



Department of Economics and Finance

Chair of Macroeconomics

**“The Limits of Behavioural Aggregation
*Gender, Risk Preferences, and the Marginal
Propensity to Consume*”**

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Table of Contents

INTRODUCTION	6
I. FROM INDIVIDUAL UNCERTAINTY TO AGGREGATE BEHAVIOUR	8
I.I <i>Why loss aversion does not predict savings on its own.....</i>	9
I.II <i>How robust is the gender gap in risk-taking?</i>	11
II. BEHAVIOURAL EXTENSION OF THE IS-LM MODEL	14
II.I <i>Loss aversion and the leftward shift of the IS curve</i>	16
II.II <i>Gender differences in the IS-LM parameters</i>	17
III. TESTING THE CHANNEL IN CROSS-COUNTRY PANEL DATA.....	19
III.I. <i>Building the panel: The World Bank and the GPS.....</i>	19
III.II <i>From theory to regression</i>	20
III.II.I <i>A first estimate consistent with the hypothesis</i>	21
III.II.II <i>Heterogeneity OECD vs non-OECD.....</i>	23
III.II.III <i>One country, one year: how Zimbabwe drove the result</i>	24
III.III <i>Correcting the specification: constant dollars and full controls</i>	25
III.III.I <i>Country by country robustness of the corrected estimate</i>	27
III.IV <i>Beyond risk: trust as an alternative channel.....</i>	27
III.V <i>Stress-testing the baseline result</i>	29
III.VI <i>What the analysis cannot identify.....</i>	31
CONCLUSION	33
APPENDIX A: THE IS-LM MODEL FRAMEWORK	35
A1. <i>Aggregate demand and the consumption function</i>	35
A1.I <i>Deriving the IS curve</i>	37
A2. <i>Money demand, money supply and the Central Bank</i>	38
A2.I <i>From Money market to the LM line</i>	39
A3. <i>Equilibrium output at a given policy rate</i>	39

<i>BIBLIOGRAPHY</i>	42
DATA SOURCES	43

INTRODUCTION

Why people consume the share of their income that they do, and not more or less, is one of the main questions in macroeconomics. The marginal propensity to consume is at the centre of the aggregate demand framework. What determines its value is not only an institutional question, but also a behavioural one. The way individuals respond to uncertainty, the weight they place on possible future losses compared to possible future gains, and the degree of optimism with which they form expectations about their own future. At the individual level, how much of an extra euro is consumed today and how much is saved against future risk.

A portfolio of studies in behavioural economics has documented that men and women, on average, differ along several of these psychological dimensions. Women tend to demonstrate higher levels of loss aversion, lower levels of financial optimism, and greater prudence in their savings behaviour. Although the stability of these differences have recently been challenged by an emerging literature, the existence of some gender-based changes in risk preferences are robust across a wide range of studies. If these differences are real, and if they shape household-level consumption decisions, then countries in which the behavioural gender gap is wider should show lower aggregate marginal propensities to consume, which in macroeconomic terms means a steeper IS curve and a structural tendency toward lower equilibrium output.

This thesis examines whether this theoretical prediction finds a result in cross-country data. The argument is developed in three steps. Chapter I lays the behavioural foundations of the analysis, it reviews the literature on uncertainty, risk aversion, loss aversion, prudence and trust as drivers of consumption and precautionary savings, and discusses the empirical evidence on gender differences in risk preferences. Chapter II develops the macroeconomic framework: through the standard IS-LM model it shows how its parameters and slopes change once households' preferences go from risk neutrality to loss aversion. The final chapter tests empirically whether the gender gap in risk preferences, discussed at the individual level in the previous chapters, affects the aggregate marginal propensity to consume. The theoretical assumption is that economies in which women, who are on average more loss averse and less optimistic than men, contribute to household consumption decisions leading to a lower aggregate marginal propensity to consume and to a steeper and leftward shifted IS curve. This empirical analysis is divided in several steps. Firstly a

description of the data sources and the construction of the panel, an empirical specification and the results of an initial estimate that appeared to confirm the theoretical prediction. A careful country by country analysis reveals that the initial result was based on a single country in a specific time, Zimbabwe in 2017 due to a currency rebasing. This issue is corrected through the use of constant 2015 dollar data and by additional macroeconomics controls, where the interaction coefficient between the gender gap and lagged income is no longer statistically distinguishable from zero. Finally an additional exploratory extension was made on the other five dimensions of the Global Preferences survey, highlighting the gender gap in trust as a potentially interesting alternative channel for future research. The contribution of the thesis lies in bringing together two literatures that have so far been kept separately, the microeconomic evidence on gender differences in risk preferences and the macroeconomic analysis of aggregate consumption, examining whether the bridge between the two holds at the level of cross-country panel data.

I. FROM INDIVIDUAL UNCERTAINTY TO AGGREGATE BEHAVIOUR

The terms “micro” and “macro” were first coined by Ragnar Frisch. Microeconomics “*mikros*” (from the Greek word) refers to a smaller environment, studying the individual economic behaviour by modelling and focusing on individual preferences. It is based on how consumers make decisions about allocating scarce resources in *ceteris paribus*; it takes on the psychological side of one of the principal drivers of the economy. Macroeconomics, “*makros*” (from the Greek word), on the other hand, studies the combinations of actions and interactions of individual agents on the overall market; it deals with the general price level, economic growth, and control of inflation through policies. When referring to economics, behavioural patterns have a huge impact on both domains. Although the two dimension may appear unrelated, the two are linked through household’s choices, showing how psychological biases at the micro level affect macro endogenous variables such as consumption and savings behaviour .

¹Microeconomics and macroeconomics are complementary; they study two different approaches; however, only by studying them together a complete perspective on the economy can be demonstrated. This behavioural foundation leads to one of the most important emotional mechanisms influencing economic decisions making: the human response to uncertainty.² Research shows that the primary internal emotion triggered by uncertainty in the human brain is fear, leading to anxiety. When facing uncertain situations, the human brain prefers certainty and feels ambiguity as a potential threat, which activates defensive mechanisms such as fear and hypervigilance, which evolves into a preference for certainty over risk. ³This tendency to safeguard the individual comes up through the

¹ Arya Salim, “Macroeconomics and Microeconomics an Overview”, IMPACT International Journal of Research in Humanities, Arts and Literature, Vol. 6, Issue 8, (Aug 2018), pp. 119-124.

² D. W. Grupe & J. B. Nitschke, "Uncertainty and anticipation in anxiety: An integrated neurobiological and psychological perspective," *Nature Reviews Neuroscience*, vol. 14,

³ Sanjit Dhami, Narges Hajimoladarvish, Konstantinos Georgalos, “Precautionary Savings, Loss Aversion, and Risk: Theory and Evidence” (Oct.29,2023).

development of risk aversion, resulting in consumers with increased economic uncertainty aversion, leading them to choose safe options. The risk aversion measures how much individuals prefer to have a sure return compared to an uncertain one. As a result, their marginal propensity to consume decreases in the short run, and precautionary savings increase to stabilize consumption smoothing throughout economic periods. However, risk aversion alone does not fully explain the reasons. The concept of loss aversion needs to be introduced by revealing that the aversion to risk intensifies when dealing with losses rather than gains.

1.1 Why loss aversion does not predict savings on its own

⁴ How loss aversion translates into savings behaviour is theoretically ambiguous. On one hand, the formal reference-dependent model of Kőszegi and Rabin (2009)¹ shows that loss-averse agents have an unambiguous first order precautionary savings motive: because higher wealth reduces the impact of bad news on future consumption, the desire to protect themselves against future negative shocks leads households to increase savings. On the other hand, more recent empirical and theoretical work by Dhami, Hajimoladarvish and Georgalos (2023)⁵ reaches the opposite conclusion: in a two-period consumption-savings model with income uncertainty, loss aversion reduces precautionary savings, because giving up current consumption is itself perceived as a loss relative to the present reference point⁶, and loss-averse households place higher psychological weight on the immediate loss than on the

⁴ Botond Kőszegi and Matthew Rabin, "Reference-Dependent Consumption Plans", The American Economic Review, Vol. 99, No. 3 (June 2009), pp. 909–936

⁵ Sanjit Dhami, Narges Hajimoladarvish, Konstantinos Georgalos, "Precautionary Savings, Loss Aversion, and Risk: Theory and Evidence", CESifo Working Paper No. 10570 (October 2023)

⁶ To be more specific, a reference dependence is a reference point that defines what is perceived as a loss or as a gain

future hedging benefit. Their empirical tests, based on subject-specific savings choices and behavioural parameters, confirm that more loss averse individuals are less likely to engage in precautionary savings.

This tension within the literature highlights that loss aversion alone is not enough to predict savings behaviour. To complete the picture, it is fundamental to introduce a different driver of precautionary savings: the concept of prudence.

