Final report

Project information and reporting objectives

Project information

Project number:	274766
Project title:	Time-varying disaster risk, asset prices and international business cycles
Activity / Programme:	FINANSMARK
Project manager:	Irarrazabal, Alfonso
Project owner:	STIFTELSEN HANDELSHØYSKOLEN BI
Project period:	2018.01.01 - 2023.02.28

Reporting objectives

1.	**Main page of the progress report:** Update progress report up to project completion date.	**Completed**
2.	**Final accounts:** Give a summary of the financial status of the project	**Completed**
3.	**Outcomes and impacts:** I understand that the information entered into the field for Outcomes and impacts will be made publicly accessible*	**Completed**
4.	**Results report:** Attach results report	**Completed**
5.	**Special reports:** Any requests for special reports must be fulfilled. Have special reports been submitted?	**Not applicable**
6.	**Final data management plan:** Has the final data management plan been uploaded?	**Not applicable**

Final accounts

Actual cost plan (Amount in NOK 1000)

Account	2023	2022	2021	2020	2019	2018	Total sum
Payroll and indirect expenses	0	915	535	215	233	137	2,035
Procurement of R&D services	0	60	0	0	0	0	60
Equipment	0	0	0	12	0	61	73
Other operating expenses	0	114	5	49	128	54	350
Sum	0	1,089	540	276	361	252	2,518

Actual cost code (Amount in NOK 1000)

Account	2023	2022	2021	2020	2019	2018	Total sum
Trade and industry	0	0	0	0	0	0	0
Research institutes	0	0	0	0	0	0	0
Universities and university colleges	0	1,046	540	236	311	220	2,353
Other sectors	0	0	0	0	0	0	0
Abroad	0	43	0	40	50	32	165
Sum	0	1,089	540	276	361	252	2,518

Actual funding plan (Amount in NOK 1000)

Account	2023	2022	2021	2020	2019	2018	Total sum
The Research Council	0	49	0	98	92	340	579
Own financing	0	903	535	188	175	137	1,938
Public funding	0	0	0	0	0	0	0
Private funding	0	0	0	0	0	0	0
International funding	0	0	0	0	0	0	0
Deviation	0	-137	-5	10	-94	225	-1
Deviation basis	0	1,089	540	276	361	252	2,518
Sum	0	952	535	286	267	477	2,517

Comment

Total costs/funding of 2.518 mnok compared to original budget 990 tnok. The increase is due to need to invest significantly more researcher time for our project manager, Alfonso Irarrazabal, than originally planned (estimated). For payroll and indirect costs, 96 tNOK has been spent for research assistants and 1.938 mnok is related to own-financed researcher time (in-kind) from Irarrazabal.

Procurement R&D Services: 60 tNOK for R&D services provided by key personnel Lin Ma through subcontractor.

Equipment: 73 tNOK for computer with extra computation capability needed for data processing in the project and iPad Pro to improve work progression. Discussed and approved with Gro Martinsen at RCN during implementation.

Other operating expenses: 350 tNOK has been spent mainly for travel costs related to research visits for co-authors to come to BI (Juan Carlos Alvarez and Nahmee Matheson), and for Irarrazabal to visit and work together with his co-author Alvarez. Some costs also for software and licenses related to data modelling/data access needed for the project.

Impacts and effects

Anticipated outcomes and impacts - from the grant application form

-

Achieved and potential outcomes and impacts - based on the project results

Results - Summary

Uploaded results - summary

Original filename: Disaster_Risk_Mar2023_v1.pdf

File reference: RESULTAT_Sluttrapport11841663.pdf

Message to the Research Council of Norway

Special reports

Comment

Uploaded file

Original filename: Disaster_LetterNRC.pdf

File reference: SARSKILT_Sluttrapport11841663.pdf

Final data management plan

Uploaded final data management plan

Progress report

Project information and reporting objectives

Project information

Project number:	274766
Project title:	Time-varying disaster risk, asset prices and international business cycles
Activity / Programme:	FINANSMARK
Project manager:	Irarrazabal, Alfonso
Project owner:	STIFTELSEN HANDELSHØYSKOLEN BI
Project period:	2018.01.01 - 2023.02.28
Rapporteringsperiode:	2021.10.01 - 2023.02.28

Reporting objectives

1.	**Popular science presentation:** I understand that the text of the popular science presentation will be made publicly available*	**Yes**
2.	**Results:** Has information on publications been provided?	**No**
3.	**Performance indicators:** All results data that have emerged from the project are to be reported. Has this been done?	**Yes**
4.	**Fellowship grants:** Information regarding all fellowship grants must be complete and correct. Have you updated the man-months and other information for each fellowship-holder?	**Yes**
5.	**International cooperation:** The extent of international cooperation is to be indicated. Has any international cooperation taken place during the report period?	**Yes**
6.	**Special reports:** If any requests for special reports have been put forth by the case officer at the Research Council, these must be fulfilled.	**No**

