Stress Testing Chilean Corporate and Household Sectors

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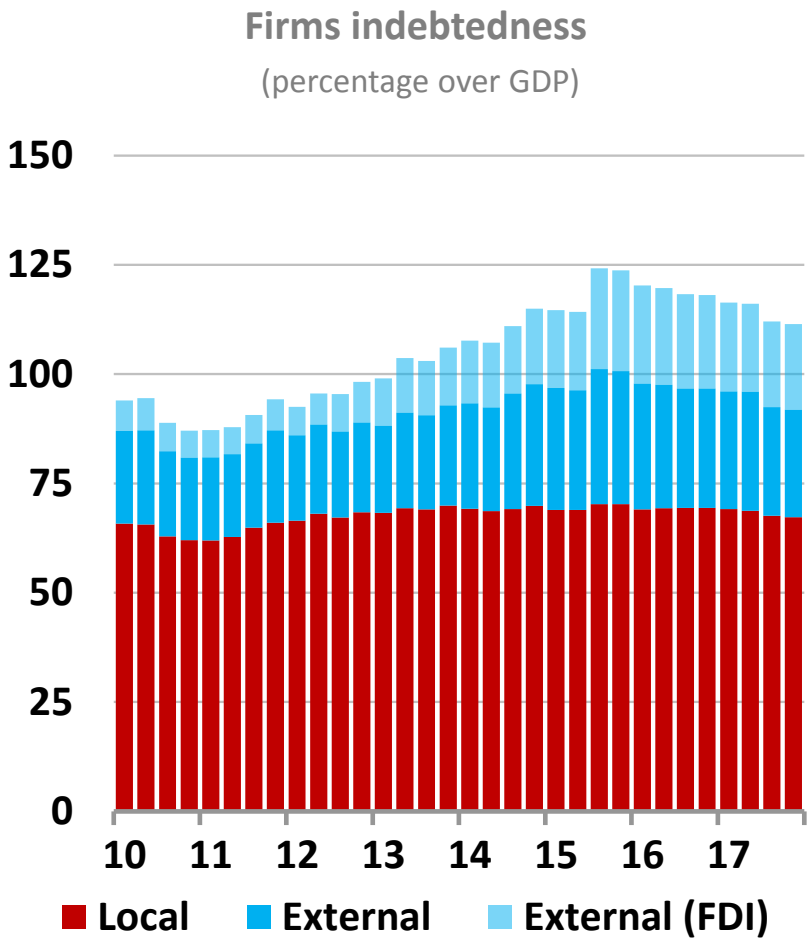
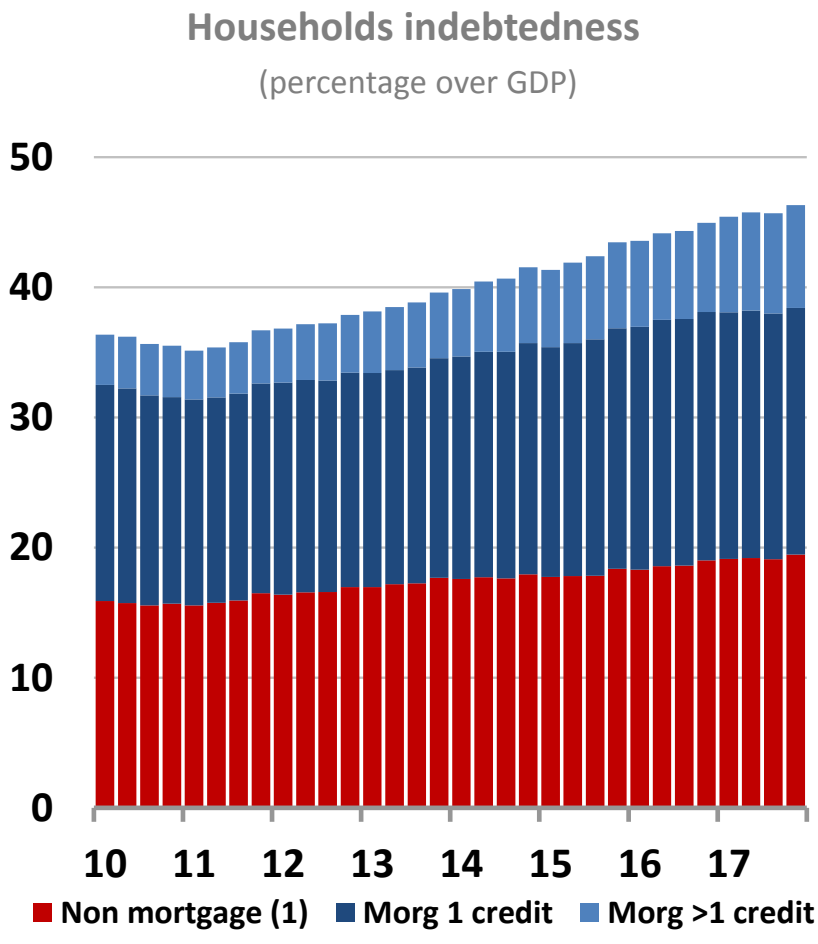
The views expressed are my own and do not necessarily reflect those of the Central Bank of Chile