⁷ The condition of Leland brings "prudence" as an additional driver for precautionary savings. A positive prudence implies a greater willingness to save money over time; a lack of prudence affects provision behaviour, leading to reckless under saving, where individuals spend more today and leave no funds for a second period.

Individuals with higher loss aversion experience the immediate pain of the reduction in consumption due to the increased reserves. This behavioural response can be explained by the concept of "Mean preserving spread", which accounts for increased future risk without changing the expected value, illustrating why intuitive predictions about savings behaviour can be paradoxical, leading to different approaches. On a theoretical aspect, the whole system is based on the rational expectations generated by the individuals, which, if not fulfilled, will turn into a less optimal margin. Understanding that the individuals do not base everything only on the absolute consumption, but on their expectations as well.

⁸A meta-analysis of 92 studies tried to estimate the risk aversion through the Euler equation of consumption. The results have been implying that numbers have been exaggerated over time by literature compared to the real life observations, which happened because either to ensure that the model was more efficient or for bias in the publications. After an estimation correction, the analysis proved that the estimated coefficient is around one in real world economic contexts. By their statements, the estimation of the risk aversion is such a complex topic; as a matter of fact, estimating these kinds of measures is hard and needs careful attention to work with due to all the factors that can change the estimated parameters. 30

⁷ Leland, H. E. (1968). Saving and uncertainty: The precautionary demand for saving. *The Quarterly Journal of Economics*, 465-473.

⁸ Ali Elminejad, Tomas Havranek, Zuzana Irsova, "Relative Risk Aversion: A Meta-Analysis", Nazarbayev University, Charles University, Meta-Research Innovation Center at Stanford, (Dec17, 2024), *Journal of Economic Surveys*

characteristics at least were found, such as the country, the gender, the circumstances etc. Showing difficulties in finding certain results over time.⁹Over the previous years, the same problem has been addressed by applying prospect theory, focusing on a psychological perspective on losses compared to gains, as previously noted. This approach derives a new Euler equation that includes loss aversion and accounts for how the reference dependence changes over time. As well, in this study the aversion to loss is empirically significant over macro aggregates. Highlighting that losses generate a much stronger effect compared to earnings.

I.II How robust is the gender gap in risk-taking?

Several studies report that women are more inclined to have more risk averse financial behaviour compared to men. Over the years, female risk aversion has been used to explain many gender differences in the labour market, such as wage gaps, different career choices, and the under-representation of women in high-level roles in companies. In this way, risk aversion has been considered as one of the factors behind women's disadvantaged position in society, supporting discriminatory behaviour. By the current analysis, this hypothesis will be reviewed and analysed.

¹⁰In experimental economics, risk attitudes are usually classified into three categories: risk neutral, risk averse, and risk seeking. A risk neutral investor cares only about the expected return and is indifferent between taking a sure payoff and a risky lottery with the same expected value, while a risk seeking investors prefer riskier options with higher potential returns. The main result of the analysis is that the measured gender gap in risk aversion turns out to be highly sensitive to the experimental method used to elicit risk preferences, depending strongly on the presence of a safe option.

⁹ Rina Rosenblatt-Wisch, "Loss aversion in aggregate macroeconomic time series", European Economic Review, Vol. 52, 2008

¹⁰ Antonio Filippin, "Gender Differences in Risk Attitudes", IZA World of Labor, No. 100 (October 2022)

The key finding of the analysis is that a larger and statistically significant gender difference is given when the task includes a completely safe, risk-free option, and a small and statistically insignificant gender difference when the task does not include a safe option, and all the available choices involve some kind of risk. When a “no risk” option is present, women choose the safe option more often compared to men. Numerically, the probability that a randomly selected woman is more riskaverse compared to a randomly selected man is 60%, only slightly above the equality, which is 50%. Women are 10% more likely to choose neutral options when available, which is a small percentage. Although women are less risk-taking, it is not sufficient by itself to be considered as a key driver for the overall gender discrimination.

Gender explains only about 3% of the variance in risk attitudes, implying that many other factors, like education, optimism, trust etc., play a crucial role. Education has a huge impact on what is the outcome of risk related decisions.¹¹ Studies have shown that women with the highest academic achievements tend to choose riskier options compared to highly educated men, who, on the other hand, prefer less risk taking. The differences in conclusions are influenced by the complexity of the task, by the presence or absence of a risk-free option, by educational levels, and by the type of samples considered, resulting in outcomes that are not consistent.

¹²Lately, several studies have been trying to identify psychological factors highlighting the gender gap difference, with a focus on loss aversion (as discussed above) and optimism. The evaluation of a risky decision can involve two main components :

(1) The personal probability that most likely the outcome will be negative, and (2) subjective evaluation of how painful the negative outcome would be on the individual (loss aversion). Optimism increases confidence about future actions and is associated with being more willing to take risks. Empirically, Dawson showed that women are, on average, more loss-averse and less optimistic compared to men, showing the main reasons why there is the existence of this gap in the first place. In an additional study¹³ Croson and Gneezy in a survey

¹¹ Giannikos, C. I., & Korkou, E. D. (2025). Are Women More Risk Averse? A Sequel. *Risks*, 13(1), 12.

¹² Dawson, C. (2023). Gender differences in optimism, loss aversion and attitudes towards risk. *British Journal of Psychology*, 114(4), 928–944.

¹³ Croson, R., & Gneezy, U. (2009). Gender Differences in Preferences. *Journal of Economic Literature*, 47(2), 448–474

examines the gender differences also in interpersonal trust. Through a trust game, introduced by Berg, Dickhaut and McCabe (1995), in which there is a sender with an initial sum of money and the receiver, which is anonymous. The sum that the sender decides to transfer initially, is multiplied by a fixed factor and the receiver will decide the amount to send back to the sender. The amount that the first player decides to trade will measure the level of trust meanwhile the amount returned by the second one measures the trustworthiness. This study shows that men have a higher trust compared to women, transferring larger amounts in the first stage of the game. At the same time women seem more sensitive to the specific context of the interaction. In the thesis framework this evidence is relevant, because it documents an additional difference in gender preferences. Just as for the risk and loss aversion, interpersonal trust is an important behavioural trait that is linked with precautionary savings and consumption, and its variation between men and women offers a further channel through which the gender gap can affect the macroeconomic outcomes.

This result links the behavioural preferences discussed in the previous sections with gender differences in risk-taking decisions. If women attach greater psychological weight to losses compared to gains, and at the same time, they are less optimistic about future outcomes and display a less stable level of interpersonal trust, it is plausible to expect a lower willingness to accept risk, in both financial decisions and in consumption and savings choices.

In this context, it seems reasonable to argue that the evidence suggests that the gender differences are the exception rather than the rule, and smaller and less robust than commonly believed, providing no certainty on a highly controversial topic.

II. BEHAVIOURAL EXTENSION OF THE IS-LM MODEL

(For the standard derivation of the IS-LM model, see Appendix A. This chapter focuses on how the parameters and slopes of the model are modified once households' preferences depart from risk-neutrality.)

Leaving aside the psychological effect of uncertainty, a standard model explains that households consume a fixed part of their income while firms invest based on the interest rate. When considering risk aversion an evident change is verified directly to consumption and savings, as previously stated. Uncertainty brings fear of the future, affecting individuals perspective over their way of living. It can be noticed a trade-off; as a consequence of fear, households save more but at the same time loss aversion brings the “hurt” idea of cutting their consumption, reducing their lifestyle. Regarding heterogeneity, Dawson (2023) suggests that women tend to display higher loss aversion and lower financial optimism compared to men, which traditionally leads to greater prudence. This behavioural tendency contributes to a decrease in aggregate consumption propensity when uncertainty rises.

Looking at the aggregate consumption, the tendency to save more affects the marginal propensity to consume (c_1) lowering it as individuals choose to consume a smaller portion of their disposable income in order to increase future funds and being protected for a long time. To analyse the great impact on the IS-LM model it is useful to look at the multiplier.

