Executive Summary

In the context of risk measures, the literature tends to focus on finding new measures to price risks more accurately, forecasting the consequences of certain events occurring and, in the financial sector, estimating the asset that financial institution should keep into reserves to cover themselves from downturn events of the economy. However, after the 2008 global crisis, people started lose faith in bank's ability to price their risk correctly and estimating their risk profiles. One of the strongest critic was written by Salmon (2012), who says that spasmodic usage of the Gaussian copula in the financial sector and the wrong interpretation of the results leaded to a deterioration of the financial sector and at the financial crisis. On the other hand, researchers started questioning the assumptions under different risk factors, starting a new field of research: the model risk. Model risk or model uncertainty can be interpreted as the effects of the assumptions on a given risk measure.

One of the risk measures which banks use to price the risk of their credit portfolios is the *Risk Weighted Assets*. The formula is given by the regulator and the derivation is based on the Portfolio loss distribution from Vasicek (2002). In his famous paper, he assumes the normality of the distribution of random variables. In this thesis, we are going to explore how to control for the risk driven by this specification and we develop a model risk measure adapted on the Risk Weighted Assets formula. Similar work has been conducted by Schönbucher (2002) on Vasicek (2002). Indeed, he studies the effects of different model assumptions (Clayton and Gumbel dependence structure) on Vasicek's distribution of loan portfolio value.

Firstly, we present a short literature review on what has been written in the context of model risk and the different fields this subject covers, such as dependence and parameter uncertainty. We describe the mathematical set up developed for the thesis, starting with the definition of risk measure and dependence structure. Then, we introduce the notion of model risk measure by Aas and Puccetti (2014) and we adapt it to the Risk Weighted Assets through the work of Schönbucher (2002). This methodology returns us a model risk measure for the Risk Weighted Assets dependence uncertainty. To study the effect of parameter uncertainty, we rely on the methodology of Zhang et al. (2008) to estimate the correlation between defaults. Moreover, we describe a methodology to estimate the probability of default and the loss given default, which are core components to calculate the

Risk Weighted Assets. Finally, we test the theorized model risk measures on a real estate mortgage portfolio. After describing the portfolio characteristics and the distribution of single risk factors, we estimate the model risk of the Risk Weighted Assets formula with Real Estate Mortgage portfolio data.

We conclude that the algorithm developed by Schönbucher can be adapted to the Risk Weighted Assets and a new specification of the formula can be defined, if intended. It is possible to control for the model risk that the Risk Weighted Assets formula inherit from the distribution of a loan portfolio defined by Vasicek. Moreover, we notice that the Risk Weighted Assets formula is really sensitive to the assumption on the model that explains the dependence between the assets and to the calibrated correlation.