasons why wealth in the community remains substantially below wealth in the city. First, there is a selection effect: sufficiently wealthy households leave the community, whereas poorer households stay. Second, the "too-big-for-their-boots" mechanism constitutes an extra cost of investment in the community, resulting in sharply limited long-term wealth for households that stay.

5. Parameters in Figures 1–3 are $\delta = \frac{8}{10}$, $U(c) = \frac{\sqrt{c}}{2}$, $\hat{U}(c) = \frac{13\sqrt{c}}{25}$, and

$$R(w) = \begin{cases} 3\left(\sqrt{w+1}-1\right) & w \leqslant \frac{11}{25}; \\ \frac{5w}{4} + \frac{1}{20} & \text{otherwise.} \end{cases}$$

The community's sole advantage over the city is that favour exchange can augment consumption in the community but not in the city. In particular, neighbours are able to observe and punish a household that reneges on $f_t > 0$. Consequently, the household can credibly promise $f_t > 0$ to repay neighbour t for providing consumption. Given a credibly promised favour $f_t > 0$, neighbour t is willing to accept any request that satisfies $c_t \le p_t + f_t$.

To understand the selection effect, note that the opportunity to engage in favour exchange is most attractive to low-wealth households, which would otherwise have low consumption and a high marginal utility of consumption. Conversely, wealthy households already consume a lot, so their marginal utility from further increasing c_t is low. Thus, wealthy households leave the community while low-wealth households stay.

To understand the "too-big-for-their-boots" mechanism, consider a household with wealth w_t that stays in the community, consumes $c_t = p_t + f_t$, and invests $I_t = w_t - p_t$. Since the household can renege on f_t, leave the community, and earn $\hat{\Pi}(R(I_t))$ in the city, the *maximum* favour that can be sustained in equilibrium depends on the investment I_t. Denote a household's maximum continuation payoff if it is in the community and has wealth $R(I_t)$ by $\Pi^*(R(I_t))$. Then, f_t must satisfy the following *dynamic enforcement constraint*:

$$f_t \leqslant \bar{f}(I_t) = \frac{\delta}{1-\delta}(\Pi^*(R(I_t)) - \hat{\Pi}(R(I_t))). \tag{DE}$$

This constraint ensures that the household prefers to do favour f_t and earn continuation payoff $\Pi^*(R(I_t))$, rather than reneging on f_t and earning punishment payoff $\hat{\Pi}(R(I_t))$.

If (DE) binds, then changing I_t affects the size of the favour, f_t, which affects period-t consumption because $c_t = p_t + f_t$. The "too-big-for-their-boots" mechanism holds when $\bar{f}(I_t)$ is decreasing in I_t, so that investment crowds out favour exchange. When this occurs, the standard cost–benefit tradeoff captured by the Euler equation, (Euler), is augmented by an extra cost: the favour f_t, and so consumption c_t, decrease as investment increases. Consequently, the household optimally invests less than the investment that would satisfy (Euler). This is the sense in which a household in the community underinvests.

This intuition elides a key complication: $\bar{f}(\cdot)$ depends on both $\Pi^*(\cdot)$ and $\hat{\Pi}(\cdot)$, which in turn depend on the household's future decisions about consumption, favour exchange, and investment. Wealth affects all of these decisions, rendering a full characterization of household-optimal equilibria intractable. The central difficulty is that the presence of equilibrium continuation payoffs in (DE) rules out standard dynamic programming techniques.[6]

Given this challenge, our main result, Proposition 2, focuses on the selection effect and the "too-big-for-their-boots" mechanism. *Selection* is summarized by a wealth threshold, $w^{se} < \bar{w}$, and a set $\mathcal{W} \subseteq [0, w^{se}]$ with $\sup \mathcal{W} = w^{se}$. The household stays forever if $w_0 \in \mathcal{W}$ and otherwise leaves the community immediately. The *"too-big-for-their-boots" mechanism* is summarized by a wealth level, $w^{tr} < w^{se}$, such that the long-term wealth of a household that stays in the community is below w^{tr}. Since $w^{tr} < w^{se} < R(\bar{w})$, the long-term wealth in the community is substantially below the long-term wealth in the city. Moreover, a household that stays with wealth $w_0 \in (w^{tr}, w^{se})$ has strictly declining wealth over time. This is the sense in which wealth inequality persists and can grow worse over time.

6. Marcet and Marimon (2011) develop recursive techniques that can handle endogenous state variables (i.e. wealth) and forward-looking constraints (i.e. (DE)). While these techniques are a powerful tool for computation and certain kinds of partial characterization, it is not clear to us how to apply them to strengthen our characterization. Our focus on the selection effect and the "too-big-for-their-boots" mechanism leads us to take a different approach to the proof.

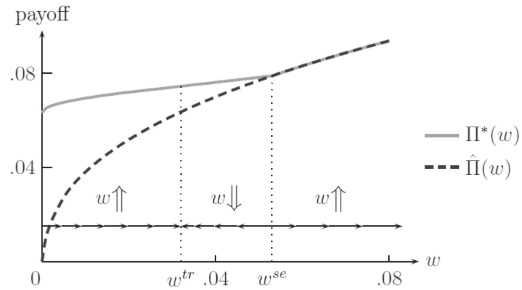

FIGURE 2

Household-optimal equilibrium payoffs and wealth dynamics.

Proposition 2. *Impose Assumption 1. There exist wealth levels w^{tr} and w^{se} satisfying $0 \leq w^{tr} < w^{se} < \bar{w}$, and a positive-measure set $\mathcal{W} \subseteq [0, w^{se}]$ with $\sup \mathcal{W} = w^{se}$, such that in any household-optimal equilibrium:*

1. ***Selection.*** *The household stays in the community forever if $w_0 \in \mathcal{W}$, and otherwise leaves in period 0.*
2. ***"Too-big-for-their-boots" mechanism.*** *If the household stays in the community, then $(w_t)_{t=0}^{\infty}$ is monotone, with*

$$\lim_{t \to \infty} w_t \leqslant w^{tr}.$$

Moreover, $\mathcal{W} \cap [w^{tr}, w^{se}]$ has a positive measure.

The proof of this result is in Appendix A. We have already argued that sufficiently wealthy households leave the community, giving us the selection threshold w^{se}, while some poorer households stay, giving us the set $\mathcal{W}$. Moreover, any household that stays in $t=0$ stays forever. The reason is that a household that leaves in period $t>0$ cannot engage in favour exchange during period $(t-1)$, so it might as well leave in period $(t-1)$. Iterating this argument, such a household might as well leave in period 0.

To understand why long-term wealth in the community is below w^{tr}, consider a household that stays with wealth *just below* w^{se}. Such a household is close to indifferent between leaving and staying. Since staying implies that wealth remains below w^{se}, which is lower than long-term wealth in the city, this household optimally stays only if it engages in significant favour exchange in some period; that is, only if $f_t \gg 0$ in some t. If the household's wealth always remains near w^{se}, then the right-hand side of the dynamic enforcement constraint, (DE), is close to zero, so $f_t \approx 0$ in every $t \geq 0$. Therefore, for $f_t \gg 0$ to be sustainable in equilibrium, the household must underinvest so severely that its wealth decreases. We conclude that long-term wealth in the community is below some level, w^{tr}, which is below the selection threshold w^{se} and so sharply below the long-term wealth in the city. The Proof of Proposition 2 strengthens this result by showing that $(w_t)_{t=0}^{\infty}$ is monotone in the community and that a positive measure of households, $\mathcal{W} \cap [w^{tr}, w^{se}]$, stay in the community. These households have decreasing wealth.

Figure 2 summarizes Proposition 2. In this simulation, the household moves to the city if $w_0 \geqslant w^{se}$ and otherwise stays in the community. Among those that stay, households with $w_0 < w^{tr}$ grow their wealth, but only up to w^{tr}. Those with $w_0 \in (w^{tr}, w^{se})$ have declining wealth over time.[7]

7. Note that in this simulation, $\Pi^*(w) > \hat{\Pi}(w)$ for all $w < w^{se}$ and $\Pi^*(w) = \hat{\Pi}(w)$ for all $w \geq w^{se}$. This property holds in every simulation that we have run, but we have not been able to prove that it is true in general.

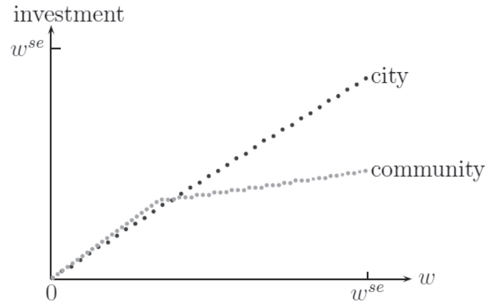

FIGURE 3
Investment in the city vs. in the community.

4.2. *Empirical implications*

An immediate implication of Proposition 2 is that one-time transfers do not necessarily improve long-term wealth. In Figure 2, consider transferring money to a household with initial wealth $w_0 < w^{se}$. If the household's post-transfer wealth is still below w^{se}, then this extra money is consumed rather than saved, and long-term wealth remains below w^{tr}. This implication resonates with Karlan *et al.* (2019), who study what happens when indebted individuals receive one-time debt relief. Consistent with Figure 2, they find that recipients tend to quickly fall back into debt. In contrast, a transfer that is large enough to bring wealth above w^{se} induces further investment, but only by spurring the household to opt out of favour exchange.

We use numerical simulations to explore further implications of our model. Figure 3 identifies a key non-monotonicity in how favour exchange affects wealth accumulation. This figure plots investment as a function of the household's current wealth both in the city (the sparsely dotted curve) and in the community (the densely dotted curve). As expected, the wealthier households in the community underinvest relative to the city; however, the poorest households invest strictly *more* than they would in the city. The reason is that the outside option for the poorest households is so low that the dynamic enforcement constraint, (DE), does not bind. These households optimally invest all of their wealth and rely on favour exchange to meet their needs. Of course, these households eventually reach wealth levels where (DE) binds, at which point the "too-big-for-their-boots" mechanism kicks in and limits their long-term wealth. Nevertheless, this simulation result shows that favour exchange has the potential to free up resources and thereby accelerate wealth accumulation. We explore this idea further in Section 5.