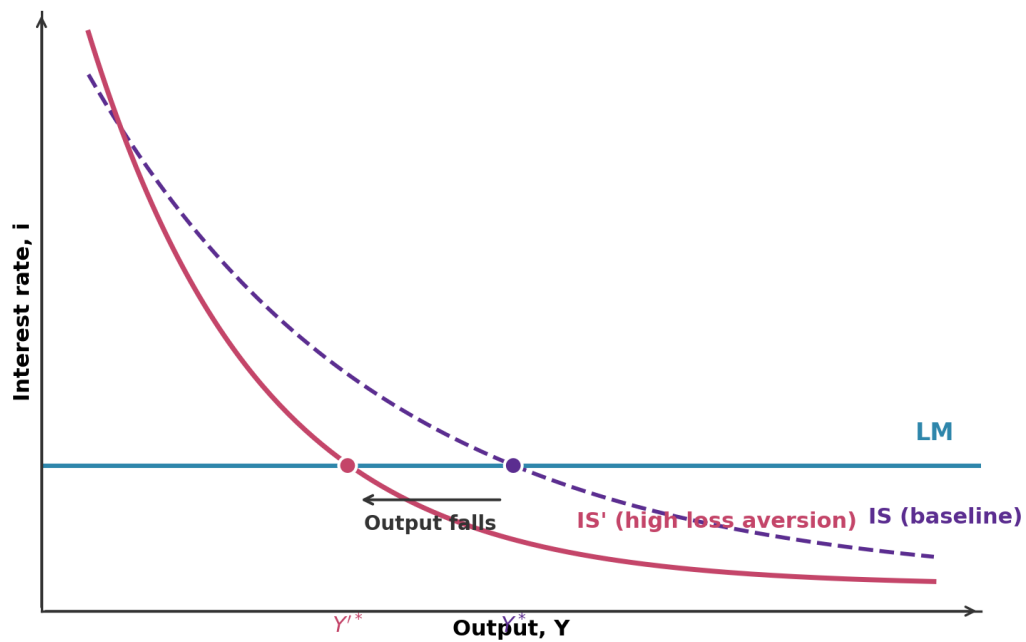
$$\frac{1}{1 - c_1 - d_1}$$

When risk aversion increases and the marginal propensity to consume decreases, as a consequence the denominator of the multiplier turns out larger than it was previously, mathematically bringing up the overall multiplier to decrease. The result means on a macroeconomic level that a given change in autonomous spending, leads to a smaller change in equilibrium output. The goods market and therefore the IS curve becomes less sensitive to demand shocks, becomes steeper. Every change in autonomous spending will shift the equilibrium output of the model by a shorter horizontal distance compared to a situation with

lower risk aversion. For any change in the interest rate, the associated change in output is reduced.¹⁴

Equilibrium output falls and monetary policy becomes less effective

Behavioural channel: higher loss aversion makes the IS steeper and shifts it leftward



Source of the graph: Author's own elaboration.

A key conclusion of higher risk aversion in this framework is that while the IS curve becomes steeper when looking at consumption, the LM line does not initially change based on the level of risk aversion. Keeping an interest rate constant, while the IS curve becomes steeper induces through fiscal policies and demand shocks to change the final equilibrium, creating a contractionary effect where output falls. If risk aversion is extreme, the economy may enter a liquidity trap, where the LM line is flat at $i = 0$ and the central bank cannot lower the interest rate further with conventional tools, monetary policy loses its effectiveness. This scenario represent the fear of losing everything that makes economic agents insensitive to

¹⁴ The graph shows the combined effect of risk aversion and loss aversion

the low cost of borrowing. Instead of investing or consuming, households and firms prefer to accumulate liquidity as a buffer against potential future losses. In this context, loss aversion transforms a psychological fear into a persistent real economic recession that monetary policy struggles to counteract.

II.I Loss aversion and the leftward shift of the IS curve

Another psychological side to consider as discussed in the previous sections, according to Prospect Theory is loss aversion. A perceived loss today is more hurtful and intense compared to the satisfaction of the gain in that slot of time. In macroeconomics the fear of a loss does not affect the marginal propensity to consume, since the individual does not wish to lower his gain. Loss aversion affects another factor in consumption, so called the autonomous consumption (c_0). When economic uncertainty arises (a shock), the fear of a potential future drop in the standard of living triggers an immediate downward revision of the "reference point." To be more clear, if before the agent's autonomous consumption included more pleasure expenses, for the loss aversion the individual will decide to lower their baseline, by including less things. Households try to create a shield against fear, deciding not to spend because the pain of a possible future poverty is so big that they prefer drastically cut basic expenditures in their life to protect against future pain. For instance, discretionary spending previously considered standard (e.g. dining out, subscriptions, vehicle upgrades) is suddenly categorized as a potential loss of liquidity. In the IS-LM framework, a reduction in autonomous consumption causes a shift of IS curve to the left implying that for any interest rate the equilibrium level of output will be lower.

II.II Gender differences in the IS-LM parameters

Recalling the evidence previously explained, women often exhibit higher levels of prudence and risk aversion with stronger loss aversion, at this time these behavioural patterns must now be formalized within the macroeconomic model. Optimism and trust plays a crucial role, especially on investment decision, by being more pessimistic or cautious it directly affects autonomous investment, lowering it and shifting the IS curve to the left. Similarly optimism influences the sensitivity of investment to the interest rate. If agents hold cautious expectations about the future, even by offering a lower interest rate, the individual will decide not to invest. This relation brings the parameter (d_2) down, and making as a consequence the IS curve steeper and significantly less reactive to the monetary policy. Dawson argues that optimism increases confidence about future actions and is associated with a greater willingness to take risks.

Finally, in the first chapter was analysed the factor of education interacting with risk preferences. As learned from the literature section, education significantly affects risk preferences: while single women with higher academic achievements tend to take more risks than their less educated counterparts, higher education in men is correlated with less risk-taking. This suggests that the "gender gap" in the IS parameters is not immutable. Higher academic levels can help overcome the gap in risk perception, potentially normalizing the slope of the IS curve. However, as long as persistent educational or financial literacy gaps exist, they will negatively impact both autonomous consumption and investment, maintaining the IS curve in a steeper and leftward-shifted position.

By following traditional literature, as previously said women exhibit a higher level of loss aversion and pessimism compared to men, consequently it is easy to deduce that an economy where consumption decisions are driven mostly by women would have lower GDP during crises, due to their preference to save. Although, an analysis previously cited, challenges this assumption, focusing on single individuals where decisions are solely made. There is no significant difference in financial relative risk aversion between men and women once wealth is controlled for. This shows that the contractionary impact of loss aversion is driven less by the type of gender but more by the level of wealth of a household.

The theoretical analysis suggests that an economy with a significant presence of high loss aversion and lower optimism in decision-making will be characterized by a steeper and

leftward-shifted IS curve. This implies a structural tendency toward lower equilibrium output and a reduced effectiveness of standard monetary policy interventions. This theoretical framework provides the necessary basis for the empirical analysis in the next section.¹⁵

¹⁵ Blanchard, O., Amighini, A., & Giavazzi, F. (2021). *Macroeconomics: A European Perspective* (4th edition). Pearson.

III. TESTING THE CHANNEL IN CROSS-COUNTRY PANEL DATA

III.I. *Building the panel: The World Bank and the GPS*

The analysis combines two types of data: country level macroeconomic series and individual level data on economic preferences.

Macroeconomics data. The aggregate variables come from the World Development Indicators of the World Bank. In particular it has been used: (i) household final consumption expenditure per capita in constant 2015 US dollars; (ii) GDP per capita in constant 2015 US dollars; (iii) annual consumer price inflation; (iv) the lending interest rate; (v) the unemployment rate as a share of the total labour forces; and (vi) general government final consumption expenditure in constant 2015 US dollars which is divided by the total population to obtain a per capita measure in logarithm.

Preference data. The gender gap in risk preferences is computed from the Global Preferences Survey (Falk et al.,2018), an international survey that measures six dimensions of economic preferences: (i) risk taking, (ii) patience, (iii) altruism, (iv) positive reciprocity, (v) negative reciprocity, (vi) trust. The survey includes approximately 80,000 individuals across 76 countries. For each country in the sample, it has been computed an average risk taking score separately for male and female individuals (gender=0 for men, gender=1 for women) and define the gender gap in risk preferences as the difference between the two

$$gap = mean(risk\ taking|male) - mean(risk\ taking|female)$$

The gap is positive in almost all the countries, men are on average more risk taker than women, with a cross country mean of approximately +0.20 and a dispersion (standard deviation 0.13).

Sample. The period of analysis goes from 2003 to 2019. 2003 is the first year in which the World Bank lending rate is consistently available for most countries, and 2019 on the other hand closes the dataset before the pandemic shock that would have distorted the macroeconomic dynamics. The full specification sample includes 51 countries with 698 country-year observations, in the levels specification and 647 in the first difference specification; the initial baseline specification includes though a sample of 56 countries.

An additional note is that the choice of the World Bank lending rate as the interest rate has a limitation, several countries as Germany, France, Spain, Belgium, Austria, Portugal; that do not report a consistent lending rate, and therefore primarily they were excluded. This compromises the representativeness of the OECD sub-sample, and is one of the reasons why robustness checks based on alternative interest-rate sources (the IMF lending rate and the ECB policy rate).

