Collateral Value and Strategic Default: Evidence from Auto Loans

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Abstract

This paper identifies the link between collateral value and strategic default incentives. Using novel auto loan performance data, I examine how unanticipated changes in vehicle import taxes and changes to loan-to-value restrictions impact borrowers' default behavior. These shocks affect the value of the underlying asset but are not related to underlying borrower characteristics or their ability to repay. Using a difference-in-difference strategy, I estimate that a 10% drop in the collateral value corresponds to a 44% increase in default rate. Consistent with the strategic default hypothesis, I find that the collateral value has a stronger effect for borrowers with higher outstanding loan balances.

JEL Classification: D12, D14, G23

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Introduction

A strategic default is a borrower decision to maximize wealth by withholding payments, despite the ability to pay. Option theoretic models predict strategic default when a drop in collateral value makes the present value of continued loan repayment less than that of defaulting (Foster and Van Order, 1984; Kau et al., 1987; Titman and Torous, 1989; Campbell and Cocco, 2015). In contract theory, the strategic default occurs when the collateral value drops sufficiently to place the relationship between a lender and a borrower outside its self-enforcing range (Klein, 1996; Hart, 2009). However, due to countervailing non-financial factors, borrowers may opt to repay loans despite financial incentives suggesting default is optimal (Bursztyn et al., 2015; Guiso et al., 2013; Bhutta et al., 2017).[1] Therefore, the extent to which the collateral value affects the borrowers' default decision is a challenging empirical question with implications in macroprudential policy interventions and contract design.

Although many papers demonstrate that default is more likely, *ceteris paribus*, for a borrower who experiences a larger drop in collateral value (Deng et al., 2000; Bajari et al., 2008; Foote et al., 2008; Palmer, 2015; Scharlemann and Shore, 2016), a causal interpretation is not possible due to confounding factors. A number of omitted variables—such as borrowers' ability to pay, discount rate, and cost of default—can be associated with both the collateral value and borrowers' default risk. As such, failure to control for these factors can introduce omitted variable biases that preclude causal inference.

In this paper, I overcome the identification challenge by exploiting policy changes that varied vehicle import tax rates and maximum loan-to-value ratios for auto loans in Sri Lanka.[2] As I show later, these unanticipated policy changes affected the secondary mar-

[1] Non-financial factors may include moral aversion to default (Bursztyn et al., 2015; Guiso et al., 2013), emotional attachment (Guiso et al., 2013; Bhutta et al., 2017), fear over the perceived consequences of default (White, 2010; Seiler et al., 2012), people's subjective expectations (Kuhnen and Melzer, 2017), inattention (Andersen et al., 2015; Agarwal et al., 2015) and financial illiteracy (Burke and Mihaly, 2012).

[2] Vehicle imports are taxed heavily in Sri Lanka. Taxes are one-off and should be paid by the importer before the vehicle is cleared from the Sri Lanka Customs Department.

ket values of vehicles already pledged as collateral. My identification strategy hinges on the notion that while these changes to the value impact borrowers' incentives to strategically default, those are not correlated with unobserved borrower characteristics or their ability to pay. Furthermore, these policy changes impacted certain classes of vehicles only, allowing me to use comparable unaffected vehicle types as control samples in a difference-in-difference setting.

Due to severe import tax rates (approximately 200%), vehicles are very expensive in Sri Lanka and constitute a large fraction of a vehicle owner's wealth–sometimes more than their home. Moreover, as a result of continuously depreciating local currency, used vehicles generally appreciate in value. This means that assertions based on auto loans in Sri Lanka are likely to be valid not just for auto loan markets, but also for mortgage markets, which is of greater economical importance.

I use a large proprietary database of auto loan transactions from a major auto loan lender in Sri Lanka. This data set includes a wide span of loan-level data at origination and month-by-month stream of payments made by the borrower, while also indicating whether (and, if so, when) the loan is in default.