Motivation

- In Chile, the implementation of Stress Tests for non-financial institutions is in a developing phase. With research in progress and ongoing efforts to collect microdata to perform the exercises.
- For firms, individual balance sheet along administrative data (credit register) has been utilized.
- For the household sector, research aimed towards addressing the lack of information has been conducted using the Household Financial Survey (HFS) as well as administrative data.
- In this presentation we will review some of the studies carried out in Chile in order to quantify the credit risk of certain firms and households.

Over the past years, both household and firm indebtedness have increased. Aggregate figures hide important developments.





(1) Non mortgage debt includes consumption and others debts.
Source: Central Bank of Chile based on information from Achef, SBIF, CMF and SUSESO.

Outline

I. Corporate sector
   1. Balance-sheet data exercise
   2. Administrative data exercise

II. Households
   1. Banking default rate (administrative data)
   2. Debt at risk (survey data)

Corporate Sector

Corporate 1: Using balance-sheet information of supervised firms, Espinosa et al. (2017) conduct a stress test exercise focusing on risks related to activity and market prices.

- Data used:
  1. Individual firm-level balance-sheets. It should be noted that consolidated balance-sheets could be affected by foreign activity (branches in the region).
  2. Currency mismatch data. This includes details on foreign assets, FX debt, and financial instruments used for hedging (e.g cross currency swaps).