III.II From theory to regression

For each country (i) and year (t), the model regresses the logarithm of per capita consumption on the logarithm of lagged per capita income, an interaction between the gender gap and lagged income, four macroeconomics controls, and country and year fixed effects. The specification has been divided in two forms: in logarithmic levels and in first differences.

$$\log(C_{(i,t)}) = \beta_1 \log(Y_{(i,t-1)}) + \beta_2 gap_i \times \log(Y_{(i,t-1)}) + \gamma X_{(i,t)} + \alpha_i + \delta_t + \varepsilon_{(i,t)}^{16}$$

Standard errors are clustered at the country level and the coefficient of interest is β_2 , which captures how the income elasticity of consumption varies with the gender gap. The theoretical prediction previously made implies that $\beta_2 < 0$, in countries with a wider gender

¹⁶ where C is per-capita consumption, Y is per-capita income, gap is the country-level gender gap in risk-taking (cross-sectional, time-invariant), X is a vector of macroeconomic controls (inflation, interest rate, unemployment, log of per-capita government spending), α and δ are country and year fixed effects, and ε is the error term.

gap, the consumption response to income should be smaller, with a lower aggregate marginal propensity to consume.

The first difference specification takes the same form on the year-on- year log- differences and provides a robustness check against the non- stationary of the level series. Because log-consumption and log-income are non-stationary but cointegrated in this type of panel the levels specification can be interpreted as a long-run equilibrium relationship, while the first-difference specification captures short-run dynamics.

III.II.I A first estimate consistent with the hypothesis

In the first version of the empirical analysis, before adding all the macroeconomic controls suggested and before introducing constant-dollar data, the specification produced lead to a confirmation of the theoretical prediction.

Variable ¹⁷	Levels	First differences
$\log(Y_{t-1})$ or $\Delta\log(Y_{t-1})$	+1.358***	+0.190**
$\text{gap} \times \log(Y_{t-1})$ or $\text{gap} \times \Delta\log(Y_{t-1})$	-0.767	-1.206**
Inflation	-0.0003	-0.0025***
Interest rate	-0.003	-0.010**
N	759	703
Countries	56	56
p-value of interaction	0.107	0.033

¹⁷ *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors clustered at the country level. All models include country and year fixed effects.

In the first difference specification, the interaction coefficient between the gender gap and the lagged growth of income is negative and statistically significant at the 5% level:

$$\beta_2 = -1.21 \text{ with } p = 0.033$$

The sign is consistent with the hypothesis, and the magnitude (combined with the average sample consumption-to-income ratio of approximately 0.40) would imply that the aggregate marginal propensity to consume falls by roughly 11% at the mean observed gender gap. In countries with a gender gap one standard deviation above the mean implies that the reduction reaches approximately 19%. Giving the assumption that the behavioural channel would have an economically detectable effect on the aggregate consumption function. In the levels specification the coefficient is also negative but only marginally significant, typical when the dependent variable is highly persistent.

$$\beta_2 = -0.77 \text{ with } p = 0.107$$

The macroeconomic controls behave as expected, increases in inflation and interest rate are associated with lower growth in consumption, both statistically significant in the first difference specification. These results would bring a confirmation of the behavioural channel formalized in the third section: countries with a wider gender gap in risk preferences brings a lower sensitivity of consumption to income.

However, this result revealed a methodological issue that changes completely the interpretation of the coefficient.

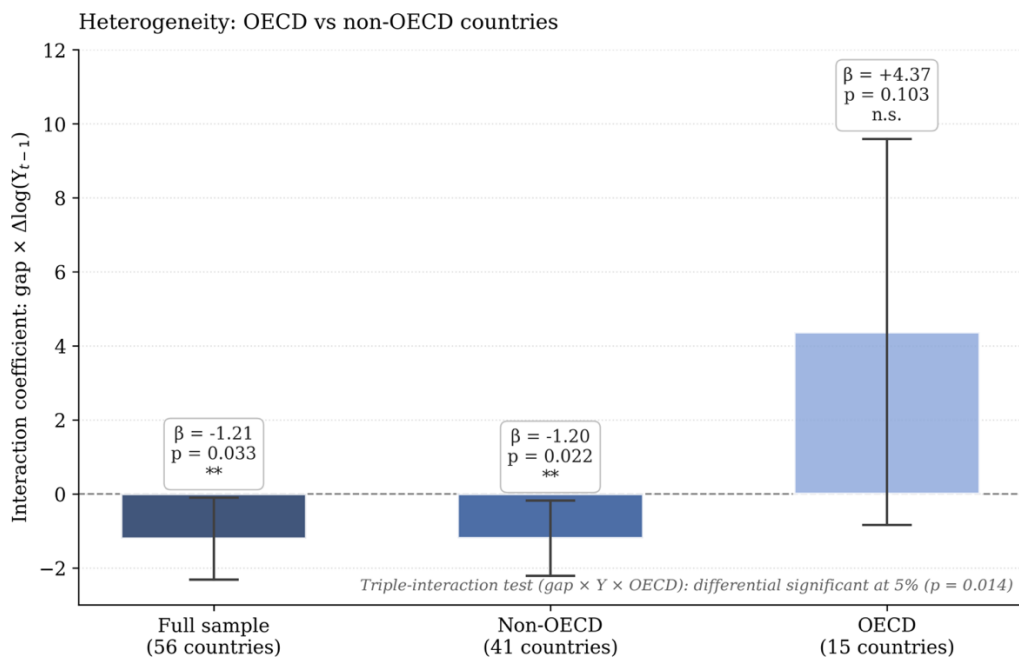
III.II.II Heterogeneity OECD vs non-OECD

To verify the uniformity of the effect, the analysis was split into OECD and non-OECD countries. From a theoretical point of view the precautionary savings channel should be stronger in countries with a weaker public safety net, lower welfare development. These kinds of characteristics are typical of non-OECD subsamples. The result is concentrated mostly in the non-OECD countries with 41 countries and 522 observations in first differences.

$$\beta = -1.20 \text{ and } p = 0.022$$

The interaction coefficient is statistically significant at 5% level and mostly identical to the coefficient of the full sample.

In the OECD sample, on the other hand composed of 15 countries and 181 observations, the coefficient is positive but not significant and is estimated with a very large standard error. A formal test of the differential effect, obtained by the interaction of the $gap \times \Delta \log(Y)$ term with an OECD dummy, confirms that the difference between the two groups is statistically significant at the 5% level. Under this initial result, this pattern would have been consistent with the theoretical idea that the behavioural channel is more detectable where there is not such a strong development of the economy stability.

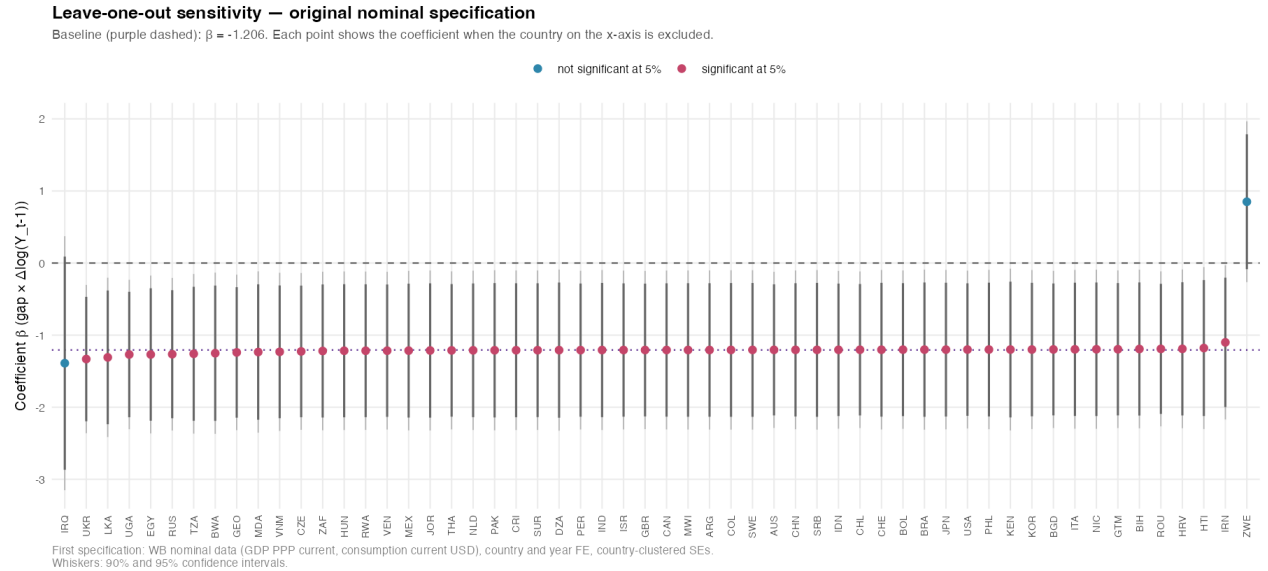


Source: Author's

own elaboration based on World Bank WDI and GPS data (Falk et al., 2018).

III.II.III One country, one year: how Zimbabwe drove the result

By conducting a country-by-country sensitivity analysis, the specification was estimated 56 times, each time excluding one country from the sample, and recorded the resulting interaction coefficient and its 95% confidence interval.