Our model also sheds light on how changes in more prosperous areas can spill over into left-behind communities. For instance, productivity has diverged across localities in the US over the past 20 years, with the most productive metropolitan areas growing even more productive relative to the rest of the country (Parilla and Muro, 2017). Figure 4 illustrates how growing productivity in the city, which we model by multiplying $\hat{U}$ by a constant strictly larger than 1, affects wealth dynamics in the community.[8] While nothing material has changed within the community, increasing $\hat{U}$ in this way translates into a higher outside option and so tightens (DE). Households in the community respond by investing less, leading to lower long-term wealth, w^{tr}.

8. The simulation for "lower $\hat{U}$" uses parameters identical to those in Figures 1–3. For "higher $\hat{U}$", parameters are the same except that $\hat{U}(c) = \frac{27\sqrt{c}}{50}$.

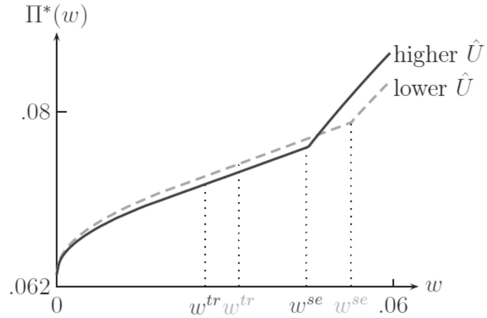

FIGURE 4

Simulated comparative statics with respect to $\hat{U}(\cdot)$. To create "higher $\hat{U}$", we multiply "lower $\hat{U}$" by a constant strictly larger than 1.

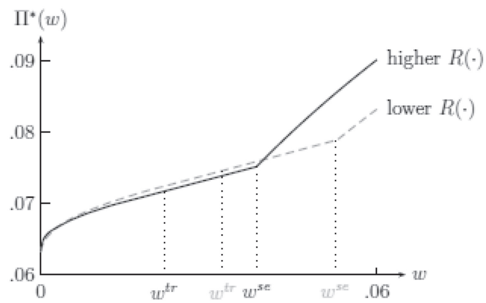

FIGURE 5

Simulated comparative statics with respect to $R(\cdot)$. To create "higher $R(\cdot)$," we multiply "lower $R(\cdot)$" by a constant strictly larger than 1 and then adjust it so that the resulting return function satisfies the conditions imposed in Section 2.

Figure 5 shows that increasing the returns to investment, $R(\cdot)$, can tighten (DE) in a way that is similar to increasing $\hat{U}$.[9] The reason is that increasing $R(\cdot)$ disproportionately benefits a household in the city since investment is higher in the city than in the community. For many households in the community, increasing $R(\cdot)$ therefore decreases equilibrium payoffs. Note, however, that this effect is not uniformly negative in the community. A household with w_0 close to 0 benefits from higher $R(\cdot)$, since it invests substantially while facing a relatively slack (DE) constraint.

5. TRANSFORMING FAVOUR EXCHANGE

While favour exchange increases consumption in left-behind communities, the accompanying "too-big-for-their-boots" mechanism is a serious obstacle to wealth accumulation. In this section, we explore how communities and policymakers can mitigate this obstacle, or even transform favour exchange into a force that accelerates wealth accumulation. Section 5.1 proves that with

9. The line labelled "lower $R(\cdot)$" uses parameters identical to those in Figures 1–3. For "higher $R(\cdot)$", the only difference is that $R(\cdot)$ is given by

$$R(w)=\begin{cases}\frac{31}{10}\left(\sqrt{w+1}-1\right) & w\leq\frac{336}{625}\\ \frac{5}{4}\left(w-\frac{336}{625}\right)+\frac{93}{125} & \textit{otherwise.}\end{cases}$$

This investment return function is obtained by multiplying the investment return function for "lower $R(\cdot)$" by a constant strictly greater than 1, then adjusting the resulting function so that it has a well-defined wealth level $\bar{w}$ above which $R'(w)=1/\delta$.

commitment, favour exchange leads to *faster* wealth accumulation than would occur in the city. Informed by this result, Section 5.2 explores practical ways to relax the household's commitment problem.

5.1. *With commitment, favour exchange accelerates wealth accumulation*

Define the *model with commitment* identically to the baseline model in Section 2, except that the household can commit to following through on promised favours. Formally, if the household is still in the community at the start of period $t \geq 0$, then it chooses a promised favour, $f_t^* \geq 0$, at the same time as it chooses the payment, p_t, and the consumption request, c_t. The promised favour is observed by all neighbours. If neighbour t accepts the request, then the household is committed to following through on its promised favour: $f_t = f_t^*$. If neighbour t rejects the request, then $f_t = 0$. We assume that favour exchange is not possible in the city, so as in Section 3, the household earns continuation payoff $\hat{\Pi}(w_t)$ if it leaves the community at the start of period t.

Recall that $\hat{C}(w_t)$ is the household's equilibrium consumption in the city, so that investment in the city equals $w_t - \hat{C}(w_t)$. We say that favour exchange *accelerates wealth accumulation* if a household that stays in the community invests strictly more than it would in the city. Our next result shows that favour exchange unambiguously accelerates wealth accumulation in the model with commitment.

Proposition 3. *Consider a household in the community with initial wealth $w_0 > 0$. In the model with commitment, there exists a household-optimal equilibrium in which the household leaves at the start of period $\tau < \infty$. For any $t < \tau$, the household invests more than it would in the city by choosing $I_t = w_t - p_t > w_t - \hat{C}(w_t)$. Moreover, for any $t < \tau - 1$, the household invests its entire wealth by choosing $p_t = 0$, so that $I_t = w_t$.*

The Proof of Proposition 3 is in Appendix B. Favour exchange allows the household to meet its needs with favours and invest the money it would have otherwise used for consumption. Indeed, the household optimally invests its entire wealth in every period until it is about to leave the community. To see why, consider the problem of maximizing the household's payoff while in the community, subject to holding fixed its continuation payoff upon leaving, $\hat{\Pi}(w_\tau)$, and its total discounted cost of favours, $\sum_{t=0}^{\tau-1} \delta^t f_t$. Holding this "budget" of favours fixed, the household can decrease f_t at rate 1 in order to increase f_{t+1} at rate $\frac{1}{\delta}$. Holding w_τ, and hence $\hat{\Pi}(w_\tau)$, fixed, the household can decrease payment p_t at rate 1 in order to increase p_{t+1} at rate $R'(w_t - p_t)$. Since $R'(w_t - p_t) \geq \frac{1}{\delta}$, the household gets higher returns from delaying monetary payments relative to delaying favours. It therefore relies entirely on favour exchange in early periods and entirely on monetary payments in later periods. Once it starts relying on monetary payments alone, the household optimally leaves the community.

5.2. *Ways to increase long-term wealth*

Proposition 3 implies that relaxing the household's commitment problem can mitigate the tension between favour exchange and investment. In this section, we show that both community leaders and policymakers have tools to accomplish this goal, although they do so in different ways.

The unifying feature of these tools is that they relax the dynamic enforcement constraint, (DE), by increasing the household's on-path payoff relative to its payoff from reneging and leaving for the city. Communities can relax this constraint by directly conditioning non-favour-exchange benefits (e.g. family, social, or religious ties) on the household's favour-exchange behaviour.

Policies cannot condition on a household's favour-exchange behaviour in this way, but they can still relax (DE) by increasing the benefits of staying in the community rather than leaving.

5.2.1. Community benefits. Thus far in our model, the only reason for the household to repay favours is to access future favours. In reality, households sometimes repay favours to avoid losing access to other benefits that communities provide (Ambrus *et al.*, 2014). They might do so to maintain warm relationships with their friends, to keep their family happy, or to remain a respected member of their social or religious community.

These types of community benefits have two properties that help transform favour exchange. First, benefits can be conditioned on the household's behaviour, and in particular, they can be withheld if the household reneges on a promised favour. Second, a household values these benefits even after it no longer relies on favour exchange. We therefore treat these benefits as being available in both the community and the city if and only if the household has not reneged.[10]

Formally, we model community benefits as providing a per-period additive utility benefit, $B>0$, so long as the household has not deviated. These benefits are lost following a deviation, so the household's punishment payoff remains the same as in the baseline model. These benefits therefore relax the commitment problem by adding B to the right-hand side of the dynamic enforcement constraint, (DE).

Figure 6 presents simulated equilibrium wealth dynamics for various levels of B.[11] Each figure gives wealth in period $t+1$ as a function of wealth in period t, so that the household's wealth is increasing in the community whenever the densely dotted line is above the dashed line and decreasing otherwise. The right-hand boundary of these figures corresponds to the selection threshold w^{se}.

Panel I sets $B=0$. The "too-big-for-their-boots" mechanism is apparent from the fact that $w_{t+1}<w_t$ whenever $w_t \in (w^{tr}, w^{se})$. As we increase B in Panel II, new wealth dynamics emerge: wealthier households in the community now accumulate wealth until they eventually leave. Even when they are about to leave, these households can engage in some favour exchange, because they prefer repaying small favours to losing B. This feature is what allows households to smoothly transition from the community to the city. As we will show, this feature is a key difference between community benefits and place-based policies.

Panel II shows that, as in Proposition 3, wealthier households in the community invest some of the money that is freed up by favour exchange and so grow their wealth *strictly faster* than they would in the city. In contrast, while low-wealth households also benefit from $B>0$, they still suffer from the "too-big-for-their-boots" mechanism and so still have substantially lower long-term wealth than in the city.

Panel III shows that large enough community benefits can completely transform favour exchange, so that the household invests more than it would in the city for *any* $w_t \in (0, w^{se})$. In this case, for any initial wealth w_0, the household has the same long-term wealth as it would in the city. Large enough community benefits can therefore turn favour exchange into a force that helps left-behind communities catch up.

In practice, community benefits are likely to be large when members rely heavily on the community for social relationships. Portes and Sensenbrenner (1993) suggest that members of the Dominican community in New York were able to accumulate wealth because the community

10. As discussed in the final paragraph of Section 2, "moving to the city" can be interpreted as staying in the community but no longer engaging in favour exchange, rather than moving to a different location. Under this interpretation, these benefits include benefits that are available only within the community.