The empirical analysis features two sections. First, I estimate the impact of change in collateral value on strategic default using three unanticipated vehicle import tax rate changes during the sample period: a November 2014 import tax rate cut for cars with an engine capacity less than 1L (henceforth, smaller-engine cars) and two import tax rate hikes for new 3-wheelers in November 2015 and April 2016.[3] As expected, I find that the decrease (increase) in import tax rates on smaller-engine cars (3-wheelers) led to a decrease (increase) in the secondary market value of used vehicles in affected category by decreasing (increasing) the relative demand for used vehicles.

Using these tax rate changes as exogenous shocks to collateral value (i.e., treatments),

[3] 3-wheelers are also known as auto-rickshaws, tuk-tuks or trishaws. These are motorized vehicles with three wheels mainly used as taxis in Sri Lanka.

I apply the standard difference-in-difference methodology to loan-month observations, to estimate the effect of collateral-value change on strategic default. *Treated* loans are those financing vehicle types affected by a tax rate change and originated prior to that respective tax rate change. In the case of the tax rate cut on smaller-engine cars, cars with engine capacity greater than 1L (henceforth, larger-engine cars) serve as the control sample. When analyzing the impact of tax rate on 3-wheeler loans, to ensure that my control group is comparable, I construct matched samples using loans offered for other types of vehicles based on similar borrower profiles and type of vehicle use.[4] I expect, after the tax cut, the default rate to increase for smaller-engine car loans originated prior to the tax rate cut in comparison to the default rate for the unaffected larger-engine car loans. Likewise, the default rate of 3-wheeler loans is expected to drop relative to the control sample, following tax rate hikes. Throughout the analysis, I include loan fixed effects to account for unobserved time-unvarying borrower characteristics and district-month fixed effects absorb any time-varying differences across borrowers at the district level.

I find strong evidence for the significant effect of collateral-value changes on borrower default decisions. Default rate of smaller-engine car (3-wheeler) loans rose (fell) by 0.4% (0.3%) who experienced a 10% drop (increase) in collateral value following tax changes. The unconditional probability of default prior to the tax change was 0.9% (1.7%) and the estimated effect corresponds to a 44% (24%) higher(lower) probability of default.

The second section examines the impact of loan-to-value ratio (LTV) cap changes on default rates. In Sri Lanka, auto loans originated prior to 2017 were subject to an LTV cap of 70%. In January 2017, the Central Bank of Sri Lanka revised the LTV caps applicable for auto loans financing *new* vehicles based on vehicle type– rising for some and decreasing for others. Specifically, according to new rules, a person buying a new car, SUV, or van can only obtain financing up to 50% of the value of the vehicle, while

[4] 3-wheelers are mainly used as a productive asset (as opposed to a consumption asset) and one of the control samples is restricted to loans used to finance the purchase of vehicles that are used for productive purposes

the LTV cap was reduced to 25% for new 3-wheelers. For new trucks and buses, lenders are allowed to finance up to 90% of the value. LTV cap for *used vehicle* loans remained unchanged at 70%.

As I show later in the paper, these changes affected the secondary market values of used vehicles as well. Consider cars, whose LTV cap was reduced. This tighter LTV cap raises down-payment requirements to buy a new car, forcing some borrowers into used-vehicle market. The down-payment requirement for a used car is then much lower since a higher LTV cap of 70% (as opposed to 50%) applied to lower valuations. With the emerging higher demand for used cars, the value of those pledged before the reform will thus rise, curbing borrower incentives to strategically default. Similarly, for vehicle types where LTV cap is increased, borrower incentives to strategically default would rise.

In this setting, I use a generalized difference-in-difference approach with dummy variables indicating loan-months of each vehicle type after new LTV rules. The sample comprised loan-month observations before and after the rule change and all loans were originated prior to the rule change. Evidence from LTV cap changes presents similar effects from collateral value: vehicle types with newly increased LTV caps, which curbed used-vehicle demand, lead to increased default rates; vehicle types with newly lowered LTV caps saw a drop in default rate.