Source: Author's own elaboration based on World Bank WDI and GPS data (Falk et al., 2018).

The plot reveals a clear pattern. For 55 of the 56 sample countries, excluding the country leaves the interaction mostly unchanged at $\beta = -1.2$ with a confidence interval that does not cross zero. The exception is Zimbabwe, by excluding it the sign changes in the coefficient $\beta \approx +0.85$ and the resulting confidence interval crosses zero, so the coefficient is no longer statistically distinguishable from zero. In other words, the negative and significant result of the original specification is driven entirely by a single country.

After a quick research, in 2017 Zimbabwe introduced a new local monetary regime, the RTGS dollar, which was officially pegged to the US dollar at a 1:1 rate but in practice traded at much higher rates. The World Bank, which converts national accounts data into US dollars using the official exchange rate, recorded a one-year jump of approximately +155% in nominal GDP, followed by a fall of -62% the year after. This is not the result of an economic shock but of a currency rebasing: when the official conversion rate diverges from the effective market rate, the dollar-valued series produces large but spurious fluctuations.

Once this single observation is removed, in the other 50 countries there is not identified a statistically significant relationship between the gender gap and the income elasticity of consumption. The correction made to the analysis involved a replacement of the data in dollar current series of GDP and consumption with their constant 2015 dollar. The replacement guarantees that there is immunity to the currency rebasing problem. From now on the chapter will use the constant dollar data.

III.III Correcting the specification: constant dollars and full controls

In this new specification the data of consumption and income per capita were substituted with the version in per capita constant 2015 dollars to avoid the Zimbabwe issue, and includes two macroeconomics controls that previously were not incorporated: the unemployment rate and per capita government spending in logarithm.

Variable ¹⁸	Levels	First differences
$\log(Y_{t-1})$ or $\Delta\log(Y_{t-1})$	+0.640***	+0.040
$\text{gap} \times \log(Y_{t-1})$ or $\text{gap} \times \Delta\log(Y_{t-1})$	+0.469	+1.230
Inflation	-0.001***	-0.0005**
Interest rate	-0.003	-0.003*

¹⁸ *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Standard errors clustered at the country level. All models include country and year fixed effects.

Unemployment rate	−0.003	−0.009***
log(government spending per capita)	+0.035	+0.029
N	698	647
Countries	51	50
p-value of interaction	0.165	0.104

As noticeable, the results are quite different from the first table. The interaction coefficient between the gender gap and lagged income is no longer statistically distinguishable from zero.

$$p = 0.165 \text{ in levels and } p = 0.104 \text{ in first differences}$$

The point estimate has inverted sign in both specifications, but the magnitude of the change is dominated by sampling uncertainty, not by a real shift in the economic relationship. Indeed in this new specification the behavioural hypothesis made previously, which predicts $\beta_2 < 0$, does not emerge as a statistically identified effect.

The macroeconomic controls, on the other hand, behave exactly as the theory predicts. The lagged income elasticity is positive and highly significant

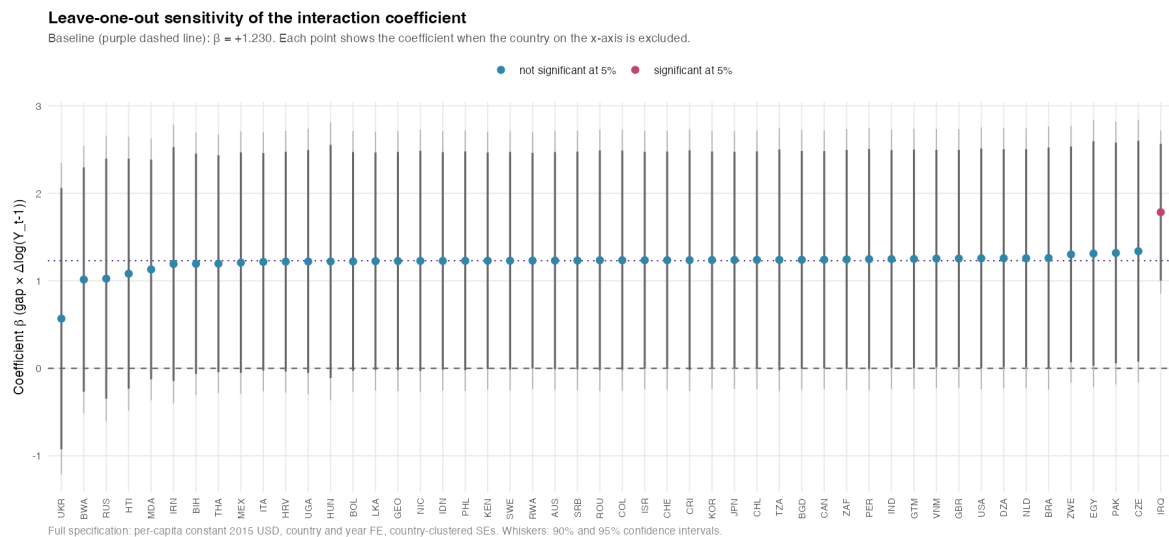
$\beta_1 = 0.64$ $p < 0.001$ in the levels specification consistent with a permanent-income type relationship between aggregate consumption and aggregate income.

Inflation is negatively related to both the level and the growth of consumption, with high statistical significance. The interest rate has the expected negative sign and is marginally significant in first differences ($p \approx 0.06$). The unemployment rate is the most strongly significant of the controls in first differences ($\beta = -0.009$, $p < 0.001$): increases in unemployment have a large and immediate negative effect on the growth of household consumption, as expected.

It shows that the addition of the unemployment rate explains a part of the difference between the original and the corrected specification. The cross-country variation in labour market volatility is correlated with the variation in the gender gap, indeed both are higher in the countries with a weak welfare institutions.

III.III.I Country by country robustness of the corrected estimate

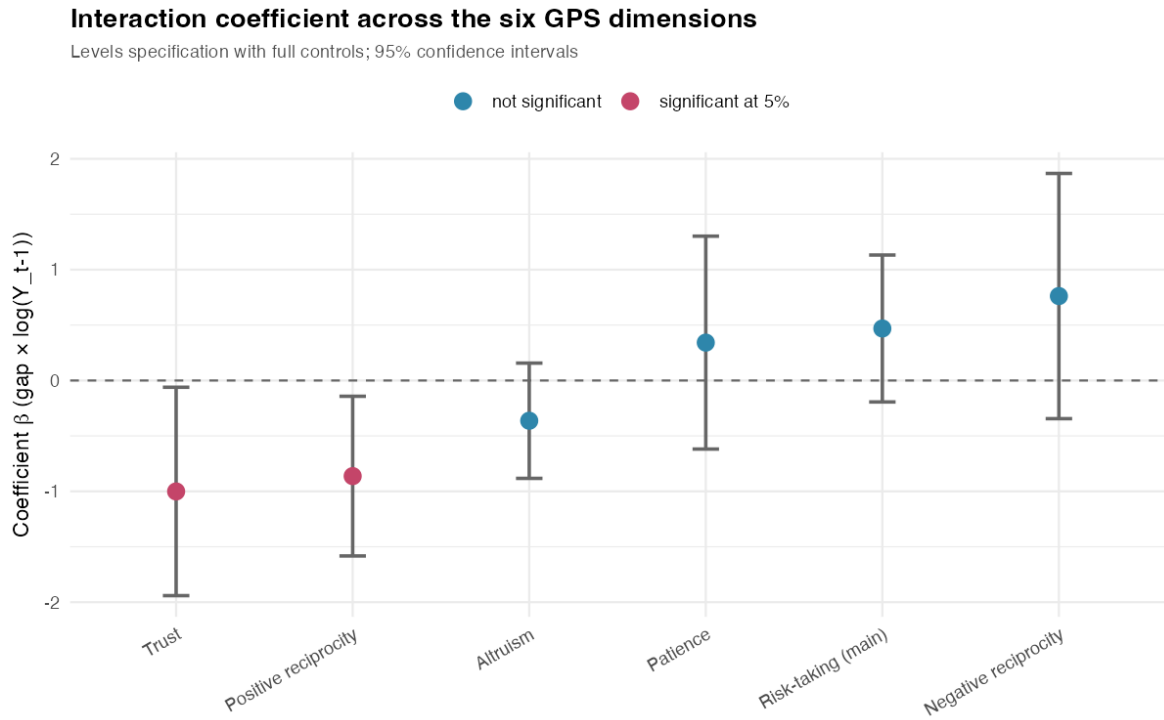
By conducting a leave one out exercise on the new specification:



The graph shows that the coefficient is stable across countries, as most countries lie around the baseline value of $\beta \approx +1.23$ with confidence intervals that consistently include zero. There is one exception, which is Ukraine, where the coefficient falls to approximately +0.57 and the p-value goes to 0.53. Due to the macroeconomics shocks that Ukraine has experienced as for (the annexation of Crimea, a collapse of the hryvnia and a sharp recession). So even in the most extreme leave one out case the confidence interval includes zero, the non significance of the result is robust

III.IV Beyond risk: trust as an alternative channel

The theoretical framework built in the previous chapters, is concentrated specifically on the risk dimension of preferences. Yet the Global Preferences Survey measures additional five dimensions of economic preferences: patience, trust, altruism, positive reciprocity and negative reciprocity. To have a wider look over the analysis, the full specification has been re-estimated by replacing the gender gap in risk taking with the gender gap in each of these five dimensions.



