Energy Efficiency:

Impact on real estate values and risk

EMF ECBC

CRIF RES Real Estate Services

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CRIF's unique contribution

Credit Bureau

Leading provider in continental Europe of banking credit information. EURISC is the **most exhaustive Italian Credit Bureau** with 78 million credit positions updated regularly, and a 94% hit rate

Property Valuation

Leading provider of property valuation in Italy with a **25% market share** towards banks**,** more than **600 professional property appraisers** and up to **100.000 valuation reports** a year.

AVM

Leading provider of Automated Valuation Model for the Italian market since 2014.

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Scope of work

Does **Energy Efficiency** of buildings impact their value?

How can such impact be **measured**?

How these findings will **benefit** the credit policies?

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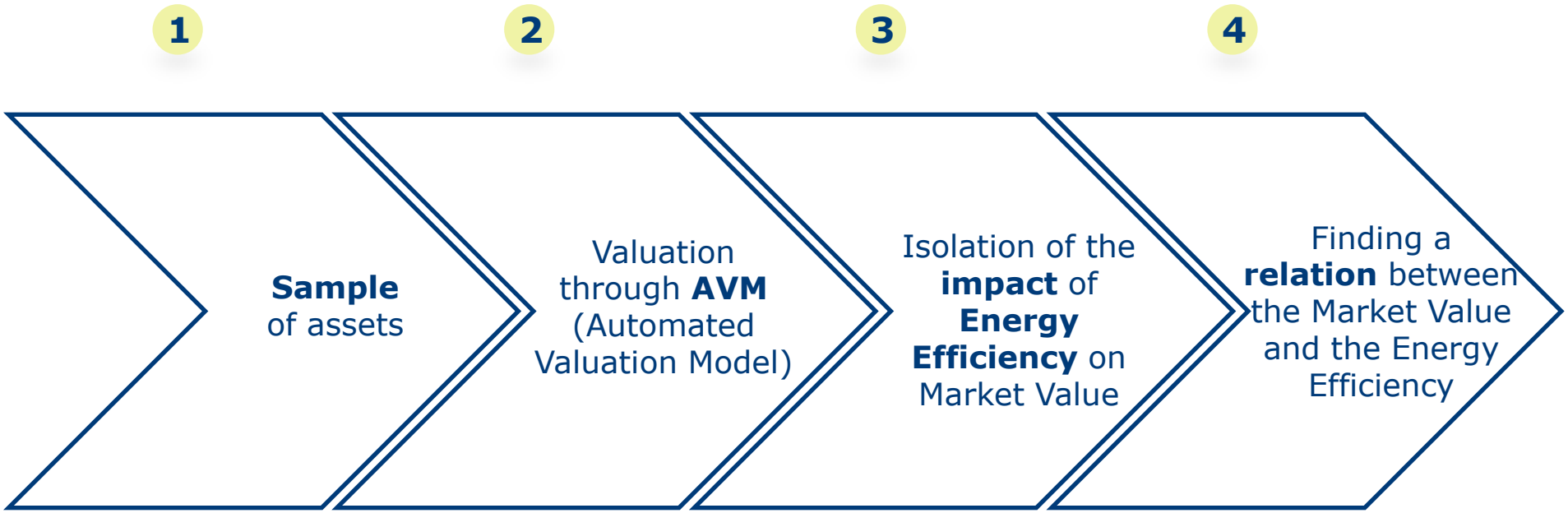
The 4 steps of the analysis



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Sample of assets
First Step

Year	# of Cases
2012	3.092
2013	2.998
2014	3.214
2015	5.417
All	**17.097**

Identification of a **representative sample** of assets valued by CRIF's Valuation Service from 2012 to 2015

The sample database includes all the **relevant data/attributes** on the assets valued

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Automated Valuation Model
Second Step (1/2)

Automated Valuation Model (AVM)

"A system that provides an estimate of value of a specified property at a specified date, using mathematical modelling techniques in an automated manner typically including a comparables-based approach similar to surveyor valuations."