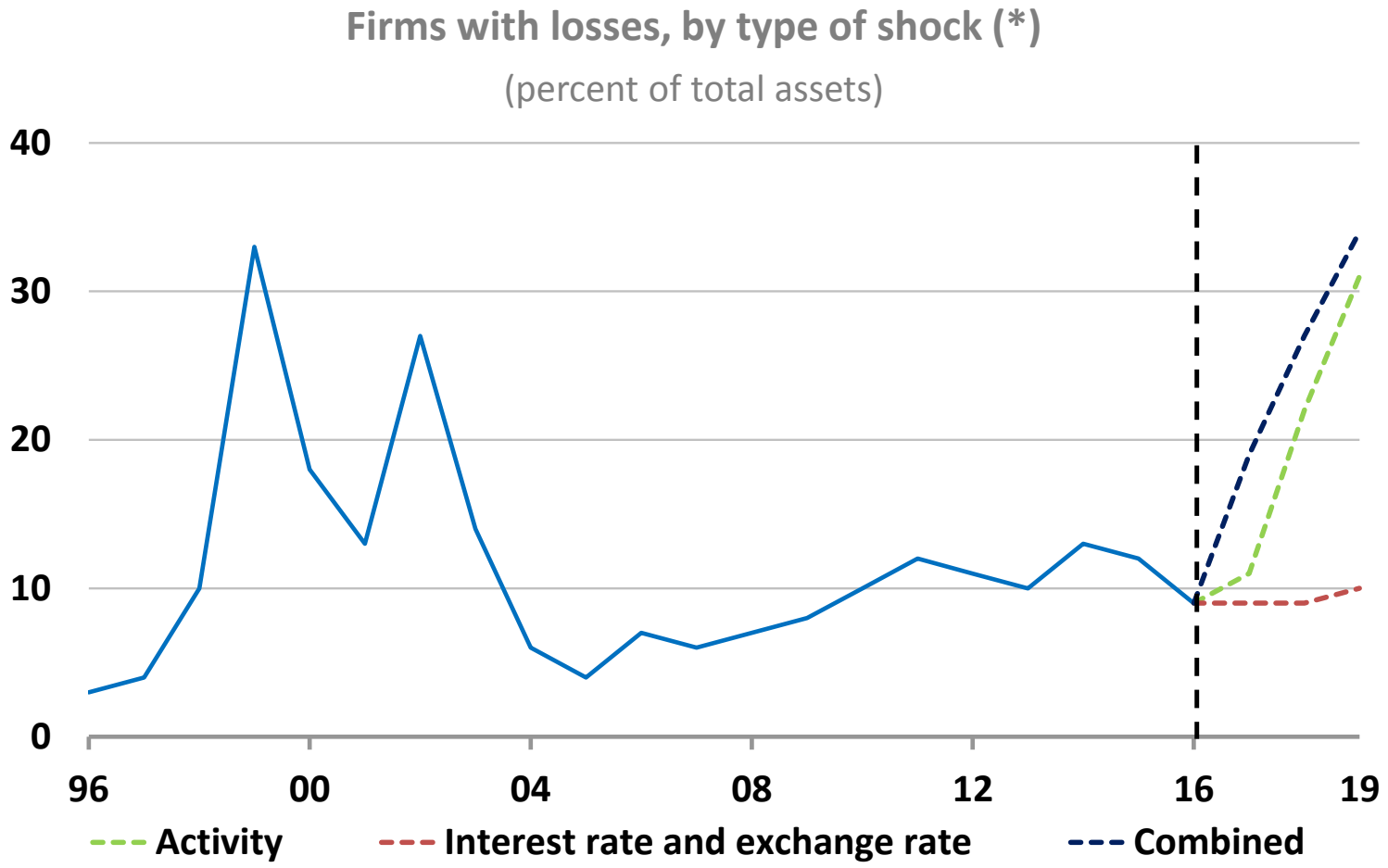
- Stress scenarios consider three shocks:
  1. **Activity**: fall in firms' operational results
  2. **Interest rates**: increase of short and long term rates
  3. **Exchange rates**: depreciation of CLP against USD

The study focuses on the next 3 years and shocks are the following:

Shock	Year 1st	2nd	3th
Activity (percentage points) (1)	-0,6	-0,6	-0,6
Interest rate: Bonds (basis points) (2)		250	250
Interest rate: Banking Debt (basis points) (3)		100	150
Exchange rate (percentage)	20%	20%	

(1) Activity is measured by changes in the EBIT (Earnings Before Interest and Taxes) ratio on Assets.
(2) It is assumed that a rate increase for debt held on bonds affects only short term maturities.
(3) It is assumed that a rate increase for banking debt affects the short term portion and a half of long term debt which is assumed must be renewed.

Main result: Activity shock is the most relevant. Predominance of long term debt (over 3 years) and no major currency mismatches explain the low impact of the interest + FX shocks.



(*) Firms with losses have an interest coverage ratio (defined as end-of-year EBIT over financial expenditure) lower than one.
Source: Central Bank of Chile base on data from CMF.

