Game Theory Final Project: Rent Negotiation

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In one of the most expensive rental markets in the country rents have been plummeting due to the COVID-19 Pandemic. People allowed to work from home have been moving to cheaper parts of the country, and landlords, desperate to find tenants, have lowered their rents. The conundrum we approach is that of renters who are staying in their rental properties but are now paying above-market level rents.

The renter would like to re-negotiate their current rent with their landlord. Negotiation is a deeply complex topic in Game Theory, especially in a quasi-continuous setting like this one, where the renter could propose any dollar value (between their current rent and the new market value) as their proposed new rent and the landlord can negotiate back, leading to an enormous amount of possibilities.

Following the ideas set forth in Langlois's A Dynamic Game Theory of Bargaining [1], we will make a GamePlan model of a discretized version of the Rubenstein model of bargaining, along with some context-specific additions. The first thing to note in these models is that the number of potential solutions scales rather alarmingly with the number of discrete negotiating positions. To that end, we look mostly at models involving three basic positions: no change in rent (at the maximum), adjustment to current market value (at the minimum), or an even split between the two. These alone give us about two hundred potential solutions to the game (pure and mixed), so there is still quite a bit of depth to mine here.

1 First Model:

In our first model (`rent_negotiation_base.gpx`), the renter can propose a new rent value and, in response, the landlord can accept the proposal, or deny it and continue to negotiate.

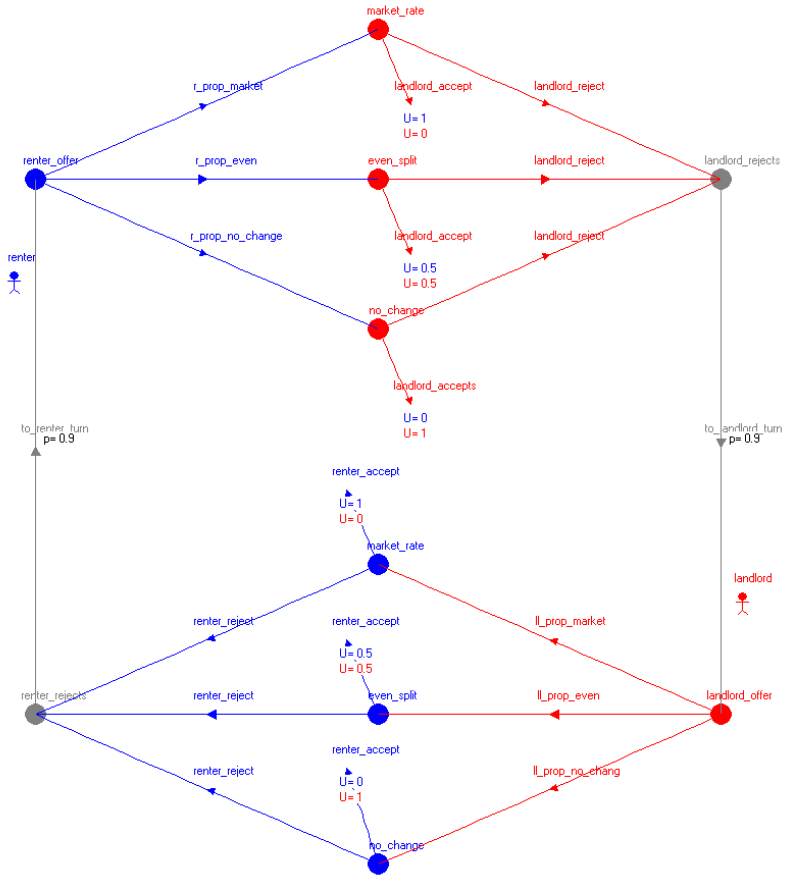

Figure 1: The basic discretized negotiation loop. The correspondence between discount factors and probability of continuation is exploited here to keep the flow of the choices tidy.

Evidently, the best result for the renter would be to have the new rent match the market rate, and for the landlord, it would be to have the rent kept at the prior rate. In these cases, we represent the utilities in the model with 1 for the landlord and 0 for the renter if the rent is kept the same, 0 for the landlord and 1 for the renter if the rent is changed to market value, and 0.5 for both if they agree on the midpoint.

Here we have a closed loop. One side or the other must eventually accept an offer for the game to end and the potential options are symmetric on both ends. Restricting ourselves just to pure solutions, the results are mildly disheartening. We do see perhaps the most amicable solution arise,

that each side would propose the even split and the other would immediately accept. But, the bulk of solutions have a less friendly strategy. One player will simply accept nothing less than a total win and the other capitulates with certainty. This class of solution is not terribly satisfying as a solution to a real life problem. To start, this doesn't really feel like negotiation in a meaningful sense, nor does it seem realistic that either side could be equally likely to pull off this unilateral power-play (if we had to guess, we suspect landlords would have an advantage here). Looking at a sample of our 180-ish mixed solutions we don't see a huge variety of strategies either. What we mostly see here is our players choosing an offer with many various likelihoods, but acceptance of those offers is rarely, if ever, probabilistic. Instead we see our emergent bullying behavior from one player or the other. Perhaps even bleaker, when including mixed solutions, outcomes where the equitable split is achieved essentially vanishes (a non-exhaustive survey of only mixed solutions show's no even split outcomes achieved).