Automated:

- No bias due to human factor
- Objectivity of outcomes
- No manual selection of comparables and other adjustments

Valuation

Model:

- AVM adopts sophisticated modelling techiques and data anlysis an requires dedicated technologies, other from the simple revaluation of historic values through indices

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Automated Valuation Model
Second Step (2/2)

Automated Valuation Model (AVM)

AVM if favorably rated by Rating agencies thanks to the reliability of data and the low level of standard deviation of the error distribution from the surveyors' values

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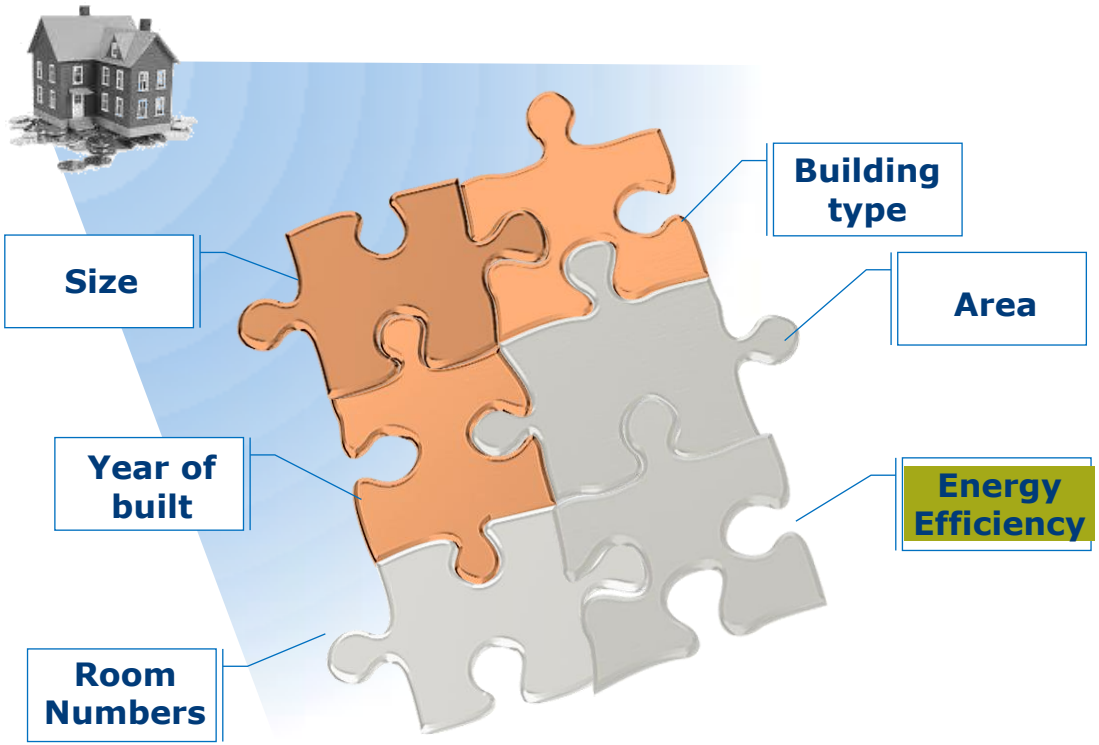
Isolation of the impact of Energy Efficiency on Market Value

Third Step (1/3)



All attributes are known and can be weighted by AVM

- All attributes contribute to the AVM valuation
- Each attribute has a different weight
- Energy Efficiency can be used as a measuring tool together with a clustering process to get more accuracy of the results