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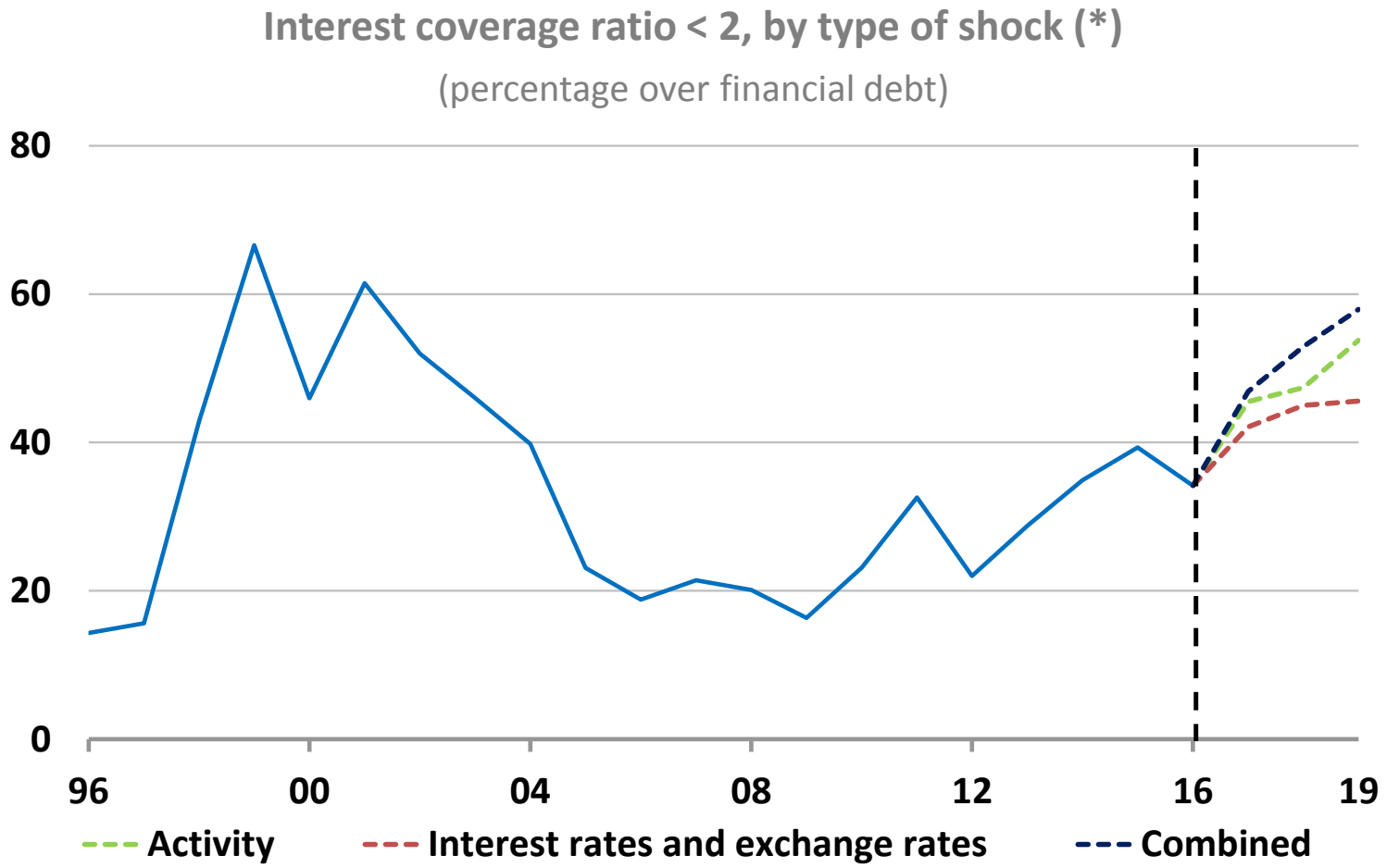


(*) Interest coverage ratio is defined as end-of-year EBIT over financial expenditure.
Source: Central Bank of Chile base on data from CMF.

The assessment of risk in these firms involves a stressed-situation, but does not directly imply an increase in non-performing loans.

- Firms with balance-sheet data are usually large enough to get funding from public sources, such local/external bonds.
- Default among these firms is rare, however it cannot be considered a zero risk event. Indeed, these firms reduced their operational size affecting both medium size firms and workers.
- We define stressed-firms as those in which there is little financial margin to face a distress. In particular, we summarize that with the Interest Coverage Ratio (ICR), considered as being stressed when ICR<2.
- To complete the assessment for the whole sector we have to consider firms with limited information (no balance-sheet data but sales-strata instead).

Corporate 2: Using administrative data, the relationship between sales strata changes and default rate is analyzed.

- Procedure (transition matrix / default):

1. Using administrative data, firms are classified according to their annual sales on 12 strata. Then firms are grouped by the number of strata changes with respect to the previous year.

2. Using data from the credit-register, January default rates are calculated for each group (number of strata changes) from years 2009 to 2017.