2 Second Model:

In our second model (`rent_negotiation_retaliation.gpx`), we expand the options to add some other context-specific possibilities for both the renter and the landlord. The renter can propose a new rent value, or simply choose to give their notice and move out (a final move). If the renter begins the negotiation, in response, the landlord can accept the proposal or deny it and continue to negotiate (as before), or in retaliation for the suggestion of lowering the rent, they can choose to raise the rent instead (this might be unlikely, but could be important for the renter to take this possibility into account, as it is well within the landlord's legal purview).

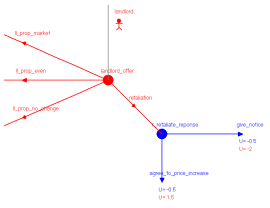

Figure 2: Retaliation

Once again, the best result for the renter would be to have the new rent match the market rate, and for the landlord, it would be a good result to have the rent kept at the prior rate. In these cases, we still represent the utilities in the model with 1 for the landlord and 0 for the renter if the rent is kept the same, 0 for the landlord and 1 for the renter if the rent is changed to market value, and 0.5 for both if they agree on the midpoint.

Additionally, however, we now represent the utilities for the landlord retaliating and the renter caving to the retaliation with 1.5 for the landlord and -0.5 for the renter, since the elevated rent

is even better for the landlord than the current one (though not quite by twice as much), and the new rent leaves the renter in a worse position than they started at. And finally, we determined that the utilities for the renter moving out (whether in response to retaliation or as an independent choice instead of negotiating) to be of -0.5 for the renter, since it is also a bad outcome (though not terrible, as the renter would be looking for a new place in a renter's market) and -2 for the landlord. The -2 might seem a dramatic shift, but it is a very poor position for the landlord, as they would likely have to spend money on repairs to prepare the property to rent again, have the property unoccupied and thus lose rent for some time, and eventually rent it out at or very near the (lower) market rate.

Here we can immediately note two things in our pure results. First, the renter never willingly leaves if not forced to make that choice via ultimatum. Further, if the landlord thinks the renter will respond to the ultimatum by actually leaving, that option will never be brought up. Instead we see that negotiation continues as in our original model. If the landlord thinks the renter will cave however (perhaps the renter has a known attachment to the property), the landlord is more than happy to press the ultimatum. This is not exactly surprising, but perhaps it lends weight to what most people would consider intuitive. Negotiation between two parties with a power imbalance only works if the weaker party has a credible threat. If we remove the option to leave in a favorable market, the negotiation process breaks down and the landlord will simply always propose a rent increase.

3 Third Model:

In our third model (`rent_negotiation_selfish.gpx`), we keep the general structure we had in the second model, but now we consider what would happen if our discretized options changed a bit towards selfishness. Both the renter and the landlord can propose no change or an adjustment to market rate (the two ends of the spectrum of possible offers), but now instead of considering the middle offer as half-way between the current rent and the market rate, each of the players makes a proposition that leans in their favor in a 3:1 ratio.

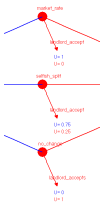

Figure 3: Selfish Split

Thus, we generally keep all the utilities the same, except for in the partial adjustment case. For the landlord partial adjustment proposal, the landlord has a utility for 0.75 and the renter has a utility of 0.25. The inverse is true for the renter partial adjustment proposal.

In this case, the solutions are not dramatically different from the second model, which is in itself interesting. The overall strategies remain the same, we just see a split in the solutions because the partial adjustment route is no longer equivalent on both sides. This leads us to see solutions where the landlord gets the 0.75 utility, and others where the renter gets the 0.75 in their favor. We even briefly considered an 80-20 split, and the strategies still remained the same, so this leads us to conclude that the game does not change dramatically with different partial offers. Of course, this is all a simplified model of the continuous game itself, and there are many more paths to consider there, but in general, it seems like the main changes happened when we considered the options to retaliate from the landlord and to threaten leaving by the renter.

4 Thoughts and Conclusions

Our main takeaway, from a game-theory-to-real-life application perspective, is that if you want to negotiate you best have credible leverage. This is perhaps not a groundbreaking revelation, but informative so see play out even in our very simplified model. Also of interest is the stubbornness of "bully" solutions to these negotiations. While this feels not inaccurate, though perhaps not in the perfect symmetry GamePlan presents, looking for ways to disincentivize this behavior would be interesting further work. Our simple attempts, however, did not seem to do much to suppress this strategy.

If you're renting however, we suggest you take advantage of the favorable market while it lasts. Maybe even try to be a bit of a bully about it.

References

[1] Jean-Pierre Langlois. *A Dynamic Game Theory of Bargaining*. Feb. 2021.