11. These simulations use parameters identical to those in Figures 1–3, with values of B given in Figure 6.

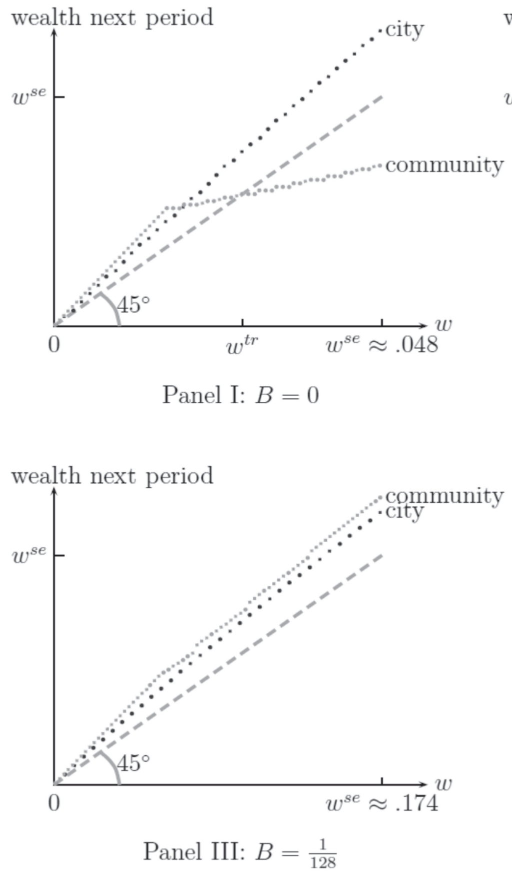

FIGURE 6

Wealth dynamics for various levels of community benefits. The x-axis is the household's current wealth. The dashed line is the 45-degree line, corresponding to current wealth. Wealth is increasing in the community if the densely dotted line is above the dashed line and decreasing otherwise. Investment is higher than it would be in the city if the densely dotted line is above the sparsely dotted line.

provided a valuable safe haven, a place of shared language and culture that was free from discrimination. In describing the economic success of the Chinese immigrant community in New York, Zhou (1992) highlights that members received similarly large benefits from the community. Religious organizations can also be a source of community benefits. Coleman (1988) notes that for the New York community of Jewish diamond merchants, the threat of social ostracism from synagogues and other religious activities supported business relationships.

5.2.2. Place-based policies. Policymakers also have tools that can relax the household's commitment problem. However, unlike community benefits, public policies typically cannot condition on a household's behaviour in its favour–exchange relationships. The closest that a policy can come is to condition on whether the household locates in the community or the city. The following simulations show that such "place-based" policies can lead to higher long-term wealth in the community, albeit without the transformative effects of community benefits.

Place-based policies include local infrastructure improvements, job subsidies, and other policies that provide localized benefits; see Austin *et al.* (2018) for a detailed discussion. We

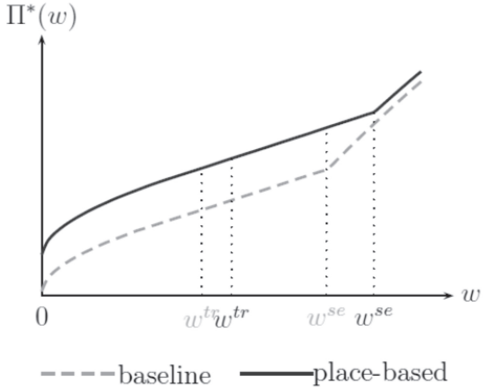

FIGURE 7
Household-optimal equilibrium payoffs with a place-based policy (solid line) vs. without the policy (dashed line).

model these policies as providing a per-period additive utility benefit, $B > 0$, *so long as the household stays in the community.* Unlike community benefits, place-based policies cannot condition on whether or not the household has deviated. Instead, a household loses the benefit B if and only if it leaves the community.

Figure 7 simulates the equilibrium effects of a place-based policy,[12] where we assume that players play a Markov perfect equilibrium following a deviation.[13] This policy increases w^{se} by inducing the household to stay for a wider range of wealth levels. It also relaxes the commitment problem and so increases long-term wealth in the community, w^{tr}. However, unlike community benefits, place-based policies do not induce households to smoothly transition from the community to the city; instead, households that choose to stay in the community stay forever, with long-term wealth substantially below that in the city. This difference arises because unlike community benefits, place-based policies cannot induce a household that was already planning to leave to repay favours. Nevertheless, because place-based policies relax the commitment problem, they have a role to play in decreasing the wealth gap between left-behind communities and the rest of the economy.

Place-based policies are most effective if the household leaves the community following a deviation. In particular, the household must prefer to leave rather than staying and continuing to benefit from the policy. Therefore, place-based policies tend to have a large effect when the utility gain from moving to the city, $\hat{U} - U$, is large relative to the policy benefit, B, since then a deviating household is likely to actually move to the city.

6. THE IMPOSSIBILITY OF MONETARY FAVOUR EXCHANGE

A key feature of our model is that favours are in-kind rather than monetary, which distinguishes it from the literature on informal lending (e.g. Bulow and Rogoff, 1989; Ligon *et al.*, 2000). In this section, we show that this distinction is crucial: in sharp contrast to in-kind favours, *no* favour exchange would occur if favours were monetary.

12. This figure uses the same parameters as those in Figures 1–3, with $B = \frac{1}{250}$.

13. Place-based policies might induce a household to stay in the community following a deviation. Thus, in contrast to our baseline model, Markov perfect equilibria do not necessarily min–max the household. This simulation therefore gives an *upper* bound on punishment payoffs and so a *lower* bound on household-optimal equilibrium payoffs.

To make this point, we consider a *model with monetary favours.* A long-lived household with initial wealth $w_0 \geq 0$ starts in the community. At the start of each period $t \in \{0, 1, 2, ...\}$, it chooses to either stay in the community or permanently leave for the city. If it remains in the community in period t, then the household plays the following community game with a *long-lived* neighbour:

1. The household requests a payment $s_t \in [-w_t, \infty)$ from the neighbour, where $s_t < 0$ indicates that it pays the neighbour.
2. The neighbour accepts ($d_t = 1$) or rejects ($d_t = 0$) this request. If it accepts, then it pays s_t. If it rejects, then no transfer is made.
3. The household chooses an amount to consume, $c_t \geq 0$, where consumption cannot exceed its total wealth including the transfer: $c_t \leq w_t + s_t d_t$. Any remaining wealth is invested, so $I_t = w_t + s_t d_t - c_t$, resulting in period-$(t+1)$ wealth $w_{t+1} = R(I_t)$.

The household's stage-game payoff is $U(c_t)$, while the neighbour's stage-game payoff is $-s_t d_t$. The parties share a common discount factor $\delta \in [0, 1)$.

Once the household leaves the community, it thereafter plays the city game, which is identical to the community game except that $s_t = 0$ in every period and the household's stage-game payoff is $\hat{U}(c_t)$. We maintain the assumptions on $U(\cdot)$, $\hat{U}(\cdot)$, and $R(\cdot)$ from Section 2.

This model makes two changes to the model from Section 2. First, and most importantly, it replaces in-kind favours with monetary favours, s_t, which capture both borrowing and repayments by the household. Borrowed money can either be consumed or invested to generate returns according to $R(\cdot)$. The second change is that the neighbour is long-lived, which ensures that the household can delay repayments in order to invest borrowed money. Making the neighbour long-lived makes it easier to sustain favour exchange and so strengthens our impossibility result.

We show that favour exchange cannot occur in any equilibrium of this model.

Proposition 4. *In any equilibrium of the model with monetary favours, $s_t = 0$ in all $t \geq 0$.*

See Appendix B for the proof of this result, which is nearly identical to the proof of the impossibility result in Bulow and Rogoff (1989). The intuition is that monetary favour exchange is inherently self-defeating; the household becomes wealthier when it borrows money, which necessarily improves its outside option. In particular, if the household ever borrows money, then there must exist a period in which the discounted sum of future repayments strictly exceeds the discounted sum of future loans. In that period, the household prefers to renege on future repayments and leave for the city.

Why are Propositions 2 and 4 so different? The key is that in-kind favour exchange can increase *consumption utility* without increasing *wealth*. As the "too-big-for-their-boots" mechanism shows, the household can access favour exchange only if it keeps its wealth from increasing, which is possible with in-kind favours. Thus, while monetary favour exchange is self-defeating, in-kind favour exchange can be self-sustaining. Our result also suggests that in Bulow and Rogoff (1989), it might be possible to sustain a lending relationship if lending and repayment were (at least partially) in-kind.[14]

14. One important feature of Bulow and Rogoff (1989)'s impossibility result is that the borrower has access to state-contingent formal contracts following a deviation. The borrower might not be able to use in-kind favours in formal contracts in the same way. See for example, Kletzer and Wright (2000) for an analysis of lending contracts if the borrower loses access to state-contingent contracts following a deviation. See also, for example, Ligon *et al.* (2000), especially their footnote 3.

We view Proposition 4 as highlighting an important difference between in-kind and monetary favour exchange in settings where households have investment opportunities and the commitment problem is at play. This result is particularly stark because investment returns are deterministic. With stochastic returns, monetary favour exchange can insure the household in the same way that in-kind favour exchange does. If households cannot purchase insurance in the market, then the insurance role of monetary favour exchange can be enough to make it self-sustaining. See for example, Ligon *et al.* (2000).

7. CONSIDERATIONS BEYOND THE MODEL

Our article focuses on a simple model to highlight the tension between accumulating wealth and relying on favour exchange. In this section, we discuss how other considerations may affect our results and empirical implications. We argue that the impact of these considerations is potentially similar to that of community benefits or place-based policies. We also discuss how our results extend to a setting with risky investments.

7.1. *Why might wealthy households engage in favour exchange?*

The reason that wealth undermines favour exchange in our model is that wealthier households have less to lose from reneging on a favour. This section highlights two key assumptions underpinning this result and discusses what happens if they do not hold. The first assumption is that consumption purchased using money is a substitute for consumption procured via favour exchange. The second assumption is that the household can continue accessing its wealth after moving to the city or reneging on a favour.