3. Thus, for a given year t, the January t+1 default rates are computed for firms strata changes between year t and t-1.

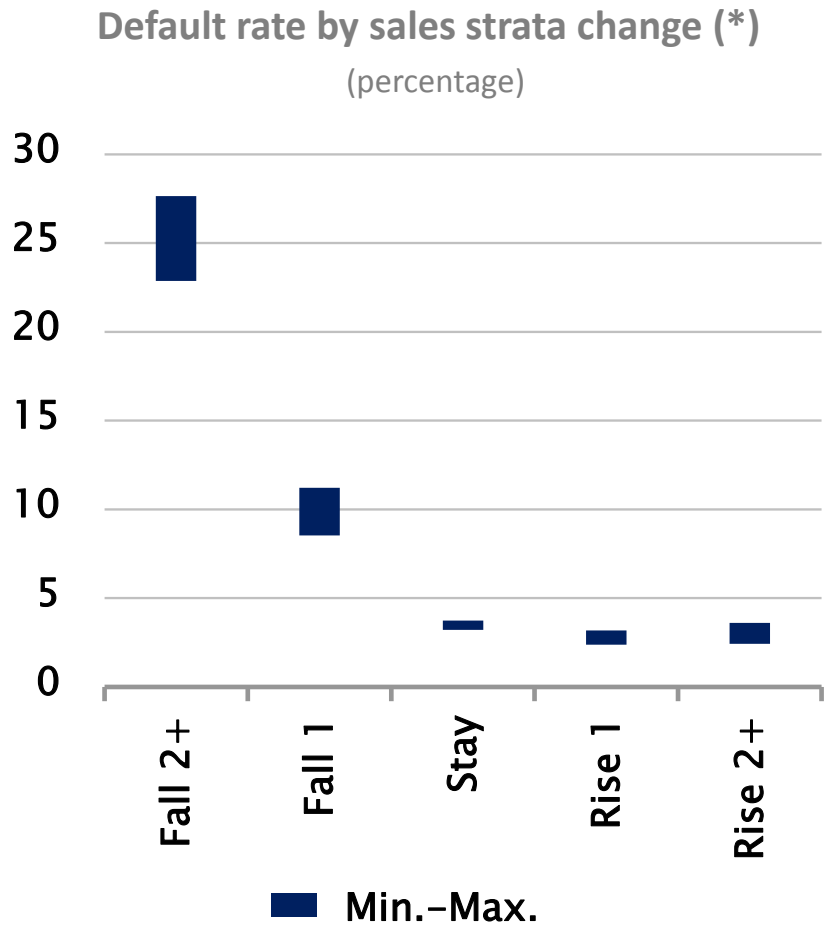
Strata according to annual sales

Sales strata	Annual sales (USD)
1	0 to 9,000
2	9,000 to 27,000
3	27,000 to 108,000
4	108,000 to 225,000
5	225,000 to 450,000
6	450,000 to 1,1 million
7	1,1 million to 2,2 million
8	2,2 million to 4,5 million
9	4,5 million to 9 million
10	9 million to 27 million
11	27 million to 45 million
12	more that 45 million

Source: National Statistic Bureau (INE).

Main result: Drop in sales translates into significant increases in default rate, being more severe for “huge-drops”.

- **Group of firms**: with no public or external debt (mostly reliant on local banks for funding).
- **Variable of interest:** Default rate, conditional on having performing debt during the previous year.



(*) Sample 2009-2017.
Sources: Central Bank of Chile based on information from INE, SII and SBIF.

Households

Households 1: Bank credit registry for mortgages and consumer loan debtors is used at the regional level. Thus default rate at that level is related to regional unemployment rate.

- Several papers document that negative income shocks associated to unemployment (as opposed to price shocks) are the best predictors of mortgage default (Deng et. al, 2000; Elul et. al, 2010; Gerardi et. al, 2015).

- With that background, Córdova and Fernández (2017) exploit regional heterogeneity since their data starts after the Global Financial Crisis (2009:Q1).

- Main specification is given by:

$$\Delta DR_{it}{}^{j} = \alpha + \delta \Delta DR_{i,t-1}{}^{j} + \sum_{k=1}^{K} \phi^{j}{}_{k} \Delta u_{i,t-k} + \mu_{it} + \varepsilon^{j}{}_{it},$$

where $i = 1,2,\ldots,15$; $j \in \{\text{con, mort}\}$.

There is a positive and significant effect of the first two lags of unemployment rate change over default rates. Thus the long-term effect implies an elasticity of about around 20% for both types of debt.