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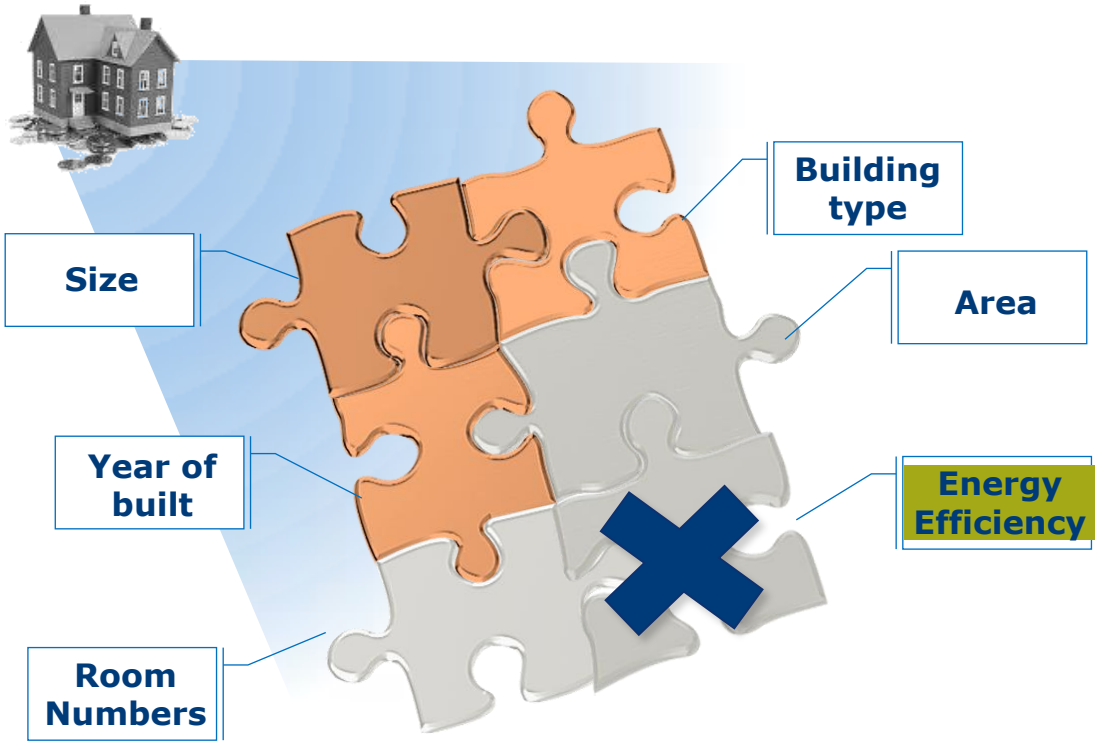
Isolation of the impact of Energy Efficiency on Market Value

Third Step (2/3)



It is possible to **isolate** the contribution of **different attributes to the Market Value**

We **have excluded the attribute "Energy Efficiency" to isolate its contribution** to the Market Value of the assets

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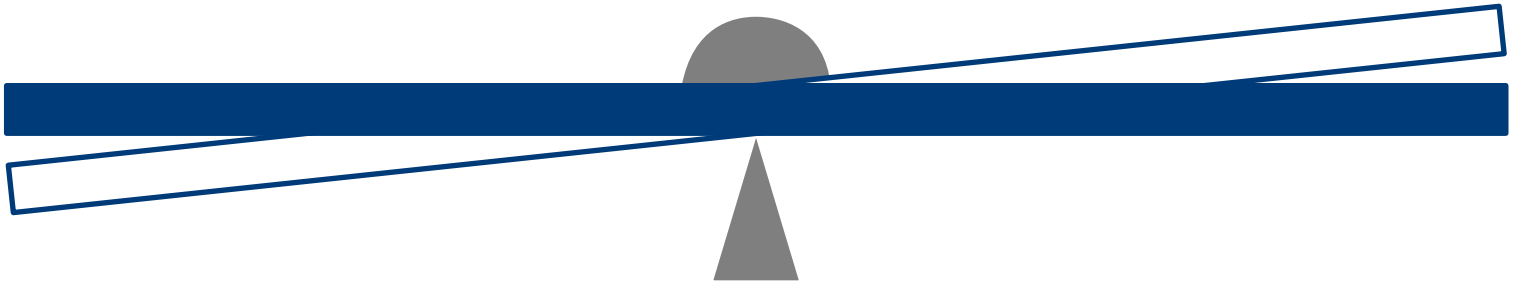
Isolation of the impact of Energy Efficiency on Market Value
Third Step (3/3)

Surveyor Value

AVM without the attribute "Energy Efficiency"



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Finding a relation between the Market Value and the E.E.
Fourth Step (1/2)

Energy efficiency class	N. Assets	Market Value (surveyors's valuation)	Market Value – EE (AVM)	Median % difference [a-b]
A	1.518	[a]	[b]	-12,53%
B	2.489			-8,02%
C	1.578			-4,53%
D	1.462			-2,98%
E	1.515			-0,65%
F	1.573			0,04%
G	6.962			3,79%
All	17.097			1,59%