First, we assume that consumption goods bought with money are substitutes for those acquired by favour exchange. While this is a reasonable assumption for many goods and services traded within communities, certain goods might be "community-specific," in the sense that they are available only from other community members. For example, childcare from neighbours, friends, or family might provide flexibility or benefits that cannot be replicated by childcare from a daycare. Even wealthy households value community-specific goods, so they may be willing to repay favours to avoid losing them. By providing an extra reason to repay favours, community-specific goods have the potential to play a role similar to community benefits in Section 5.2. Like community benefits, such goods might relax the commitment problem for wealthy households, increase long-term wealth, and potentially even transform favour exchange into a force for faster wealth accumulation.

Second, we assume that the household keeps its wealth after leaving for the city or reneging on a favour. In some settings, however, a household's wealth might be "localized," in the sense that it would be lost if the household leaves the community, or "favour-exchange specific," in the sense that it would be lost if the household fails to repay a favour. We discuss each of these possibilities in turn.

Localized investments are lost if the household leaves the community. For example, a household might invest in starting or expanding a local business, which might be difficult to sell or relocate upon moving. Such localized investments give the household an extra reason to stay in the community and therefore resemble the place-based policies discussed in Section 5.2. We would therefore expect households with localized investments to have higher long-term wealth. Since the cost of losing a localized investment is increasing in wealth, those households that would be most tempted to leave face the largest such loss. Therefore, localized investments might encourage even more wealth accumulation than place-based policies that provide benefits independent of wealth.

Favour-exchange specific investments are lost if the household reneges on a favour. For example, the household might own a business that serves other members of the community, who might be able to threaten a boycott if the household reneges on a favour. The more profitable the business, the more the household loses from a boycott, giving wealthy households an additional reason to repay favours. Indeed, favour-exchange specific investments resemble the community benefits discussed in Section 5.2, since both are lost following a deviation. Like community benefits, this type of investment might have the potential to transform favour exchange so that it encourages faster wealth accumulation for at least some households.[15]

This discussion suggests two testable implications. First, the wealth gap should be smaller when the household can invest in ways that yield returns only within the community or when those returns rely on the cooperation of the community. Second, when households have access to both localized and non-localized investments, they should disproportionately choose investments with localized returns. This latter implication resonates with Zhou (1992), which describes New York's Chinatown as comprising many small entrepreneurs whose businesses predominantly serve those within the community. This discussion also suggests that policies aimed at expanding access to localized or favour-exchange specific investments might be especially effective at encouraging wealth accumulation. Such policies include programs that fund entrepreneurs in underserved communities.[16]

For a localized or favour-exchange specific investment to provide such benefits, it must be difficult to convert into liquid wealth. For instance, if the household could easily sell its business when it moves, then it could keep its wealth after leaving the community and so its investment would not be localized. Investments must also remain difficult to convert to liquid wealth in the long run; otherwise, favour exchange could unravel from the point at which an investment becomes liquid.[17]

7.2. *Stochastic investment returns*

While our baseline model imposes the simplification that investment is riskless, real-world investments sometimes entail substantial risk. In Supplementary Appendix C, we enrich our model to study how risky investment returns affect our main results. Favour exchange has an additional role in this setting, because it can provide insurance against negative shocks.

If returns are not too risky, then we prove that our main result still holds: the "too-big-for-their-boots" mechanism depresses long-term wealth for households that rely on favour exchange. If returns are extremely noisy, then qualitatively different dynamics can emerge. Using numerical simulations, we show that noisy returns relax the commitment problem, since even wealthy households value access to future favours following negative wealth shocks. Thus, extremely noisy returns can transform favour exchange as in Section 5.1, so that it becomes a force that accelerates wealth accumulation rather than discouraging it.

15. Note that favour-exchange specific investments resemble relationship-specific investments, which are valuable within but not outside of a relationship. Klein and Leffler (1981), among others, show how such investments can encourage cooperation. Favour-exchange specific investments might similarly encourage cooperation in our setting, leading to more wealth accumulation.

16. Examples of such policies include the New Economic Initiative, which provides business grants and place-based support to entrepreneurs in underserved communities in southeast Michigan, and NetWork Kansas, which organizes community-administered funds for entrepreneurs and small businesses.

17. For this reason, policies that provide households with "lock boxes" for saving, whose proceeds can only be accessed following a delay, might not be enough to overcome the "too-big-for-their-boots" mechanism.

8. CONCLUSION

Helping left-behind communities requires understanding the social constraints faced by those experiencing poverty. This article argues that while favour exchange is an essential source of support in left-behind communities, it imposes hidden costs that can constrain wealth accumulation and deepen long-term inequality. More work remains to be done to understand how heterogeneity within communities—whether from heterogeneous access to favour-exchange networks, heterogeneous ability to repay favours, or another source—influences the constraints imposed by favour exchange and thereby affects economic outcomes.

Acknowledgments. We thank Nageeb Ali, Renee Bowen, Matthias Fahn, George Georgiadis, Ben Golub, Sanjeev Goyal, Maria Guadalupe, Marina Halac, Oliver Hart, Rachel Kranton, Judith Levi, Dilip Mookherjee, Andrew Newman, Michael Powell, Benjamin Roth, Kathryn Spier, and the audiences at Aalto, Berkeley, SIOE 2020, the Harvard Contracts Lunch, the Canadian Economic Theory Conference virtual seminar series, SITE 2021, ThReD 2021, Johannes Kepler University, Northwestern University, and Pennsylvania State University for comments. We thank Edwin Muñoz-Rodriguez for excellent research assistance.

Supplementary Data

Supplementary data are available at *Review of Economic Studies* online. And the replication packages are available at https://dx.doi.org/10.5281/zenodo.6818828.

A. APPENDIX: PROOF OF PROPOSITION 2

Let $\Pi^*(w)$ be the maximum equilibrium payoff of a household with wealth w. Define

$$\Pi_c(w) = \max_{c\geqslant 0, f\geqslant 0} \left\{(1-\delta)(U(c)-f)+\delta\Pi^*(R(w+f-c))\right\}$$

$$\text{s.t.} \quad 0\leqslant c-f\leqslant w \tag{1}$$

$$f\leqslant \frac{\delta}{1-\delta}\left(\Pi^*(R(w+f-c))-\hat{\Pi}(R(w+f-c))\right). \tag{2}$$

We show that $\Pi_c(w)$ is the household's maximum payoff conditional on staying in the community in the current period. Hence, the household's maximum equilibrium payoff, $\Pi^*(w)$, is the maximum of $\hat{\Pi}(w)$ and $\Pi_c(w)$.

Lemma 1. *The household's maximum equilibrium payoff is* $\Pi^*(w_0)=\max\left\{\hat{\Pi}(w_0), \Pi_c(w_0)\right\}$, *where* $\Pi_c(\cdot)$ *and* $\Pi^*(\cdot)$ *are strictly increasing.*

Proof of Lemma 1:. In any equilibrium, neighbour 0 accepts only if $c_0\leqslant p_0+f_0$. The household's continuation payoff is at most $\Pi^*(R(w_0-p_0))$ and at least $\hat{\Pi}(R(w_0-p_0))$. Hence, it is willing to do favour f_0 only if

$$f_0\leqslant \frac{\delta}{1-\delta}\left(\Pi^*(R(w_0-p_0))-\hat{\Pi}(R(w_0-p_0))\right).$$

Setting $c_0=p_0+f_0$ yields $\Pi_c(w_0)$ as an upper bound on the household's payoff from staying.

This bound is tight. For any (c_0,f_0) that satisfies (1) and (2), it is an equilibrium to set $p_0=c_0-f_0\geqslant 0$, play a household-optimal continuation equilibrium on-path, and respond to any deviation with the household leaving and $f_t=0$ in all future periods.[18] Thus, $\Pi_c(\cdot)$ is the household's maximum equilibrium payoff conditional on staying. It follows that $\Pi^*(w)=\max\{\hat{\Pi}(w), \Pi_c(w)\}$. Since $\Pi_c(\cdot)$ is strictly increasing by inspection and $\hat{\Pi}(\cdot)$ is strictly increasing by Proposition 1, $\Pi^*(\cdot)$ is strictly increasing. ■

The next three lemmas characterize household-optimal equilibria in the community. First, we show that households that stay in the community, stay forever.

Lemma 2. *If* $w_0\geqslant 0$ *is such that* $\Pi^*(w_0)>\hat{\Pi}(w_0)$, *then in any* $t\geqslant 0$ *of any household-optimal equilibrium,* $\Pi^*(w_t)>\hat{\Pi}(w_t)$ *on the equilibrium path.*

18. If $f_t=0$ in all $t\geq 0$, then the household is willing to leave because $U\leq \hat{U}$.

Proof of Lemma 2:. Suppose $t>0$ is the first period in which $\Pi^*(w_t)=\hat{\Pi}(w_t)$, so $\Pi^*(w_{t-1})=\Pi_c(w_{t-1})>\hat{\Pi}(w_{t-1})$. Let $\{c_{t-1},f_{t-1}\}$ achieve $\Pi_c(w_{t-1})$. Since $\Pi^*(w_t)=\hat{\Pi}(w_t)$, (2) implies $f_{t-1}=0$. Therefore, $\hat{\Pi}(w_{t-1})\geqslant\Pi_c(w_{t-1})$, since if the household exits in $t-1$, it could choose the same p_{t-1} and c_{t-1} and earn continuation payoff $\hat{\Pi}(w_t)=\Pi^*(w_t)$. This contradicts the presumption that $\Pi_c(w_{t-1})>\hat{\Pi}(w_{t-1})$. ■

Second, we show that wealthy households leave the community, while poorer households stay.

Lemma 3. *The set* $\mathcal{W}=\left\{w:\Pi^*(w)>\hat{\Pi}(w)\right\}$ *has positive measure. Moreover,* $w^{se}=\sup\left\{w:\Pi^*(w)>\hat{\Pi}(w)\right\}$ *satisfies* $0<w^{se}<\bar{w}$.

Proof of Lemma 3:. First, we show that $\Pi^*(0)>\hat{\Pi}(0)=0$. Because $\lim_{c\downarrow 0}U'(c)=\infty$, there exists a $c>0$ such that $c\leqslant\delta U(c)$. Suppose that in all $t\geqslant 0$, $f_t=c_t=c$ and $p_t=0$ on the equilibrium path, so the household's equilibrium payoff is $U(c)-c$. Any deviation is punished by $f_t=0$ in all future periods and the household immediately exiting. This strategy delivers a strictly positive payoff. It is an equilibrium because $c\leqslant\delta U(c)$ implies (2). Thus, $\Pi^*(0)>0$. Since $\Pi^*(w)$ is increasing and $\hat{\Pi}(w)$ is continuous, there exists an interval around 0 such that $\Pi^*(w)>\hat{\Pi}(w)$. So $\left\{w:\Pi^*(w)>\hat{\Pi}(w)\right\}$ has positive measure.