Default Rate (90-180d)

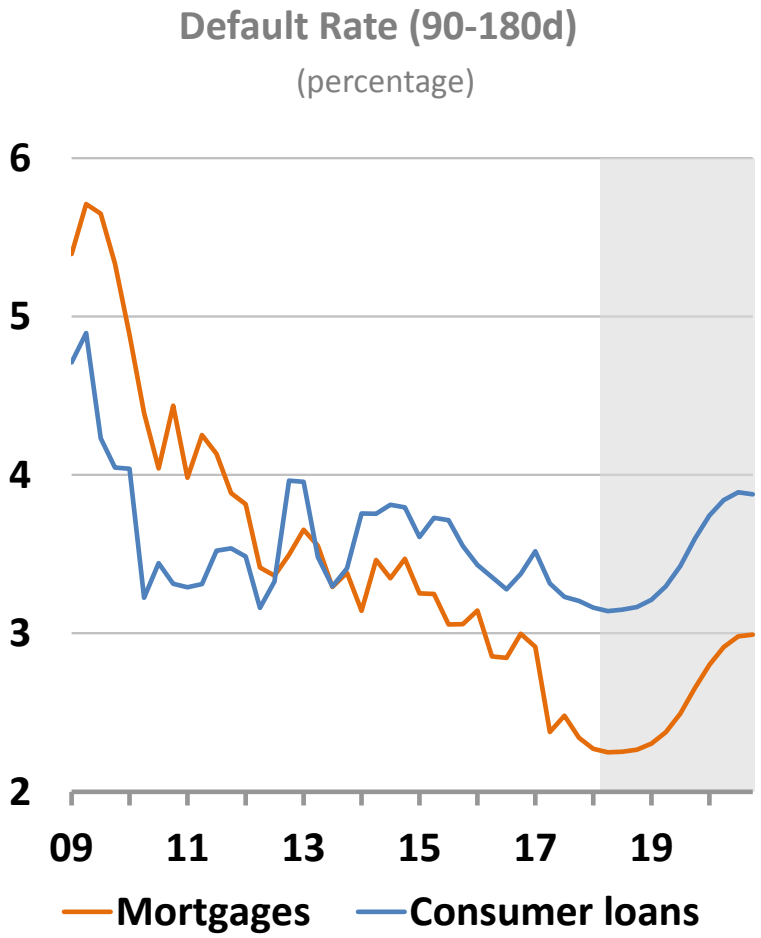
	(1) Mortgage	(2) Consumer	(3) Mortgage	(4) Consumer
U (-1)	0.03**	0.06**	0.03 **	0.06 **
U (-2)	0.04**	0.05**	0.03 **	0.04**
U (-3)	- 0.02	0.00	- 0.04	0.00
U (-4)	- 0.00	- 0.05	- 0.05	0.00
DR (-1)	0.69***	0.48***	0.58 ***	0.46 ***
Obs	405	405	405	405
LT Effect	0.23	0.21	0.14	0.19
FE	Region	Region	Region, Time	Region, Time
R^2 Aj. *within*	0.623	0.315	0.711	0.420

Note: Robust standard errors (clustered by region).

* p<0.1, ** p<0.05, *** p<0.01.

This 'bottom-up' national stress test exercise manages to replicate the build-up of consumer loan default seen during the Global Financial Crisis.

- Unemployment stressed path follows the realized trajectory observed during the Global Financial Crisis (starting on 2008:Q4).
- Common path for all regions, then aggregate default rates up to the national level.



Source: Own elaboration based on SBIF data.

Households 2: Survey Data allow us to quantify credit-risk of consumer loans. Madeira (2014) proposes the use of Debt-at-Risk measure.