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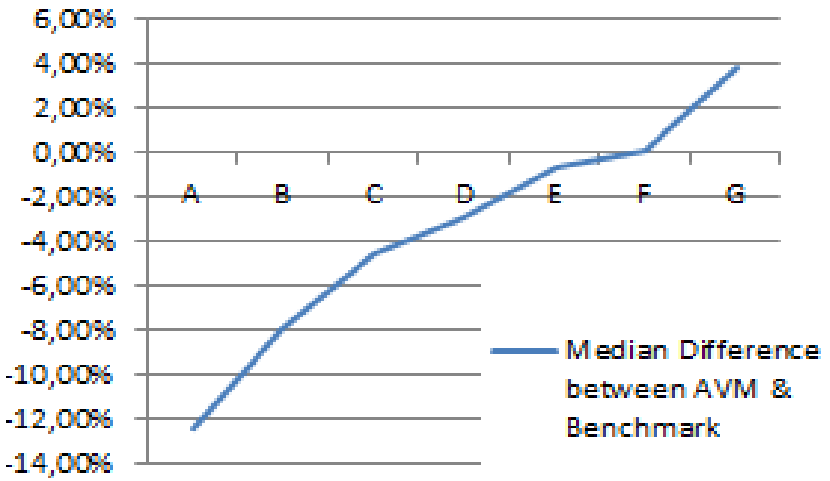
Finding a relation between the Market Value and the E.E.
Fourth Step (2/2)

- There is a **direct correlation** between the level of Energy Efficiency and the value of properties.

- This analysis reveals that:

- **for high level of energy efficiency (ABC), values determined without considering the Energy Efficiency underestimate the real value of the property**;
- **for low level of energy efficiency (FG), values determined without considering the Energy Efficiency overestimate the real value of the property**;



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Preliminary conclusions
Impact of Energy Efficiency on property values

- Energy Efficiency has a relevant and measurable impact on the value of assets and it should be considered in the valuation process

- There is a **positive correlation**, leaving all the other attributes unchanged, between the **Energy Efficiency level and the value of the assets**

- High Energy Efficiency level corresponds to a higher value of the asset and therefore to the possibility to grant a higher credit

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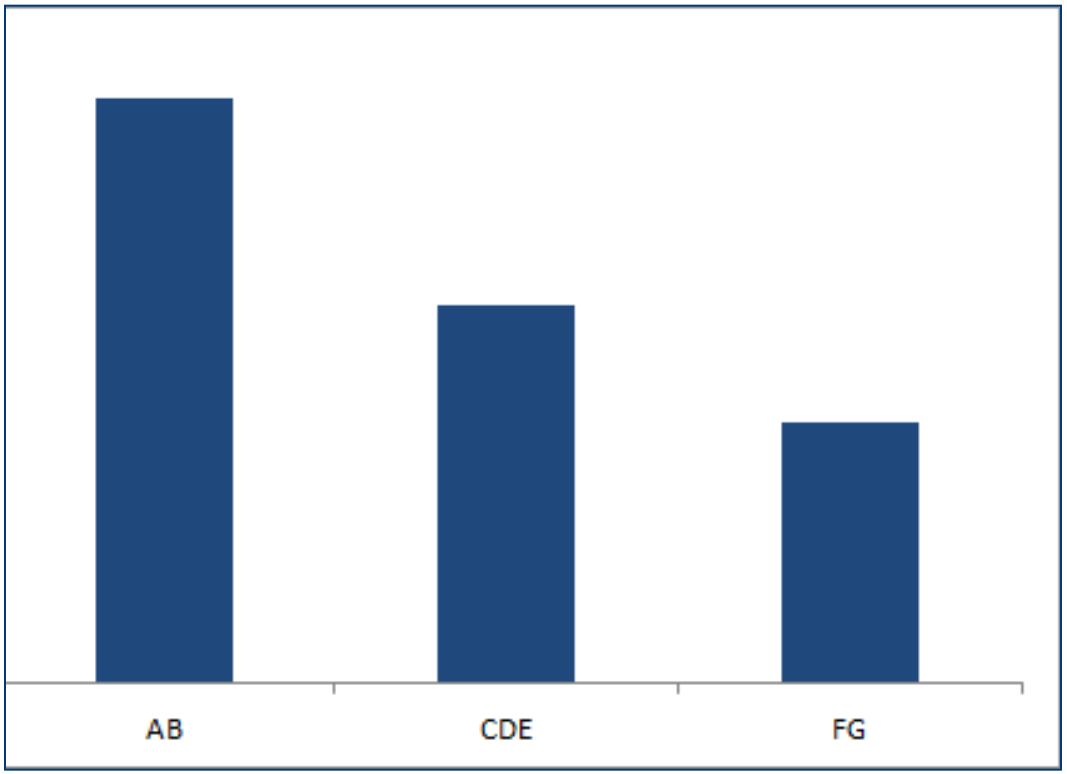
Credit Bureau Score on a sample portfolio