Next, we show that $w^{se}<\bar{w}$. Let $\bar{c}$ satisfy $U'(\bar{c})=1$, and let w_0 be such that $\Pi^*(w_0)>\hat{\Pi}(w_0)$. By Lemma 2, $\Pi^*(w_t)>\hat{\Pi}(w_t)$ in any $t\geqslant 0$ of any household-optimal equilibrium. Suppose that $c_t>\bar{c}$ in period $t\geqslant 0$. If $f_t>0$, then we can perturb the equilibrium by decreasing c_t and f_t by $\epsilon>0$, which increases the household's payoff at rate $1-U'(c_t)>0$ as $\epsilon\to 0$. So, $f_t=0$.

Let $\tau>t$ be the first period after t such that $f_\tau>0$. Consider decreasing p_t and c_t by $\epsilon>0$, increasing p_τ by $\chi(\epsilon)$, and decreasing f_τ by $\chi(\epsilon)$, where $\chi(\epsilon)$ is chosen so that $w_{\tau+1}$ remains constant. Then, $\chi(\epsilon)\geqslant\frac{\epsilon}{\delta^{\tau-t}}$ because $R'(\cdot)\geqslant\frac{1}{\delta}$. As $\epsilon\to 0$, this perturbation increases the household's payoff by at least $\delta^{\tau-t}\frac{1}{\delta^{\tau-t}}-U'(c_t)>0$. It is an equilibrium because $f_s=0$ for all $s\in[t,\tau-1]$, so (2) still holds in these periods.

The above argument implies that if $c_t>\bar{c}$, then $f_\tau=0$ for all $\tau\geqslant t$. But then $\Pi^*(w_t)\leqslant\hat{\Pi}(w_t)$, contradicting Lemma 2. Therefore, if $\Pi^*(w_0)>\hat{\Pi}(w_0)$, then $c_t\leqslant\bar{c}$ in every $t\geq 0$ and so $\Pi^*(w_0)\leqslant U(\bar{c})$. Since $R(\bar{w}-\bar{c})>\bar{w}$ by Assumption 1, it follows that $\Pi^*(\bar{w})\geqslant\hat{\Pi}(\bar{w})>\hat{U}(\bar{c})\geqslant U(\bar{c})$. By the definition of w^{se}, there exists a sequence of initial wealth levels in $\mathcal{W}$ which are arbitrarily close to w^{se} such that the household strictly prefers to stay in the community with those initial wealth levels. If $w^{se}\geqslant\bar{w}$, the equilibrium payoffs at those initial wealth levels would be strictly above $U(\bar{c})$ due to the continuity of $\hat{\Pi}(w)$. This leads to a contradiction, so $w^{se}<\bar{w}$. ■

Finally, we show that household-optimal equilibria exhibit monotone wealth dynamics.

Lemma 4. *In any household-optimal equilibrium,* $(w_t)_{t=0}^{\infty}$ *is monotone.*

The proof of Lemma 4 is presented after we complete the proof of the main result. The key step of this proof shows that household-optimal investment, w_t-p_t, increases in w_t. Thus, if $w_1\geqslant w_0$, then $w_2=R(w_1-p_1)\geqslant R(w_0-p_0)=w_1$ and so on, and similarly if $w_1\leqslant w_0$.

We can now prove Proposition 2. *Selection* is implied by Lemmas 2 and 3. For the *"too-big-for-their-boots" mechanism,* define

$$\tilde{c}(w)=w-R^{-1}(w)$$

and $\tilde{\Pi}(w)=U(\tilde{c}(w))$. Since $w^{se}<\bar{w}$ by Lemma 3, consumption $\tilde{c}(w^{se})$ does not satisfy (Euler). Thus, there exists $K>0$ such that

$$\tilde{\Pi}(w^{se})+K<\hat{\Pi}(w^{se}).$$

Define

$$\tilde{f}(w)=\frac{\delta}{1-\delta}\left(\hat{\Pi}(w^{se})-\hat{\Pi}(w)\right)$$

and

$$\tilde{p}(w)=w^{se}-R^{-1}(w).$$

Consider $w_0<w^{se}$ such that $\Pi^*(w_0)>\hat{\Pi}(w_0)$ and suppose that there exists an equilibrium in which $(w_t)_{t=0}^{\infty}$ is increasing on the equilibrium path. We claim that $p_t\leqslant\tilde{p}(w_0)$ and $f_t\leqslant\tilde{f}(w_0)$ in every $t\geq 0$. Indeed,

$$f_t\leqslant\frac{\delta}{1-\delta}\left(\Pi^*(w_{t+1})-\hat{\Pi}(w_{t+1})\right)\leqslant\frac{\delta}{1-\delta}\left(\Pi^*(w^{se})-\hat{\Pi}(w_0)\right)=\tilde{f}(w_0),$$

and

$$p_t=w_t-R^{-1}(w_{t+1})\leqslant w^{se}-R^{-1}(w_0)=\tilde{p}(w_0),$$

where the inequalities hold because (i) $w_t,w_{t+1}\leqslant w^{se}$ by Lemma 2 and (ii) $w_{t+1}\geq w_0$ by our presumption that $(w_t)_{t=0}^{\infty}$ is increasing.

Since $c_t \leqslant p_t + f_t$, the household's payoff satisfies

$$\Pi^*(w_0) \leqslant U\left(\tilde{p}(w_0) + \tilde{f}(w_0)\right) = H(w_0).$$

The function $H(w_0)$ is continuous and decreasing in w_0, with $H(w^{se}) = \tilde{\Pi}(w^{se})$. Since $\tilde{\Pi}(w^{se}) + K < \hat{\Pi}(w^{se})$, there exists $w^{tr} < w^{se}$ such that for any $w_0 \in (w^{tr}, w^{se})$,

$$H(w_0) < \hat{\Pi}(w_0).$$

Therefore, for any $w_0 \in (w^{tr}, w^{se})$, if $w_0 \in \mathcal{W}$, then $(w_t)_{t=0}^{\infty}$ must be strictly decreasing, with $\lim_{t\to\infty} w_t \leqslant w^{tr}$.

By definition of w^{se}, there exists $w_0 \in \mathcal{W} \cap (w^{tr}, w^{se})$ such that $\Pi^*(w_0) > \hat{\Pi}(w_0)$. Since $\Pi^*(\cdot)$ and $\hat{\Pi}(\cdot)$ are increasing, with $\hat{\Pi}(\cdot)$ continuous, we conclude that $\Pi^*(w) > \hat{\Pi}(w)$ on a neighbourhood around w_0. So $\mathcal{W} \cap [w^{tr}, w^{se}]$ has a positive measure. ■

Proof of Lemma 4. We break the proof of this lemma into four steps.

Step 1: Locally bounding the slope of $\Pi^*(\cdot)$ from below. We claim that for any $w \in [0, w^{se})$, there exists $\epsilon_w > 0$ such that for any $\epsilon \in (0, \epsilon_w)$,

$$\Pi^*(w+\epsilon) - \Pi^*(w) > (1-\delta)\epsilon.$$

First, suppose $\hat{\Pi}(w) \geq \Pi_c(w)$, and let $\{w_t, c_t\}_{t=0}^{\infty}$ be the wealth and consumption sequences if the household enters the city. The proof of Lemma 3 implies that for any $w_0 < w^{se}$, $R(w_0 - \bar{c}) < w_0$. Proposition 1 says that $\{w_t\}_{t=0}^{\infty}$ is increasing, so $c_0 < \bar{c}$. Hence, there exists $\epsilon_w > 0$ such that $U'(c_0 + \epsilon_w) > 1$. Since $\hat{U}'(c) \geq U'(c)$ for all $c > 0$, $\hat{U}'(c_0 + \epsilon_w) > 1$.

For any $\epsilon < \epsilon_w$, if $w_0 = w + \epsilon$, then the household can enter the city and choose $\hat{c}_0 = c_0 + \epsilon$, with $\hat{c}_t = c_t$ in all $t > 0$. We can bound $\Pi^*(w+\epsilon)$ from below by the payoff from this strategy,

$$\Pi^*(w+\epsilon) \geq (1-\delta)\left(\hat{U}(c_0+\epsilon) - \hat{U}(c_0)\right) + \hat{\Pi}(w) > (1-\delta)\epsilon + \hat{\Pi}(w) = (1-\delta)\epsilon + \Pi^*(w).$$

We conclude that $\Pi^*(w+\epsilon) - \Pi^*(w) > (1-\delta)\epsilon$, as desired.

Now, suppose $\hat{\Pi}(w) < \Pi_c(w)$. Let $\{w_t, c_t, f_t\}_{t=0}^{\infty}$ be the wealth, consumption, and favour sequence in a household-optimal equilibrium. There exists $\tau \geq 0$ such that $f_\tau > 0$ for the first time in period τ; otherwise, the household could implement the same consumption sequence in the city. Choose $\epsilon_w > 0$ to satisfy $\epsilon_w < \delta^\tau f_\tau$.

For $\epsilon \in (0, \epsilon_w)$ and initial wealth $w_0 = w + \epsilon$, consider the perturbed strategy such that $\hat{p}_t = p_t$, $\hat{c}_t = c_t$, and $\hat{f}_t = f_t$ in every period *except* τ. In period τ, $\hat{f}_\tau = f_\tau - \frac{\epsilon}{\delta^\tau}$ and $\hat{p}_\tau = p_\tau + \chi$, where χ is chosen so that $\hat{w}_{t+1} = w_{t+1}$. Then, $\hat{c}_\tau = c_\tau + \chi - \frac{\epsilon}{\delta^\tau}$. Based on the Proof of Proposition 2, $w_t < w^{se}$ for all $t \leq \tau$. This observation together with $w^{se} \leq \bar{w}$ and Assumption 1, implies that we can choose a sufficiently small ϵ_w such that the marginal return from capital in every $t < \tau$ is strictly higher than $\frac{1}{\delta}$ even if the initial wealth is $w+\epsilon$ rather than w. Hence, $\chi > \frac{\epsilon}{\delta^\tau}$.