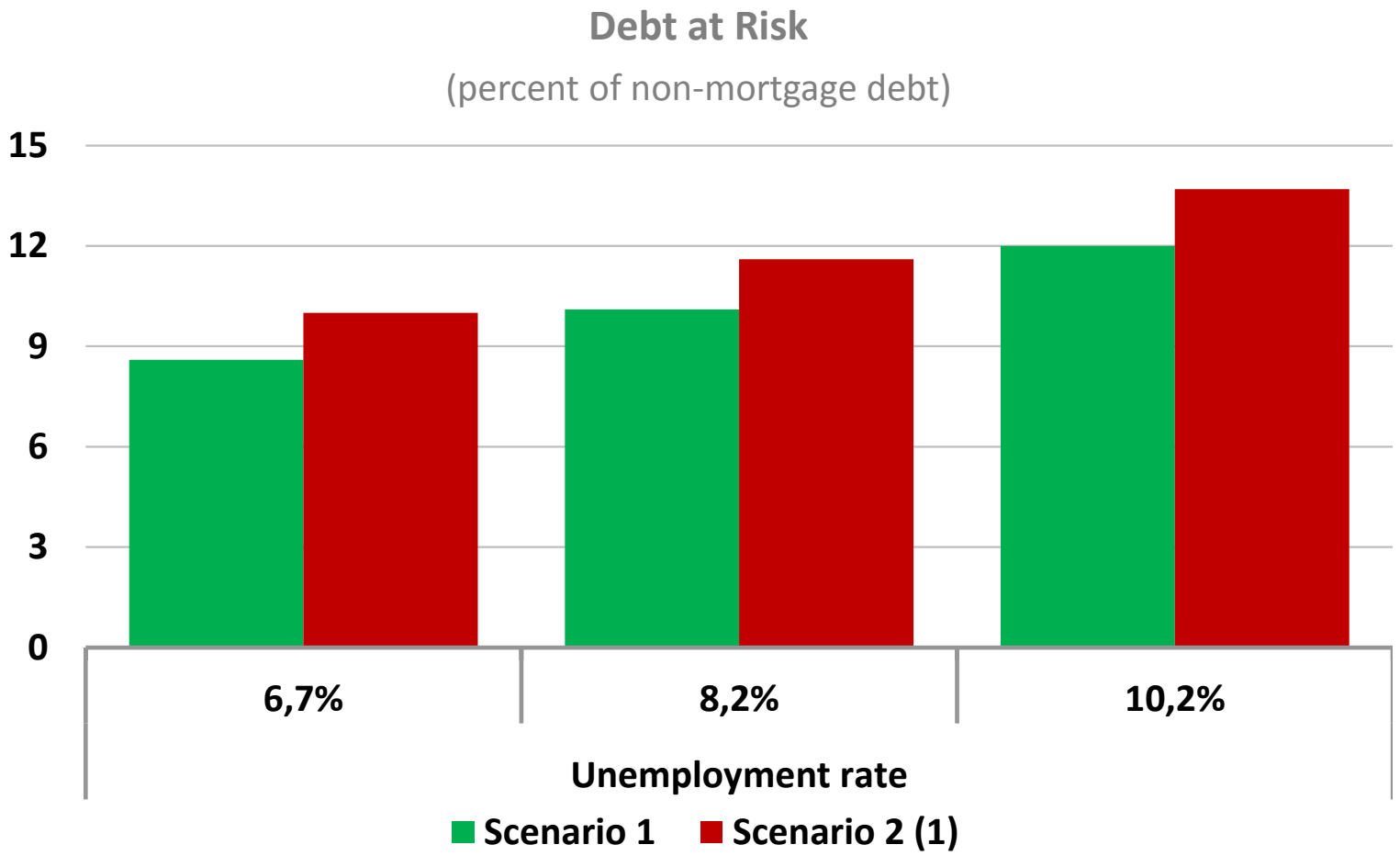
- Debt at risk (DaR) is defined as

$$DaR_t = \frac{\sum_i \Pr\left(Df_{i,t} = 1 \middle| X_{i,t}, \beta\right) D_{i,t}}{\sum_i D_{i,t}}$$

where D stands for debt and Pr() is estimated with a probit model using a set of surveys (CASEN and EFH).

- Thus, main determinants of consumer default are:
  - High indebtedness and financial burden
  - Unemployment risk, low income
  - Family size, education and marital status of head of family

Main result: Debt-at-Risk (over a 3m horizon) increases with unemployment rate and also with lower employment quality.



(1) Scenario 2 considers a deterioration in job quality, i.e. that a group of workers suffer a 20% drop on their salary due to lower quality jobs (e.g. informal work) while others lose 10% for working less hours.
Source: Household Financial Survey 2014.

Final Remarks

- Over the past years, both firm and household indebtedness have increased. But those aggregate measures do not provide a proper assessment of risk. We rely on micro-data and stress-tests exercises to evaluate vulnerabilities on these sector.

- For firms, economic activity (measured by earning or sales) is a key determinant of risk, interest rate and exchange rate do not involve major increments on risk.

- For households, credit register and survey data suggest that labor market dynamics (unemployment rate, job quality) are relevant for household-risk.

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