Source: Author's own elaboration based on World Bank WDI and GPS data (Falk et al., 2018).

Of all the six dimensions tested, only two turned out to have an interaction coefficient that is statistically significant at the 5% level in the levels of specification:

the gender gap in trust ($\beta = -1.00$ and $p = 0.037$)

the gender gap in positive reciprocity ($\beta = -0.86$ and $p = 0.019$)

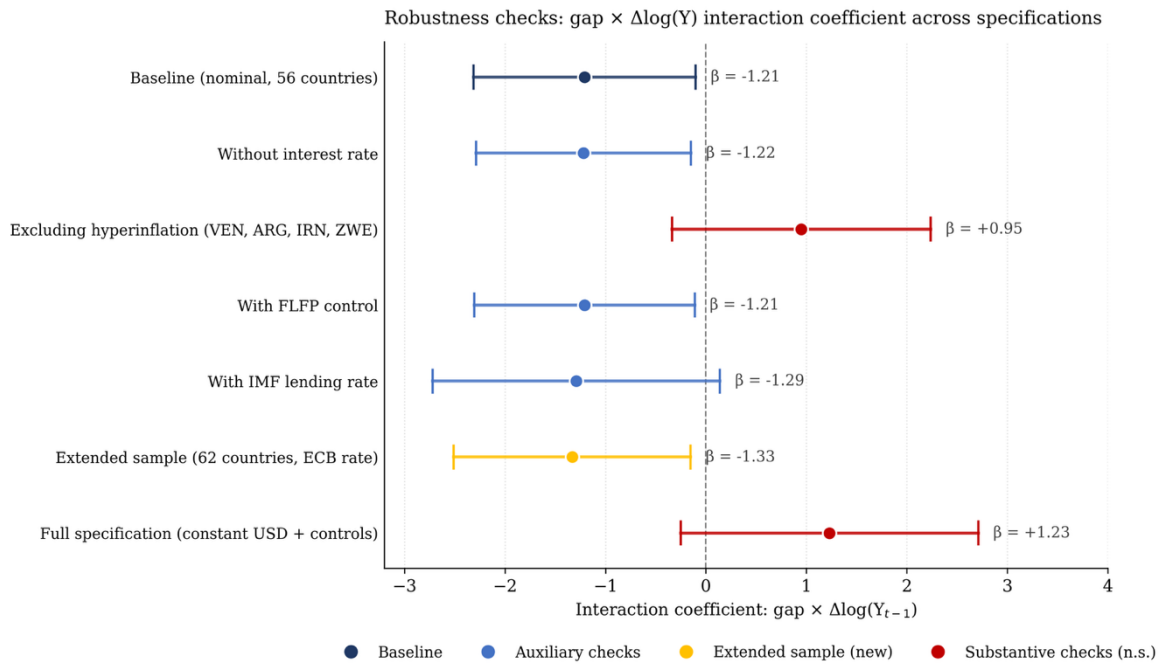
The finding on the gender gap in trust is nonetheless of potential interest for future research, indeed a natural extension of this thesis would be to construct a theoretical framework that places trust at the centre of the behaviour aggregation argument.

III.V Stress-testing the baseline result

A series of robustness checks were made to give more stability to this thesis.

Specification ¹⁹	Coefficient	p-value
Baseline (nominal, 56 countries)	−1.21	0.033
Without interest rate	−1.22	0.026
Excluding hyperinflation countries (VEN, ARG, IRN, ZWE)	+0.95	0.148
With FLFP control	−1.21	0.031
With IMF lending rate (alternative source)	−1.29	0.077
Extended sample (62 countries, ECB policy rate)	−1.33	0.027
Full specification (constant USD, full controls)	+1.23	0.104

¹⁹ Interaction coefficient $\text{gap} \times \Delta \log(Y_{t-1})$ from the first-difference specification. Rows 1–5 vary one element of the specification at a time relative to the original baseline (row 1). Row 6 extends the sample to 62 countries by adding six euro-area economies (Germany, France, Spain, Austria, Greece, Portugal) for which the World Bank lending rate is unavailable; for these countries the interest rate is replaced by the ECB policy rate. Row 7 reports the full specification in constant 2015 US dollars with the complete set of controls (inflation, interest rate, unemployment, log government spending per capita), as discussed in Section IV.III. Standard errors clustered at the country level.



Source: Author's own elaboration based on World Bank WDI and GPS data (Falk et al., 2018).

Robustness checks (1) and (3) confirm that the result is not driven by the choice or inclusion of the data from the WB and neither by the female labour force participation. Robustness check (4) confirms that this kind of result is independent of the specific source used for the interest rate, because by using the IMF equivalent the sign remains unchanged. Since the lending rate of the World Bank for some countries was not available, the interest rate was replaced by the policy rate set by the ECB. The coefficient is approximately similar to the original, helping confirming that the result is not generated by the exclusion of these developed economies. Check (2) and the final row are the substantive checks because they give the idea that by excluding hyperinflation countries or by switching to constant dollar data they both lead to not significant results.

III.VI *What the analysis cannot identify*

In conclusion, the empirical analysis presented is quite informative, the behavioural channel introduced in the IS-LM framework, whereby a wider gender gap in risk preferences should be showed into a lower aggregate marginal propensity to consume, does not emerge as a statistically robust feature of cross country panel data once the corrected specification was made. The interaction coefficient between gender gap and lagged income is not statistically distinguishable from zero nor in the levels nor in the first difference specification.

As for the personal interpretation, this result does not invalidate the theoretical argument. The mechanism by which loss aversion and pessimism brings a higher precautionary savings mindset remains plausible, and the IS-LM assumptions are mathematically straight forward. What the analysis suggests is that the magnitude of the channel, once all the adjustments are made from individual decisions to country level of consumption, is sufficiently small to be absorbed by the macroeconomic environment, and in particular by the circumstances of labour market and unemployment rate.

Of course the gender gap differences were found through the Global Preferences Survey in a single wave, bringing the data to be time invariant. The identification of the interaction coefficient relies on cross country variation in the gap with within country variation in income, with the country fixed effects absorbing the level of gap itself. This explains that there are some limitations, it does not allow the identification of how the channel evolves over time at the country level. As a matter of fact it is known that the gender gap in risk preferences is correlated with a wide set of cross country characteristics such as institutions, cultural traits, financial development, that may influence the final consumption income relationship and that the fixed effects cannot absorb completely.

Despite these limits the chapter helps documenting how a coefficient that is negative and statistically significant at the 5% level can rest on a single high-leverage observation that was distorted by an artefact, and how the careful approach to the methodological method, combined with the leave one out sensitivity analysis approach reveals the fragility of the outcome. The behavioural aggregation channel, proves identifiable in theory but not

robustly observable in cross country panel data, a difficulty in detecting the behavioural effects at the macroeconomic level and that brought the analysis to look over a future research topic, the dimension of trust.

CONCLUSION

The main objective of this thesis was to investigate whether the gender gap in the economic preferences, a behavioural trait on the individual level can affect the aggregate marginal propensity to consume. The starting point was the observation supported by literature, that women on average have a higher risk aversion, greater loss aversion and lower optimism and trust compared to men. If this observation is meaningful, and if women contribute to household decisions in modern economies, then there is an impact on the macroeconomic consumption function. The chapter of the theoretical framework argued that, even though gender differences in preferences are often smaller and more controversial depending on the context than commonly believed. The literature supports the existence of a robust gender gap in loss aversion, and that, under the reference-dependent model, loss aversion translates into stronger precautionary savings motive. Chapter III incorporates the behavioural pattern into the IS-LM framework, showing that higher precautionary savings motive on the side of female household members produces a lower aggregate marginal propensity to consume and therefore a steeper and leftward shifted IS curve. In the final chapter two natural directions for future research were found. The first concerns the exploration of alternative dimensions of preferences, where trust was found as statistically significant at the 5% level in the levels specification, instead of the risk-taking. This result is quite interesting even if the thesis more concerns about risk and loss aversion, trust is actually an important determinant factor for the agents and their decision over a risk opportunity. A second direction includes the way the channel could be identified through time. In this analysis the gender gap is time invariant, since the Global Preferences Survey, gives only a constant for each country. Meaning that the channel can be identified only by comparing different countries to each other, and not over time. The thesis closes, with a result that is deliberately less spectacular compared to the one appeared at the beginning of the analysis. The behavioural aggregation channel between the gender preferences and the aggregate marginal propensity to consume remains theoretically plausible, and the IS-LM model gives a coherent framework to look over this analysis. What the empirical part has shown is that detecting this channel requires data and methods more sophisticated than those available. The title of the thesis “ The limits of behavioural aggregation” was chosen exactly to explain this double effect and meaning. In

the framework of an academic thesis, the honesty of this conclusion is in itself a form of scientific contribution.