Under this perturbed strategy, (2) is satisfied in all $t < \tau$ because $f_t = 0$ in these periods; in $t = \tau$ because $\hat{f}_\tau < f_\tau$ and $\hat{w}_{\tau+1} = w_{\tau+1}$; and in $t > \tau$ because play is unchanged after τ. Moreover, $f_\tau - \frac{\epsilon}{\delta^\tau} > 0$ because $\epsilon < \epsilon_w$, and $\hat{f}_\tau + \hat{p}_\tau = \hat{c}_\tau$, so this strategy is feasible. Thus, it is an equilibrium. Consequently, $\Pi^*(w+\epsilon)$ is bounded from below by the household's payoff from this strategy,

$$\Pi^*(w+\epsilon) > (1-\delta)\delta^\tau \frac{\epsilon}{\delta^\tau} + \Pi_c(w) = (1-\delta)\epsilon + \Pi^*(w),$$

as desired.

Step 2: Moving from local to global bound on slope. Next, we show that for any $0 \leq w < w' < w^{se}$, $\Pi^*(w') - \Pi^*(w) > (1-\delta)(w'-w)$.

Let

$$z(w) = \sup\{w'' | w < w'' \leq w^{se}, \text{ and } \forall w' \in (w, w''], \Pi^*(w') - \Pi^*(w) > (1-\delta)(w'-w)\}.$$

By Step 1, $z(w) \geq w$ exists. Moreover,

$$\Pi^*(z(w)) - \Pi^*(w) \geq \lim_{\tilde{w}\uparrow z(w)} \Pi^*(\tilde{w}) - \Pi^*(w) \geq (1-\delta)(z(w)-w),$$

where the first inequality follows because $\Pi^*(\cdot)$ is increasing, and the second inequality follows by definition of $z(w)$.

Suppose that $z(w) < w^{se}$. By Step 1, there exists $\epsilon_{z(w)}$ such that for any $\epsilon < \epsilon_{z(w)}$,

$$\Pi^*(z(w)+\epsilon) - \Pi^*(z(w)) > (1-\delta)\epsilon.$$

Hence,

$$\Pi^*(z(w)+\epsilon) - \Pi^*(w) = \Pi^*(z(w)+\epsilon) - \Pi^*(z(w)) + \Pi^*(z(w)) - \Pi^*(w) > (1-\delta)\epsilon + (1-\delta)(z(w)-w).$$

This contradicts the definition of $z(w)$, so $z(w) \geq w^{se}$.

For any $w' < w^{se}$, $w' < z(w)$ and so $\Pi^*(w') - \Pi^*(w) > (1-\delta)(w'-w)$, as desired.

Step 3: Investment is increasing in wealth. Consider two wealth levels, $0 \le w_L < w_H < w^{se}$, and suppose that $\Pi_c(w_L) > \hat{\Pi}(w_L)$ and $\Pi_c(w_H) > \hat{\Pi}(w_H)$. Given any household-optimal equilibria, let p_H, p_L be the respective period-0 payments under w_H, w_L. We prove that $w_H - p_H \ge w_L - p_L$. Define $I_k = w_k - p_k$, $k \in \{L, H\}$. Towards a contradiction, suppose that $I_H < I_L$.

We first show that $c_H > c_L + (w_H - w_L)$. Suppose instead that $c_H \le c_L + (w_H - w_L)$. Since $I_H < I_L$, we have $p_H > p_L + (w_H - w_L)$. But then $f_H < f_L$, since

$$f_H = c_H - p_H < c_H - (p_L + (w_H - w_L)) \le c_L + (w_H - w_L) - (p_L + (w_H - w_L)) = f_L.$$

Consider the following perturbation: $\hat{p}_H = p_L + (w_H - w_L) \in (p_L, p_H)$, $\hat{f}_H = f_H + p_H - \hat{p}_H \ge f_H$, and $\hat{c}_H = c_H$. Under this perturbation, $\hat{I}_H = w_H - \hat{p}_H = I_L$. Thus, to show that the perturbation satisfies (2), we need only show that $\hat{f}_H \le f_L$. Indeed:

$$\hat{f}_H = f_H + p_H - (p_L + (w_H - w_L)) = c_H - (c_L - f_L) - (w_H - w_L) = f_L + c_H - (c_L + w_H - w_L) \le f_L,$$

where the final inequality holds because $c_H \le c_L + (w_H - w_L)$ by assumption. Thus, this perturbation is also an equilibrium.

We claim that a household with initial wealth w_H strictly prefers this equilibrium to the original equilibrium, which is true so long as

$$\begin{aligned}
& (1-\delta)(U(c_H) - \hat{f}_H) + \delta \Pi^*(R(I_L)) > (1-\delta)(U(c_H) - f_H) + \delta \Pi^*(R(I_H)) \\
\iff \quad & (1-\delta)(\hat{f}_H - f_H) < \delta(\Pi^*(R(I_L)) - \Pi^*(R(I_H))) \\
\iff \quad & (1-\delta)(p_H - \hat{p}_H) < \delta(\Pi^*(R(I_L)) - \Pi^*(R(I_H))).
\end{aligned}$$

We know that $I_L = I_H + p_H - \hat{p}_H$. Since the household stays in the community, $I_H < I_L < w^{se}$, so $R'(I_H), R'(I_L) > \frac{1}{\delta}$. Thus,

$$R(I_L) - R(I_H) > \frac{1}{\delta}(I_L - I_H) = \frac{1}{\delta}(p_H - \hat{p}_H).$$

By Step 2, $\Pi^*(\cdot)$ increases at rate strictly greater than $(1-\delta)$, so we conclude

$$\delta(\Pi^*(R(I_L)) - \Pi^*(R(I_H))) > \delta(1-\delta)\frac{1}{\delta}(p_H - \hat{p}_H),$$

as desired. Thus, if $I_H < I_L$, then $c_H > c_L + (w_H - w_L)$.

We are now ready to prove that $I_H < I_L$ contradicts household optimality. To do so, we consider two perturbations: one at w_L and one at w_H. At w_H, consider setting

$$\begin{aligned}
\hat{c}_H &= c_L + (w_H - w_L) > c_L \ge 0, \\
\hat{p}_H &= p_L + w_H - w_L \in (p_L, w_H], \\
\hat{f}_H &= \hat{c}_H - \hat{p}_H = f_L.
\end{aligned}$$

By construction, $w_H - \hat{p}_H = I_L$. Thus, $\hat{f}_H$ satisfies (2) because f_L does. Moreover, $\hat{p}_H + \hat{f}_H = \hat{c}_H$, so the neighbour is willing to accept. This perturbed strategy is therefore an equilibrium. For the original equilibrium to be household optimal, we must therefore have

$$(1-\delta)(U(c_H) - f_H) + \delta \Pi^*(R(I_H)) \ge (1-\delta)(U(\hat{c}_H) - \hat{f}_H) + \delta \Pi^*(R(\hat{I}_H)). \tag{3}$$

At w_L, consider setting

$$\begin{aligned}
\hat{c}_L &= c_H - (w_H - w_L) > c_L \ge 0, \\
\hat{p}_L &= p_H - (w_H - w_L) \in (p_L, w_L], \\
\hat{f}_L &= \hat{c}_L - \hat{p}_L = f_H.
\end{aligned}$$

By construction, $w_L - \hat{p}_L = I_H$. Thus, $\hat{f}_L$ satisfies (2) because f_H does. This perturbed strategy is again an equilibrium, so the original equilibrium is household-optimal only if

$$(1-\delta)(U(c_L) - f_L) + \delta \Pi^*(R(I_L)) \ge (1-\delta)(U(\hat{c}_L) - \hat{f}_L) + \delta \Pi^*(R(\hat{I}_L)). \tag{4}$$

Combining (3) and (4) and plugging in definitions, we have

$$U(c_H) - U(c_H - (w_H - w_L)) \ge U(c_L + (w_H - w_L)) - U(c_L).$$

However, $c_H > c_L + w_H - w_L$ and $U(\cdot)$ is strictly concave, so this inequality cannot hold. Thus, if $I_H < I_L$, then at least one of the equilibria at w_H and w_L cannot be household-optimal.

Step 4: Establishing monotonicity. We have shown that investment, $I(w)$, is increasing in w. Consider a household-optimal equilibrium with $w_1 \ge w_0$. Then, $I(w_1) \ge I(w_0)$, so $w_2 = R(I(w_1)) \ge R(I(w_0)) = w_1$. Thus, $w_2 \ge w_1$, and $w_{t+1} \ge w_t$ for all $t > 1$ by the same argument. Similarly, if $w_1 \le w_0$, then $I(w_1) \le I(w_0)$, $w_2 \le w_1$, and $w_{t+1} \le w_t$ in all $t \ge 0$. We conclude that $(w_t)_{t=0}^{\infty}$ is monotone in any household-optimal equilibrium. ■

B. APPENDIX: OTHER PROOFS

B.1. *Proof of Proposition 1*

Suppose that the household lives in the city. In any period t, since future vendors do not observe f_t, the household always chooses $f_t=0$. Hence, vendor t accepts only if $p_t \geq c_t$. This means that $c_t \in [0, w_t]$ are the feasible consumption levels, so that the household's equilibrium continuation payoff is at most $\hat{\Pi}(w_t)$ given wealth w_t.

The following equilibrium gives the household an equilibrium continuation payoff of $\hat{\Pi}(w_t)$. In period t, (i) the household proposes $(c_t, p_t) = (\hat{C}(w_t), \hat{C}(w_t))$; (ii) vendor t accepts if and only if $p_t \geq c_t$. Vendor t has no profitable deviation. This strategy attains $\hat{\Pi}$, so the household has no profitable deviation either.