The main assumption underlying my approach is that absent the tax-LTV policy changes, the average default rate in the treated and control groups would have moved in parallel. Graphical and regression evidence suggest that default rates moved in parallel before the treatments—providing support for this assumption. Furthermore, placebo tests simulating the reforms at earlier dates confirm that the results are not driven by preexisting trends inherent to specific vehicle types.

Another concern I address is equity extraction. If liquidity-constrained borrowers could extract increased equity in the form of a secondary loan following gains in collateral value, then my results would be picking up the impact of relaxed liquidity constraints. Detailed

monthly level data allowed tracking of total loan balances from month to month and I do not observe any increase in loan balances. Also, regulations do not allow borrowers to pledge the same asset as the collateral for a secondary loan with another lender. In private conversations, management of the lender further confirmed no equity extractions following any collateral value gains.

My findings contribute to two strands of literature. First, I contribute to household finance literature by using new sources of variation to isolate the collateral value channel in borrowers' default incentives. The work of Palmer (2015), that uses long-run regional variation in house-price cyclicality as an instrument for house price declines, comes closest to my paper. One potential concern with his methodology is that the exclusion restriction is likely to be violated if the instrument is associated with credit risk of borrowers. No other previous study to my knowledge has used actual data to identify the causal link between collateral value and strategic default. Guiso et al. (2013) and Bajari et al. (2008) use survey data and structural estimation respectively to understand how borrowers' willingness to default changes with the home-equity shortfall. The existing work on strategic default does not provide evidence on the collateral value channel (Mayer et al., 2014; Yannelis, 2017; Blouin and Macchiavello, 2017; Artavanis and Spyridopoulos, 2018). Studies, such as Deng et al. (2000); Bajari et al. (2008); Foote et al. (2008); Scharlemann and Shore (2016), that show a negative association between collateral value and default do not permit causal inference. Identification of the collateral value channel is particularly relevant for ex-ante policy interventions, such as loan-to-value restrictions and mortgage insurance, which have been implemented under the assumption that collateral value is an important determinant of strategic default, despite limited empirical evidence.

Second, my study contributes to the empirical literature on contractual imperfections and defaults by examining how contractual defaults respond to unanticipated changes in market conditions. Theoretical models suggest that parties to a self-enforcing agreement have incentive to engage in 'hold-up' when market conditions change sufficiently to place

the business relationship outside its self-enforcing range (Klein, 1996; Hart, 2009). A recent study by Blouin and Macchiavello (2017) provide evidence to support this prediction by showing that unanticipated rises in market prices increase defaults on coffee pre-financing agreements. I complement their study by showing unanticipated drops in collateral value lead to more defaults.

In addition, this paper also adds to the sparse literature on determinants of auto loan default. Agarwal et al. (2008) and Agarwal et al. (2007) study the relationship between borrower consumption choices and future auto loan performance. Heitfield and Sabarwal (2004), Ghulam and Hill (2017) and Wu and Zhao (2016) look at the determinants of auto loan default.

Finally, this paper presents direct evidence on the effect of unanticipated policy reforms in the Sri Lankan auto finance market. I show that an unintended consequence of selective import tax cuts and LTV cap increases was to increase the number of strategic defaults for certain types of loans. I also quantify the impact on the secondary market values of vehicles due to these policy reforms.

1. Theoretical and Institutional Background

1.1 Role of Collateral Value in Strategic Default

Economic theory predicts strategic default when the collateral value drops. Household finance literature has traditionally modeled individual loan default using option pricing theory, where borrowers default when the expected utility of continued loan repayment falls below that of default (Foster and Van Order, 1984; Kau et al., 1987; Titman and Torous, 1989). In these models, default arises from borrowers' unwillingness, rather than inability, to repay. These defaults are called strategic defaults or ruthless defaults. In contract theory, strategic default is the result of borrowers engaging in 'hold-up' if large and unanticipated changes occur in collateral value (Klein, 1996; Hart, 2009).