The Credit Bureau Score shows a trend when moving from FG class to AB class

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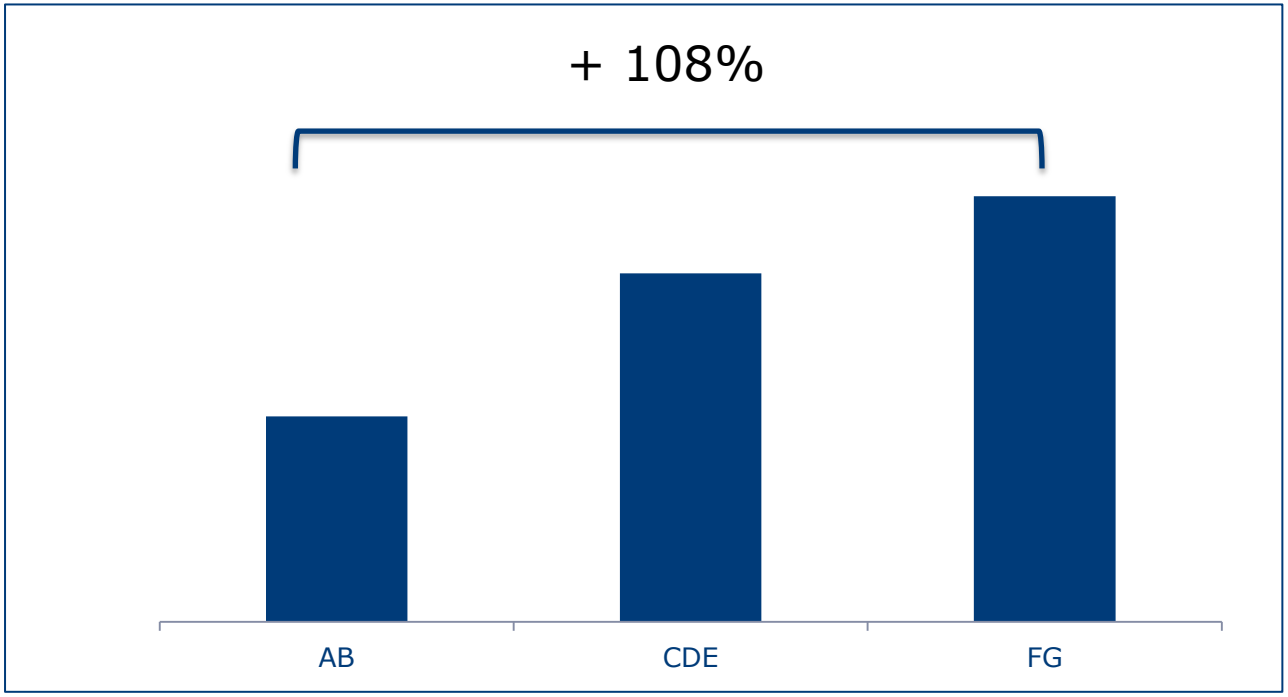
Impact of Energy Efficiency on payment behaviour

The **Bad Rate** represents **the payment behavior** observed during a 12 months period.



The bad rate observed in the period (12 months) on the worst energy classes is **twice** the one registered on best energy classes

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Next steps

- The measurement of the relation beetween values and Energy Efficiency could be strengthened through the application of the same methodology to larger samples (e.g. major banks)

- To calculate the impact on mortgage risk, additional analysis and larger samples are needed

- Supporting credit policies addressed to high rated assets where Energy Efficiency plays a relevant role

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Energy Efficiency and mortage risk

How is the energy efficiency correlated to mortgage risk?

Process phases	Creation of DataBase analysis	Segmentation	Portfolio analysis	Green Mortgage Effect

Description	▪ Pool of sample of mortgage portfolio
	▪ Contract Information:
	  ▪ Loan to Value
	  ▪ Amount financed
	  ▪ Duration
	  ▪ Value of assets
	  ▪ Real estate data (including EE)
	▪ Applicant Information:
	  ▪ Income
	  ▪ Profession
	  ▪ Age
	  ▪ …
	▪ **Performance** (Bank)
		▪ Segments defined based on (e.g.):
		  ▪ Value of assets
		  ▪ Applicant's income
		  ▪ Good mix of energy efficiency classes in each segment
		▪ The **size** of each segment has to be **robust**
			▪ Analysis of green clients
			  ▪ Information contained in the portfolio
			  ▪ Credit Bureau information
			
			including performance information
				▪ For each variable we calculate the **Information Value**, which can identify the variables with a high predictive capability and that can better separate the good from the bad
				