Popular science presentation

Popular science presentation (Norwegian)

Dette prosjektet analyserer sammenhengen mellom makroøkonomi og finans i industri- og utviklingsland ved bruk av økonomiske modeller som både forklarer årsakene til og konsekvensene av kriser, som for eksempel finanskrisen på 2000-tallet. Vi har et spesielt fokus på å forklare sammenhengen mellom avkastningen på finansielle produkter og makroøkonomiske størrelser på tvers av land. Dette vil øke vår forståelse av transmisjonsmekanismen til økonomisk sjokk, både til realøkonomien og finansmarkeder. Vi gir også et teoretisk grunnlang som kan forklare de kristiske faktorene bak store fall i økonomisk aktivitet i land. En bedre forståelse av disse mekanismene vil gi beslutningstakere bedre verktøy for å tidligere kunne opppdage potensielle økonomiske ubalanser og iverksette nødvendige tiltak for å begrense omfanget av en eventuell krise.

Popular science presentation - Updated (Norwegian)

Dette prosjektet analyserer forholdet mellom prising av finansielle goder og økonomiske fluktuasjoner. Vi anvender en økonomisk modell der finanspriser i hovedsak er bestemt av investors frykt for store, men uvanlige, økonomiske nedgangstider slik som ble observert i perioden 2008-10. Vi modellerer en sannsynlighet for fall i inntekt og dividende som varierer over tid. Vi konstruerer en generell modell der investorers preferanser forklarer årsaken til risikoaversjon og villigheten til å substituere konsum over tid som følge av en reduksjon i fremtidig formue. Blant forskere i makroøkonomi og finans har verdien av elastisiteten av intertemporal substitusjon (EIS) lenge vært debattert. Makroøkonomiske modeller er basert på en EIS-verdi under 1. Derimot forutsetter finansprisingsmodeller EIS-verdier over 1 for å kunne forklare empiriske trekk ved datamaterialet knyttet til forutsigbarheten av avkastningen. Vi estimerer EIS til å være mellom 1,5 og 3,5. Dette betyr at modellen vår kan forklare ulike finansmarkedsfenomener uten å måtte forutsette at investorer er urimelig risikoaverse.

Popular science presentation (English)

This project analyses the relation between macroeconomics and finance, both in developed and developing countries, with the use of economic models that are capable to account for the origin and consequences of economic disasters, similar to that observed recently in 2008-2010. In particular, we are interested in explaining the comovement between the return of financial assets and macroeconomic fundamentals across countries to better understand the transmission of economic disturbances both to the real economy and the financial markets. In a similar fashion, we provide theoretical foundations that explain the occurrence and determinants of big downturns in the economic activity of nations. A better understanding of these mechanisms provides policy makers with tools to build early warning indicators to accurately implement economic policies when the financial conditions of households and firms deteriorate.

Popular science presentation - Updated (English)

This project analyses the relationship between financial asset prices and economic fluctuations. We use an economic model in which asset prices are driven mainly by the investor’s fear of large, but unusual, economic downturns, similar to that observed in 2008-2010. In the model, the likelihood of these events is captured by a time-varying probability model of a fall in income and dividend payout. Our model extends previous frameworks to a general setting where investors’ preferences separately account for their risk aversion and their willingness to substitute consumption in response to a future fall in wealth. There is a long-standing debate among researchers working in macroeconomics and finance about the value of the elasticity of intertemporal substitution (EIS). Macroeconomic models depend on an EIS below 1. In contrast, financial asset pricing models have assumed values above one to explain a feature of the data related to equity return predictability. In this paper, we estimate a value of the EIS above one, in a range between 1.5 and 3.5. Our estimation implies that the model is able to explain a variety of financial markets phenomena without having to assume that investors are unreasonably risk averse.

Message to the Research Council of Norway

We have update the popular science presentation in light of the results of the paper.

Results

Performance indicators

Fellowship grants

Fellowship grants funded under the project

International cooperation

International cooperation funded under the project (in NOK 1000)

Amount in NOK 1000

Country	2018	2019	2020	2021	2022	2023
Chile	0	0	0	0	40	0
Denmark	54	95	40	20	43	0

Special reports

Comment

I have added a preliminary working paper in the section Results report.

Uploaded file

Original filename: Disaster_LetterNRC.pdf

File reference: SARSKILT_Framdriftsrapport11841663.pdf

1 Non-technical Summary

The field of macro-finance is devoted to explain, among other things, the co-movement between asset prices and economic activity using general equilibrium models. In the data asset prices and business cycle are positive correlated, that is, stocks prices rise in good times and fall in bad times. Real and nominal interest rates behave in a similar way. The data also suggests that stocks provide higher returns that government bonds, giving rise to the so called equity premium. Since stocks are riskier, macro-finance models aim at providing alternative stories as to why stock prices fall when the economy is not performing well. Most theories rely on a general idea: the market's ability to bear risk is time varying and it depends on the state of the economy.