APPENDIX A: THE IS-LM MODEL

FRAMEWORK²⁰

A1. Aggregate demand and the consumption function

To introduce the IS curve, it is useful to recall the aggregate demand in the goods market. Gross Domestic Product (GDP) is the monetary value of all final goods and services produced within a country in a certain period. In macroeconomics, GDP can be decomposed into consumption (C), fixed investment (I), government spending (G), net exports (NX) and changes in inventories. Under the assumption of a closed economy, net exports are set to zero by considering imports and exports equal, so the aggregate demand reduces to:

$$Z = C + I + G$$

Consumption represents the expenses made by consumers on goods and services, that shows the household income spent in the economy. It is usually written as:

$$C = c_0 + c_1(Y - T) \quad 0 < c_1 < 1$$

Where c_0 is the autonomous consumption, the part of consumption that does not directly depend on the income, and c_1 is the marginal propensity to consume, which measures the susceptibility of consumption to the disposable income, defined as the difference between income and taxes.

$1 - c_1$ is the marginal propensity to save, representing the part of income not used yet in the market. Investment depends positively on income and negatively on the interest rate: $I = d_0 + d_1(Y) - d_2(i)$, with $d_1 > 0$ and $d_2 > 0$. Government spending G is exogenous, and fiscal policy is summarised by $(G - T)$.

The equilibrium condition $Y = C + I + G$ implies, after substituting the behavioural equations: $\frac{1}{1 - c_1 - d_1} \times c_0 - c_1T + d_0 - d_2i + G$

²⁰ This chapter follows the standard IS-LM treatment in Blanchard, Amighini & Giavazzi (2021), chapters 3–

The term $\frac{1}{1-c_1-d_1}$ is denominated spending multiplier. The multiplier measures how much equilibrium income increases to a one unit change in autonomous spending.

$$c_0 - c_1T + d_0 - d_2i + G$$

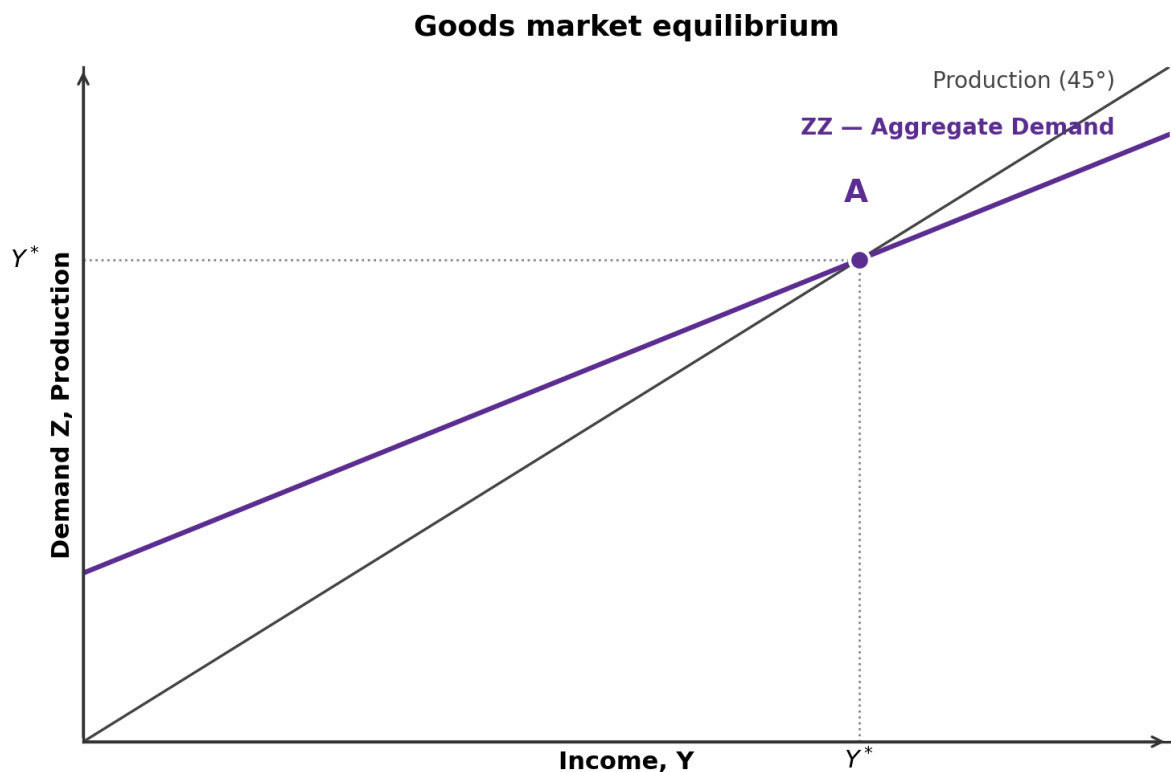
is considered as the spending that does not depend on the output.

An higher marginal propensity to consume, or sensitivity to investment to income, increases the multiplier and leads to an increase on the overall equilibrium output. Equilibrium can be seen as well as :

$$I = S + (T - G)$$

An equilibrium condition of savings-investment, an alternative way to calculate the equilibrium of the good market. In a closed economy the total savings is given by the sum of private and public savings.

Equilibrium occurs where aggregate demand equals production ($Y = Z$)



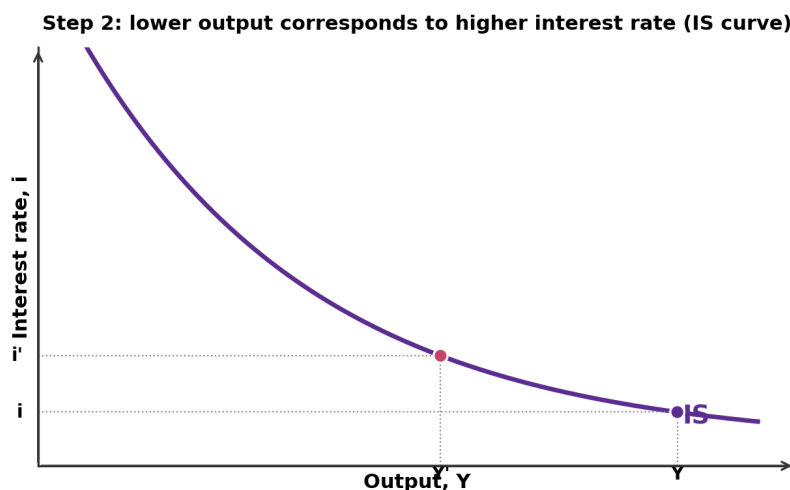
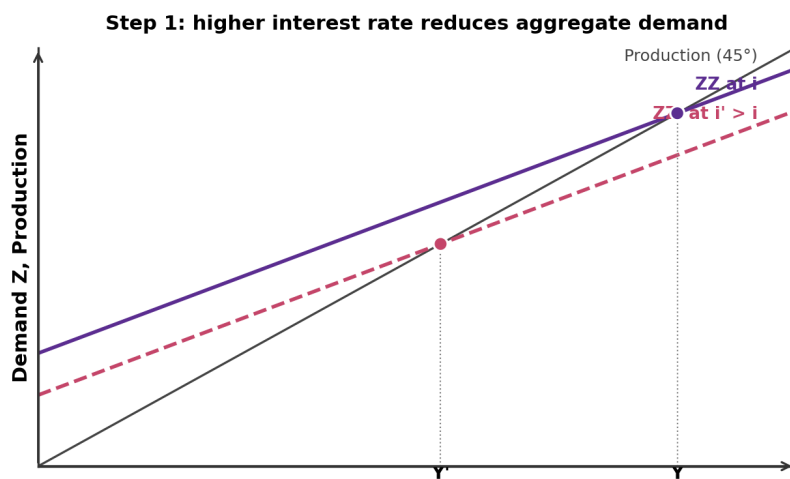
Source of the graph: Author's own elaboration.

A1.I Deriving the IS curve

The IS curve summarises all combinations of output and interest rate compatible with the equilibrium of the goods market. It is downward-sloping: a higher interest rate reduces investment, which reduces aggregate demand and therefore equilibrium output. Movements along the curve correspond to changes in the interest rate; shifts of the curve correspond to changes in autonomous components.