Let $\{c_t^*\}_{t=0}^{\infty}$ be the consumption sequence in the equilibrium above, given initial wealth w. If $w=0$, then $c_t^*=0$ in all $t \geq 0$, so $\hat{\Pi}(0)=\hat{U}(0)=0$ is the unique equilibrium payoff. If $w>0$, then it must be true that $c_t^*>0$ in every $t \geq 0$. Suppose otherwise. Let $\tau \geq 0$ be the first period in which $\min\{c_\tau^*, c_{\tau+1}^*\}=0$ and $\max\{c_\tau^*, c_{\tau+1}^*\}>0$. If $c_\tau^*>0$ and $c_{\tau+1}^*=0$, consider the perturbation $c_\tau = c_\tau^* - \epsilon_1$, $c_{\tau+1}=c_{\tau+1}^*+\epsilon_2$ for some small $\epsilon_1, \epsilon_2>0$ such that the wealth $w_{\tau+2}$ stays the same. If $c_\tau^*=0$ and $c_{\tau+1}^*>0$, consider the perturbation $c_\tau=c_\tau^*+\epsilon_1$, $c_{\tau+1}=c_{\tau+1}^*-\epsilon_2$ for some small $\epsilon_1, \epsilon_2>0$ such that the wealth $w_{\tau+2}$ stays the same. In either case, the perturbation gives a strictly higher payoff, since $\lim_{c \downarrow 0} \hat{U}'(c)=\infty$.

Next, we show that $\hat{\Pi}(w)$ is the household's *unique* equilibrium payoff. At $w=0$, $\hat{\Pi}(0)=0$, so the household's unique equilibrium payoff is indeed $\hat{\Pi}(0)$. For $w>0$, the household can choose $(c_t, p_t)=((1-\epsilon)c_t^*, c_t^*)$ in every $t \geq 0$ for $\epsilon>0$ small. Vendor t strictly prefers to accept. As $\epsilon \downarrow 0$, the consumption sequence $\{(1-\epsilon)c_t^*\}_{t=0}^{\infty}$ gives the household a payoff that converges to $\hat{\Pi}(w)$. So the household must earn at least $\hat{\Pi}(w)$ in any equilibrium.

Turning to properties of $\hat{\Pi}(\cdot)$, we claim that $\hat{\Pi}(\cdot)$ is strictly increasing. Pick $0 \leq w < \tilde{w}$. Let $\{c_t^*\}_{t=0}^{\infty}$ be the sequence associated with w. If the initial wealth is $\tilde{w}$, it is feasible to choose $c_0=c_0^*+\tilde{w}-w$ and $c_t=c_t^*$ for $t \geq 1$. Since $\hat{U}(\cdot)$ is strictly increasing, so too is $\hat{\Pi}(\cdot)$.

It remains to show that $\hat{\Pi}(\cdot)$ is continuous for all $w>0$. If $w>0$, then $\hat{C}(w)>0$. For $\tilde{w}$ sufficiently close to w, setting $c_0=\hat{C}(w)+(\tilde{w}-w)$ and $c_t=\hat{C}(w_t)$ for $t \geq 1$ is feasible. The household's payoffs converge to $\hat{\Pi}(w)$ as $\tilde{w} \to w$ under this perturbation, which means that $\lim_{\tilde{w} \uparrow w} \hat{\Pi}(\tilde{w}) \geq \hat{\Pi}(w)$ and $\lim_{\tilde{w} \downarrow w} \hat{\Pi}(\tilde{w}) \geq \hat{\Pi}(w)$. Since $\hat{\Pi}(\cdot)$ is increasing, we conclude that $\hat{\Pi}(\cdot)$ is continuous at every $w>0$.

We now show that $\hat{\Pi}(\cdot)$ is continuous at $w=0$. Consider $\lim_{w \downarrow 0} \hat{\Pi}(w)$. Since $R'(\bar{w})=\frac{1}{\delta}$, the line tangent to $R(\cdot)$ at $\bar{w}$ is $\hat{R}(w)=R(\bar{w})+\frac{w-\bar{w}}{\delta}$. Since $R(\cdot)$ is concave, $R(w) \leq \hat{R}(w)$ for all $w \geq 0$. Therefore, $\hat{\Pi}(w)$ is bounded from above by the household's maximum payoff if we replace $R(\cdot)$ with $\hat{R}(\cdot)$. For consumption path $\{c_t\}_{t=0}^{\infty}$ to be feasible under $\hat{R}(\cdot)$, it must satisfy

$$(1-\delta)\sum_{t=0}^{\infty}\delta^t c_t \leq (1-\delta)w_0+\delta R(\bar{w})-\bar{w}.$$

This means that the payoff of a household with initial wealth w_0 is at most

$$\hat{U}((1-\delta)w_0+\delta R(\bar{w})-\bar{w}).$$

Pick any small $\epsilon>0$. There exists $T<\infty$ and sufficiently small $w_0>0$ such that

$$\delta^T \hat{U}\left((1-\delta)R^T(w_0)+\delta R(\bar{w})-\bar{w}\right) < \frac{\epsilon}{2},$$

where $R^T(w_0)$ denotes the function that applies $R(\cdot)$ T-times to w_0.

Consider a hypothetical setting that is more favourable to the household: we allow the household to both consume *and* save its wealth until period T, after which it must play the original city game. The household's payoff from this hypothetical is strictly larger than $\hat{\Pi}(w_0)$ and is bounded from above by

$$(1-\delta)\sum_{t=0}^{T-1}\delta^t(\hat{U}(R^t(w_0))+\delta^T\hat{U}((1-\delta)R^T(w_0)+\delta R(\bar{w})-\bar{w}).$$

As $w_0 \downarrow 0$, $R^T(w_0) \downarrow 0$, so $R^t(w_0) \downarrow 0$ for any $t<T$. Thus,

$$\hat{\Pi}(w_0) \leq (1-\delta)\sum_{t=0}^{T-1}\delta^t\hat{U}(R^t(w_0))+\delta^T\hat{U}((1-\delta)R^T(w_0)+\delta R(\bar{w})-\bar{w})<\epsilon.$$

This is true for any $\epsilon>0$, so $\lim_{w \downarrow 0}\hat{\Pi}(w)=0$.

Finally, consider any equilibrium in the city. If $w_0=0$, then $w_t=0$ in any $t \geq 0$. If $w_0>0$, then we have shown that $c_t>0$ in every $t \geq 0$, so $w_t>c_t>0$. A standard argument (see below) implies the following Euler equation:

$$\hat{U}'(c_t)=\delta R'(w_t-c_t)\hat{U}'(c_{t+1}). \tag{5}$$

Together with $R'(\cdot) \geq \frac{1}{\delta}$ and $\hat{U}(\cdot)$ strictly concave, (5) implies $c_t \leq c_{t+1}$, and strictly so if $w_t-c_t<\bar{w}$.

Next, we argue that $\hat{C}(\cdot)$ is strictly increasing in w. Let $\{c_t\}_{t=0}^{\infty}$ and $\{\tilde{c}_t\}_{t=0}^{\infty}$ be the equilibrium consumption sequences for $w>0$ and $\tilde{w}>w$, respectively. Suppose $c_0 \geq \tilde{c}_0$, and let $\tau \geq 1$ be the first period such that $c_t < \tilde{c}_t$, which must exist because $\hat{\Pi}(\cdot)$ is strictly increasing. Then, $c_{\tau-1} \geq \tilde{c}_{\tau-1}$, $w_{\tau-1} - c_{\tau-1} < \tilde{w}_{\tau-1} - \tilde{c}_{\tau-1}$, and $c_\tau < \tilde{c}_\tau$, so at least one of $(c_{\tau-1}, w_{\tau-1}, c_\tau)$ and $(\tilde{c}_{\tau-1}, \tilde{w}_{\tau-1}, \tilde{c}_\tau)$ violates (5). Hence, $\hat{C}(w)$ is strictly increasing in w. Therefore, $c_{t+1} \geq c_t$ implies $w_{t+1} \geq w_t$, with strict inequalities if $w_t \leq \bar{w}$.

Since $(w_t)_{t=0}^{\infty}$ is monotone, it converges to some $w^{\infty} \in \mathbb{R}_+ \cup \{\infty\}$. Suppose $w^{\infty} < R(\bar{w})$. Since $w_{t+1} = R(w_t - c_t)$, we must have c_t and $w_t - c_t$ converging, with $\lim_{t\to\infty}(w_t - c_t) < \bar{w}$. But then $R'(w_t - c_t)$ converges to a number strictly above $\frac{1}{\delta}$, which implies that (5) is violated as $t \to \infty$. We conclude that $\lim_{t\to\infty} w_t \geq R(\bar{w})$. ■

B.1.1. Deriving the Euler equation. Consider a household in the city, and let its optimal consumption and wealth sequence be $\{c_t^*, w_t^*\}_{t=0}^{\infty}$. We prove that if $w_0 > 0$, then

$$\hat{U}'(c_t^*) = \delta R'(w_t^* - c_t^*)\hat{U}'(c_{t+1}^*)$$

in every $t \geq 0$.

The Proof of Proposition 1 says that $c_t^* > 0$, $c_{t+1}^* > 0$, and $w_t^* - c_t^* > 0$. Suppose that $\hat{U}'(c_t^*) > \delta R'(w_t^* - c_t^*)\hat{U}'(c_{t+1}^*)$. Then, we can perturb (c_t^*, c_{t+1}^*) to $(c_t^* + \epsilon, c_{t+1}^* - \chi(\epsilon))$, where $\chi(\epsilon)$ is chosen such that w_{t+2}^* remains the same as before the perturbation. In particular,

$$R(w_t^* - (c_t^* + \epsilon)) - (c_{t+1}^* - \chi(\epsilon)) = R(w_t^* - c_t^*) - c_{t+1}^*.$$

Hence, $\chi'(\epsilon) = R'(w_t^* - (c_t^* + \epsilon))$.

As $\epsilon \downarrow 0$, this perturbation strictly increases the household's payoff:

$$\begin{aligned}
&\lim_{\epsilon\downarrow 0}\left\{\hat{U}'(c_t^* + \epsilon) - \delta\hat{U}'(c_{t+1}^* - \chi(\epsilon))\chi'(\epsilon)\right\} \\
=\ &\lim_{\epsilon\downarrow 0}\left\{\hat{U}'(c_t^* + \epsilon) - \delta\hat{U}'(c_{t+1}^* - \chi(\epsilon))R'(w_t^* - c_t^* - \epsilon)\right\} \\
=\ &\hat{U}'(c_t^*) + \delta R'(w_t^* - c_t^*)\hat{U}'(c_{t+1}^*) > 0.
\end{aligned}$$

This contradicts the fact that (c_t^*, c_{t+1}^*) is optimal. Using a similar argument, we can show that $\hat{U}'(c_t^*) < \delta R'(w_t^* - c_t^*)\hat{U}'(c_{t+1}^*)$ is not possible either. ■

B.2. *Proof of Proposition 3*

We show that there exists a household-optimal equilibrium such that if $p_t > 0$, then $f_{t'} = 0$ in all $t' > t$ so $\tau \leqslant t+1$.