In classical finance, the return to a risky asset is determined by the correlation between the stochastic discount factor, which is related to the the marginal utility of a investors, and the excess return of the asset relative to the return to bonds. According to this theory, expected asset returns are high because stock prices fall when marginal utility is high. In consumption based asset pricing models, investors are uncertain about future consumption and are willing to pay a premium for an asset that is correlated with future consumption. Shocks to expected future consumption affects prices. Different theories of asset pricing specify (i) different preferences which determine investor perception of risk, and (ii) the shocks to consumption growth that investors will experience in the future.

Asset pricing theories are commonly assessed using two criteria. First, on their ability to explain as many features of the data without generating counterfactual implications. Successful models have been able to explain (i) consumption and dividend dynamics, (ii) mean and volatility of market return, risk-free rate and price-dividend ration, and (iii) consumption and return predictability, among others. Second, theories are judged by how reasonable are the modeling assumptions and parameter values used in the quantitative exercises they are used. For example, the original equity premium puzzle of Mehra and Prescott (1985) refers to the inability of a standard asset pricing model to generate the mean excess return observed in the data with reasonable values of the parameter describing the investor's coefficient of relative risk aversion.

In the asset pricing literature there are at least two successful models that have been able to explain key features of the data. Both use recursive utility and exogenous shocks to consumption growth. Recursive utility is convenient, as it separates risk aversion motive (being afraid of gambles) from the willingness to substitute consumption over

time. The first model is the Long Run Risk (LRR) model of Bansal and Yaron (2004). The LRR model is able to explain several empirical puzzles using a model where aggregate consumption is subject to persistent fluctuations in its mean and volatility. The second model is the disaster risk model. The model, originally proposed by Reitz (1988) and Barro (2006), assumes that investors demand additional compensation for holding risky assets that may be affected by the occurrence of macroeconomic disasters (e.g., a large economic downturn). Gabaix (2012) and Wachter (2013) have employed models where the risk of rare consumption disasters changes over time. In particular, Wachter (2013) has shown that such model is able to explain several empirical puzzles without generating the counterfactual implications for which the LRR model has been criticized. Crucially, Wachter (2013) solves and calibrate her model assuming that the model's elasticity intertemporal substitution (EIS) is one.

Our paper extends this literature by solving a time-varying disaster risk model with any value of the EIS. We use the quantitative model to estimate the EIS using US financial data. The key question is whether the model is able to explain the data without resorting to unreasonable parameter values of the risk aversion parameter and EIS. In particular, we make three contributions to the literature that reaffirm the virtues of the time-varying disaster risk model while simultaneously addressing some of its caveats for empirical analysis.

First, we explore the ability of the model to generate an appropriate fit to a set of selected moments commonly used in the literature for different values of EIS. We start by replicating the calibration in Wachter (2013) for the case of an unitary EIS. We confirm the good fit of the data. Then, we study the effects that different values of the EIS, both below and above one, have on asset pricing moments. We conclude that the model fit deteriorates rapidly for values of the EIS below one.

Second, we ask whether there is a range of values for the EIS for which the model provides a satisfactory fit in terms of asset price moments and predictability. We recalibrate the model parameters by targeting the same empirical moments as in Wachter (2013) for different values of the EIS. We find that across different values of the EIS, the model-implied moments are similar, or in the same order of magnitude as those reported in Wachter (2013). Our calibration exercise allows to conclude that there is a range of values of the EIS between 0.7 and 3.5, for which the model delivers a good fit to the data. The results suggest that, contrary to previous literature, the time-varying disaster risk model is able to generate, from a qualitative perspective, a countercyclical equity risk

premium for values of the EIS above 0.7, as long as the investors prefer early resolution of uncertainty. This is an interesting result, as it is believed that for asset pricing models, such as the LRR, the EIS must be above one to be able to generate return predictability from a theoretical perspective. We show instead that it is possible to explain some of the main stylized facts (excess equity return, and predictability patterns observed in the data) even with values of EIS below 1.

Finally, our third contribution is to provide an estimate of the controversial EIS. More specifically, we provide an statistical estimate of the EIS and the coefficient of relative risk aversion together with point estimates of the other parameters model parameters. Our choice of moments is dictated by the full set of moments analyzed in Wachter (2013) as part of the external validity of her calibration exercise. These include not only first and second order moments of asset prices but also statistics from OLS predictability regressions of the excess return at different horizons by the price-dividend ratio. We find a statistically significant value of the EIS of around 3.4 that satisfies the identifying restrictions imposed by the data and that is consistent with low values of risk aversion contrary to the statistical evidence reported in the LRR literature. In other words, we conclude that the time-varying disaster risk model can explain asset prices with low risk aversion and reasonable values of the EIS.