				▪ Energy Efficiency impact on credit risk

Deliverable	**Pooling**	**Segment identified**	**Performance**	**Data Analysis** **Final result: Correlation**

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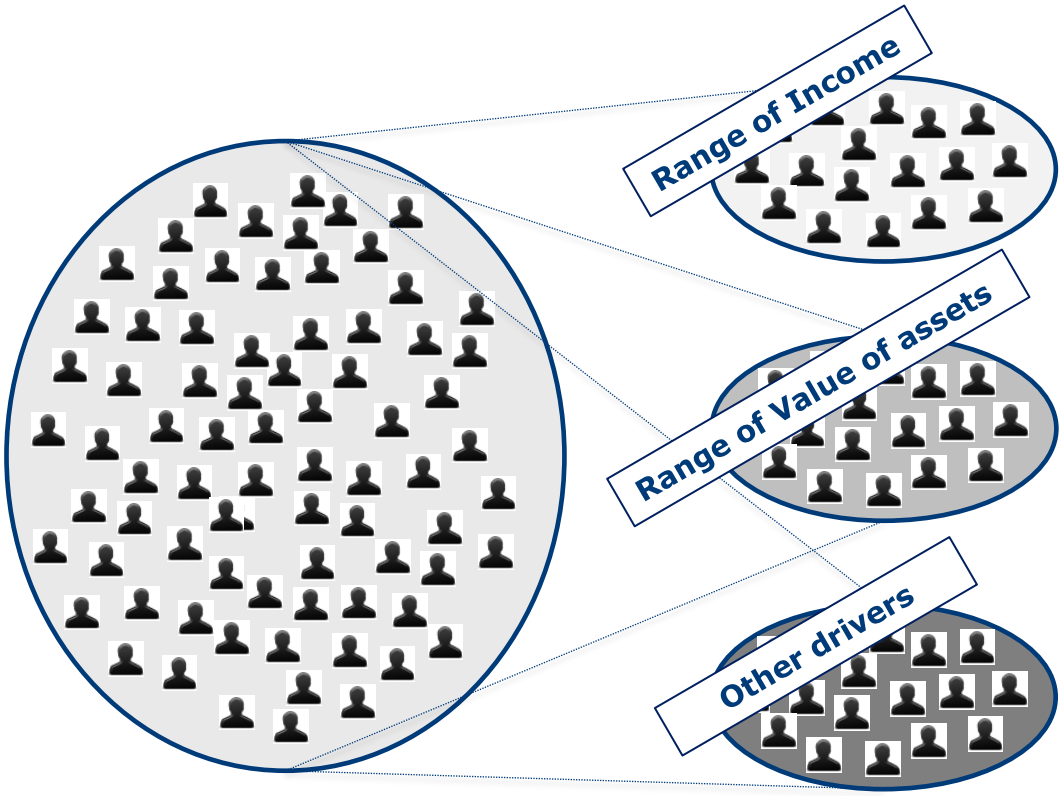
Energy Efficiency and mortage risk

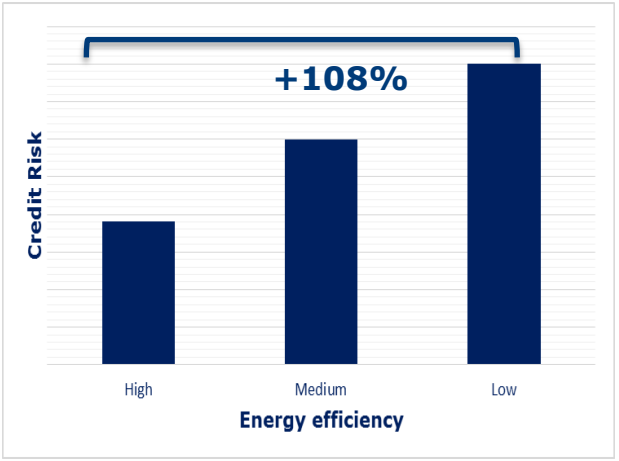
How is the energy efficiency correlated to mortgage risk?

ILLUSTRATIVE

POOL of MORTGAGE	SEGMENTATION	GREEN MORTGAGE EFFECT



Energy Efficiency impact on credit risk



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