Define $\epsilon = \min\left\{p_t, \delta^{t'-t} f_{t'}\right\}$. Consider the following perturbation in periods t and t' (denoted by tildes): in period t, $\tilde{p}_t = p_t - \epsilon$, $\tilde{f}_t = f_t + \epsilon$, and $\tilde{c}_t = c_t$; in period t', $\tilde{p}_{t'} = p_{t'} + R(\tilde{w}_{t'-1}) - R(w_{t'-1})$, $\tilde{f}_{t'} = f_{t'} - \frac{\epsilon}{\delta^{t'-t}}$, and $\tilde{c}_{t'} = c_{t'} + (\tilde{p}_{t'} - p_{t'}) + (\tilde{f}_{t'} - f_{t'})$. This perturbation is feasible, and neighbours t and t' are willing to accept these requests. Thus, it is also an equilibrium.

Note that $c_t = \tilde{c}_t$ and $\delta^t \tilde{f}_t + \delta^{t'} \tilde{f}_{t'} = \delta^t f_t + \delta^{t'} f_{t'}$. Thus, this perturbation improves the household's payoff only if $\tilde{c}_{t'} \geq c_{t'}$, or $\tilde{p}_{t'} + \tilde{f}_{t'} \geq p_{t'} + f_{t'}$. But $\tilde{p}_{t'} - p_{t'} = R(\tilde{w}_{t'-1}) - R(w_{t'-1}) \geq \frac{\epsilon}{\delta^{t'-t}}$ because $R'(\cdot) \geq \frac{1}{\delta}$, while $\tilde{f}_{t'} = f_{t'} - \frac{\epsilon}{\delta^{t'-t}}$. Therefore, $\tilde{c}_{t'} \geq c_{t'}$, as desired. By similarly perturbing any periods $t < t'$ such that $p_t > 0$ and $f_{t'} > 0$, we can construct a household-optimal equilibrium with the property that if $p_t > 0$, then $f_{t'} = 0$ in all $t' > t$. If $\tau = \infty$ in this equilibrium, then $p_t = 0$ for every t which is clearly suboptimal. Hence, $\tau < \infty$ in this equilibrium and $p_t = 0$ for every $t < \tau - 1$. Since $I_t = w_t$ for every $t < \tau - 1$, the household invests strictly more than in the city with the same wealth level.

We next show that for $t = \tau - 1$, the household also invests strictly more. If $p_{\tau-1} = 0$, then this is clearly true. If $p_{\tau-1} > 0$, let $\{c_t\}_{t \geqslant \tau-1}$ be the consumption sequence starting from period $\tau - 1$. Optimality implies that

$$U'(c_{\tau-1}) = \delta R'(w_{\tau-1} - p_{\tau-1})\hat{U}'(c_\tau).$$

Now consider a household in the city with wealth $w_{\tau-1}$. The household can consume $p_{\tau-1}$ today and continue with the consumption sequence $\{c_t\}_{t \geqslant \tau}$. Since $p_{\tau-1} < p_{\tau-1} + f_{\tau-1} = c_{\tau-1}$ and $\hat{U}' \geqslant U'$,

$$\hat{U}'(p_{\tau-1}) > \delta R'(w_{\tau-1} - p_{\tau-1})\hat{U}'(c_\tau).$$

Hence, the household in the city with wealth $w_{\tau-1}$ would like to consume strictly more than $p_{\tau-1}$. Hence, the household would invest strictly less than $w_{\tau-1} - p_{\tau-1}$, which is the investment level in the community. ■

B.3. *Proof of Proposition 4*

We first claim that if $w \geqslant R(\bar{w})$, then the household leaves the community. This shows that in the community, wealth is at most $R(\bar{w})$.

To prove this claim, we give the household a more generous return function $\hat{R}(w)=(w-\bar{w})/\delta+R(\bar{w})$. Suppose that the household starts in the community with some initial wealth $w \geqslant R(\bar{w})$. Then, the discounted sum of consumptions is at most:

$$(1-\delta)\sum_{t=0}^{\infty}\delta^t c_t \leqslant (1-\delta)w+\delta R(\bar{w})-\bar{w}+(1-\delta)\sum_{t=0}^{\infty}\delta^t s_t.$$

The neighbour's payoff at the beginning of period 0 is $-(1-\delta)\sum_{t=0}^{\infty}\delta^t s_t$, so it must be the case that $(1-\delta)\sum_{t=0}^{\infty}\delta^t s_t \leqslant 0$. Therefore, the discounted sum of consumptions is at most:

$$(1-\delta)\sum_{t=0}^{\infty}\delta^t c_t \leqslant (1-\delta)w+\delta R(\bar{w})-\bar{w}.$$

The best consumption sequence given this constraint is to consume constantly $(1-\delta)w+\delta R(\bar{w})-\bar{w}$ in every period. If the household with wealth w chooses to consume $(1-\delta)w+\delta R(\bar{w})-\bar{w}$, then the investment is:

$$w-((1-\delta)w+\delta R(\bar{w})-\bar{w})=\delta w+\bar{w}-\delta R(\bar{w}),$$

which is greater than $\bar{w}$ if $w \geqslant R(\bar{w})$. Hence, this constant consumption sequence can be sustained in the city under the return function $R(\cdot)$ for any $w \geqslant R(\bar{w})$. This shows that in the community, the wealth is at most $R(\bar{w})$.

Consider an equilibrium such that the household stays in the community. Define $L_t=(1-\delta)\sum_{\tau=t}\delta^{\tau-t}s_\tau$. We first show that $-L_t \leqslant R(\bar{w})$ for any $t \geqslant 0$. This is because:

$$\begin{aligned} L_t+R(\bar{w}) &= (1-\delta)\textstyle\sum_{\tau=t}\delta^{\tau-t}(s_\tau+R(\bar{w})) \geqslant (1-\delta)\sum_{\tau=t}\delta^{\tau-t}(s_\tau+w_t) \\ &\geqslant (1-\delta)\textstyle\sum_{\tau=t}\delta^{\tau-t}(s_\tau+w_t-I_t)=(1-\delta)\sum_{\tau=t}\delta^{\tau-t}c_t \geqslant 0. \end{aligned}$$

Here, the first inequality follows from the previous result that $w_t \leqslant R(\bar{w})$ in the community.

Next, we show that $-L_t \leqslant 0$ for any $t \geqslant 0$. Suppose not. Let $k \in (0,1]$ be the smallest number such that:

$$-L_t \leqslant kR(\bar{w}),\ \forall t \geqslant 0.$$

Therefore, there exists a period t' such that:

$$-L_{t'} > k\delta R(\bar{w}).$$

Consider the following deviation in period t': the household chooses $s_{t'}=0$ and leaves for the city. In each $\tau \geqslant t'$, it chooses the investment $\tilde{I}_\tau$ given by:

$$\tilde{I}_\tau=I_\tau-s_\tau+\frac{k\delta R(\bar{w})+L_\tau}{1-\delta},$$

with the remainder, $\tilde{c}_\tau$, being consumed. We show that this deviation (i) is feasible and (ii) strictly improves the household's payoff.

Note that in each $\tau \geqslant t'$,

$$\tilde{I}_\tau-I_\tau=-s_\tau+\frac{k\delta R(\bar{w})+L_\tau}{1-\delta}=\frac{k\delta R(\bar{w})+L_\tau-(1-\delta)s_\tau}{1-\delta}=\delta\frac{kR(\bar{w})+L_{\tau+1}}{1-\delta}\geqslant 0, \tag{6}$$

where the inequality holds by the definition of k. Thus, this deviation results in more investment, and so higher wealth, in each period $\tau \geqslant t'$.

Next, we show that this deviation is profitable. Using the definition of $\tilde{I}_\tau$ and the fact that $\tilde{w}_{t'}=w_{t'}$, period-t' consumption satisfies

$$\tilde{c}_{t'}=\tilde{w}_{t'}-\tilde{I}_{t'}=w_{t'}-I_{t'}+s_{t'}-\frac{k\delta R(\bar{w})+L_{t'}}{1-\delta}>c_{t'}.$$

Here, the inequality follows from the fact that $k\delta R(\bar{w})+L_{t'}<0$ by choice of t'. So this deviation results in strictly higher consumption in period t'.

Now consider $\tau > t'$. From (6) and $R'(\cdot) \geqslant \frac{1}{\delta}$, we have that:

$$\tilde{w}_\tau-w_\tau=R(\tilde{I}_{\tau-1})-R(I_{\tau-1})\geqslant\frac{kR(\bar{w})+L_\tau}{1-\delta}.$$

Therefore,

$$\begin{aligned} \tilde{c}_\tau &= \tilde{w}_\tau-\tilde{I}_\tau \geqslant w_\tau+\tfrac{kR(\bar{w})+L_\tau}{1-\delta}-\left(I_\tau-s_\tau+\tfrac{k\delta R(\bar{w})+L_\tau}{1-\delta}\right) \\ &= c_\tau+kR(\bar{w})>c_\tau. \end{aligned}$$

Therefore, this deviation leads to strictly higher consumption in every $\tau \geqslant t'$. Since $\hat{U} \geq U$, we conclude that this deviation is profitable, which contradicts the presumption that the original strategy was an equilibrium. Thus, it must be that $-L_t \leqslant 0$ for any $t \geqslant 0$.

Suppose that $s_t > 0$ in some period $t \geqslant 0$. For the neighbour to be willing to choose $s_t > 0$, it must be that her continuation payoff satisfies $-\sum_{\tau=t+1}^{\infty} \delta^{\tau-(t+1)} s_\tau > 0$, or $-L_{t+1} > 0$. This contradicts $-L_{t+1} \leqslant 0$. We conclude that $s_t \leqslant 0$ in all $t \geqslant 0$, which implies $s_t = 0$ for all $t \geq 0$, proving the proposition. ■

There are no new data associated with this article. The computational code is available on Zenodo at https://doi.org/10.5281/zenodo.6818828.

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