Derivation of the IS curve

An increase in the interest rate from i to i' reduces investment, aggregate demand, and equilibrium output



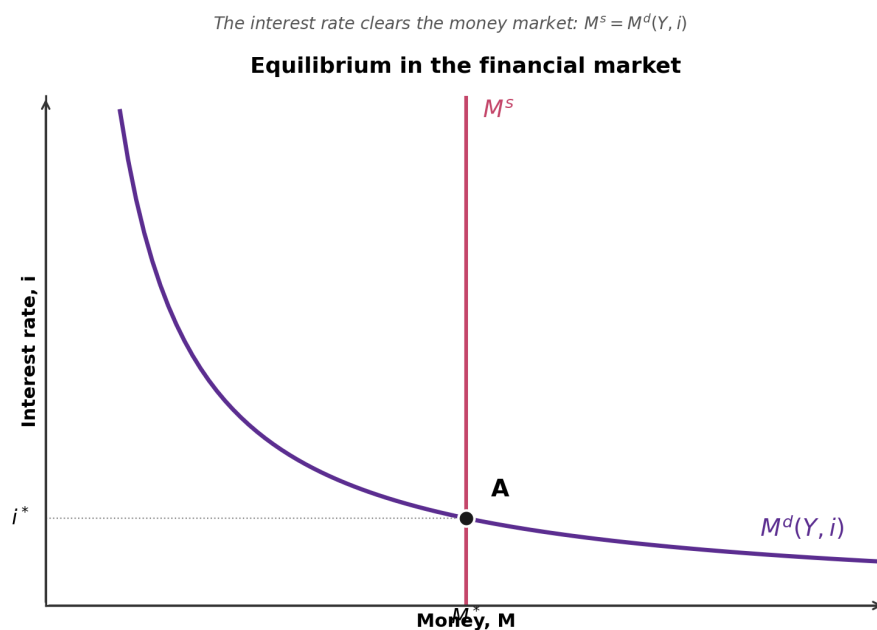
Source of the graph: Author's own elaboration.

A2. Money demand, money supply and the Central Bank

The financial market determines the equilibrium between money demand $M^d(Y, i)$ which increases in income and decreases in the interest rate and money supply M^s , controlled by the central bank. Equilibrium requires:

$$M^s = M^d(Y, i) \quad (2)$$

The central bank adjusts the money supply through open market operations. Its control is limited by the zero lower bound: once the interest rate reaches zero, conventional monetary tools cannot push it lower, producing the so-called liquidity trap.



Source of the graph: Author's own elaboration.

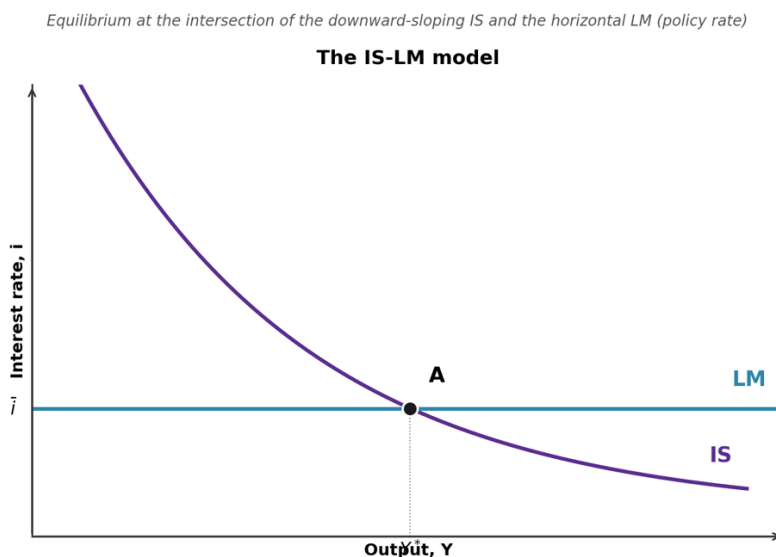
A2.I From Money market to the LM line²¹

The LM line is composed by the equilibrium condition in the money market *given by Money demand equals to money supply*, which implies an upward-sloping LM curve. In modern practice, however, central banks choose the short-term interest rate directly and adjust the money supply to achieve it. In this case, the LM relation can be represented as a horizontal line at the policy rate i , and monetary policy is modelled as a shift of this horizontal LM line.

A3. Equilibrium output at a given policy rate

The intersection of the downward-sloping IS and the horizontal LM determines the equilibrium level of output for a given policy rate.

Having derived the standard IS-LM equilibrium, we now turn to how this framework changes when households' preferences depart from risk-neutrality. The following sections develop the role of risk aversion, loss aversion, and gender-based heterogeneity in these behavioural traits, showing how each affects the slope and position of the IS curve.



Source of the graph: Author's own elaboration.

²¹ in my exposition, following Blanchard, it is used the assumption that the central bank sets the interest rate, so the LM is drawn as a horizontal line at the policy rate

BIBLIOGRAPHY

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, Reciprocity, and Social History. *Games and Economic Behavior*, 10(1), 122–142.

Blanchard, O., Amighini, A., & Giavazzi, F. (2021). *Macroeconomics: A European Perspective* (4th ed.). Pearson Education.

Croson, R., & Gneezy, U. (2009). Gender Differences in Preferences. *Journal of Economic Literature*, 47(2), 448–474

Dawson, C. (2023). Gender differences in optimism, loss aversion and attitudes towards risk. *British Journal of Psychology*, 114(4), 928–944. <https://doi.org/10.1111/bjop.12668>

Dhami, S., Hajimoladarvish, N., & Georgalos, K. (2023). *Precautionary Savings, Loss Aversion, and Risk: Theory and Evidence* (CESifo Working Paper No. 10570). Center for Economic Studies and ifo Institute, Munich.

Elminejad, A., Havranek, T., & Irsova, Z. (2024). Relative Risk Aversion: A Meta-Analysis. *Journal of Economic Surveys* (forthcoming). Working paper version, 17 December 2024.

Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., & Sunde, U. (2018). Global Evidence on Economic Preferences. *The Quarterly Journal of Economics*, 133(4), 1645–1692.

Filippin, A. (2022). Gender Differences in Risk Attitudes. *IZA World of Labor*, 100v2 (October 2022). <https://doi.org/10.15185/izawol.100.v2>

Giannikos, C. I., & Korkou, E. D. (2025). Are Women More Risk Averse? A Sequel. *Risks*, 13(1), 12. <https://doi.org/10.3390/risks13010012>

Grupe, D. W., & Nitschke, J. B. (2013). Uncertainty and anticipation in anxiety: An integrated neurobiological and psychological perspective. *Nature Reviews Neuroscience*, 14(7), 488–501. <https://doi.org/10.1038/nrn3524>

Kőszegi, B., & Rabin, M. (2009). Reference-Dependent Consumption Plans. *The American Economic Review*, 99(3), 909–936. <https://doi.org/10.1257/aer.99.3.909>

Leland, H. E. (1968). Saving and Uncertainty: The Precautionary Demand for Saving. *Quarterly Journal of Economics*, 82(3), 465–473.

Rosenblatt-Wisch, R. (2008). Loss aversion in aggregate macroeconomic time series. *European Economic Review*, 52(7), 1140–1159. <https://doi.org/10.1016/j.eurocorev.2007.12.001>

Salim, A. (2018). Macroeconomics and Microeconomics: An Overview. *IMPACT: International Journal of Research in Humanities, Arts and Literature*, 6(8), 119–124.

DATA SOURCES

European Central Bank. (2024). *Key ECB interest rates* [Data set]. ECB Statistical Data Warehouse.

https://www.ecb.europa.eu/stats/policy_and_exchange_rates/key_ecb_interest_rates/html/index.en.html

Falk, A., Becker, A., Dohmen, T., Enke, B., Huffman, D., & Sunde, U. (2018). *Global Preferences Survey* [Data set].

International Monetary Fund. (2024). *International Financial Statistics (IFS)* [Data set]. IMF Data Portal. <https://data.imf.org>

OECD. (2024). *List of OECD Member Countries*. Organisation for Economic Co-operation and Development. <https://www.oecd.org/about/document/ratification-oecd-convention.htm>

World Bank. (2024). *World Development Indicators (WDI)* [Data set]. The World Bank Group. <https://databank.worldbank.org/source/world-development-indicators>

Series used: NE.CON.PRVT.PC.KD (Household final consumption expenditure per capita, constant 2015 USD); NY.GDP.PCAP.KD (GDP per capita, constant 2015 USD); FP.CPI.TOTL.ZG (Inflation, consumer prices, annual %); FR.INR.LEND (Lending interest rate); SL.UEM.TOTL.ZS (Unemployment, total, % of total labour force); NE.CON.GOV.T.KD (General government final consumption expenditure, constant 2015 USD); SP.POP.TOTL (Population, total); SL.TLF.CACT.FE.ZS (Labour force participation rate, female, % of female population ages 15+).