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DIVERSITY AND MONETARY POLICY: THE GENDER FACTOR

RELATORE:

CH.MO PROF. DONATA FAVARO

LAUREANDA: INA GOLIKJA

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Introduction

When in July 2019 the European Council nominated Christine Lagarde as the new president of the European Central Bank, she became the first woman to head the European Central Bank since its creation in 1998. The last year has been an eventful period when it comes to women at the top positions in monetary and political institutions. The successor of Christine Lagarde at the head of the International Monetary Fund will be Kristalina Georgieva, an economist with a previous position as the second in command at the World Bank. Furthermore, on the second of July, Ursula Von der Leyer was elected as President of the European Commission, succeeding Jean Claude Junker. Another first time for a woman in a European institution. Meaningful is even the presence of two women, Minouche Shafik, director of the London School of Economics and Shriti Vadera, chair of Santander UK, in the shortlist of possible successors of Mark Carney at the top of Bank of England. However, the top management positions are still strongly held by men, with women representing only 6% of CEOs in the S%P 500 companies and the share of women in the monetary policy committees in central banks have an average of less than 20%. This dissertation aims to investigate the differences in the managing of monetary policy when there is more diversity in the central bank committee in terms of gender. The diversification of the components of boards and committees has been related to a better quality of information collected and policies adopted because of the different personal and professional background of the members. The diversity has been claimed to be a remedy of group-thinking. The presence of few women in a predominantly male sector as one of the central bank boards has brought to wonder if their presence can make the difference in terms of monetary policy implemented. The analysis of the topic will start debating some phenomena related to gender as masculinity and femininity and gender attitudes. They are useful in explaining gender differences in the level of risk taken in uncertain situations and their approach to leadership. The main idea is that women are more risk-averse and cautious, compared to men and this has an impact both in the personal and professional dimension. After these general considerations, the discussion will focus on those elite bodies that are the boards of central banks. The exclusivity is given both by the small size of the committees and by the prestige of the members together with the remarkable economic effect of their decisions. Looking deeply at the number of women who managed to reach the top positions of governor or president of a central bank, an empirical analysis was conducted by collecting data on macroeconomic variables on 175 countries from 1980 to 2018. The aim of the empirical model is to assess if there is any change

in the monetary policy preferences when the responsibility of chair of the board switches from a man to a woman. The previous literature in monetary policy preferences has defined chairwomen as more conservative and focused on gaining reputation, with very strict behaviour in achieving targets in order to prove their leadership and acquire authenticity by the other members of the committee. In monetary policy, using some specific jargon, women are defined as more hawkish than man in their willingness to use monetary policy tools to fight inflation volatility and keep it at the target level. The empirical analysis in will test this hypothesis and try to identify some patterns in the preferences of female monetary policy chairs, compared to male counterparties.

1. Gender attitudes and their economic influence

1.1 Masculinity and femininity

The aim of this dissertation is to investigate if there are differences in monetary policy decisions when a woman is appointed as chair of the central bank board. To understand the reason for these differences is important to explain some psychological and economic phenomena related to gender. Some of the key concepts and expressions to analyse are gender identity, as much as gender roles and attitudes. Stets and Burke (2000) define gender identity as "the degree to which an individual considers oneself as masculine or feminine" and in their opinion, these two categories are much products of social interactions than results of biological processes. Since the human being is a social animal, always looking for connections and bonds with other counterparts, in the last thousands of years even more complex societies made possible for mankind to live together in large communities. The society has a primary role in shaping the mindset of community members, even in very deep psychological levels such as self-identity. The culture in which an individual has grown up and the overhead political and organizational structures decide what to define as feminine or masculine and which patterns of behaviour are more appropriate for one or another. More in general, the gender theory can be defined as the study of what is called masculine or feminine behaviour in different contexts and fields of research, such as in literature, education, philosophy and health research (Jule, 2014). At this stage a distinction between sex and gender is necessary. If the former essentially refers to the biology of the human body, the latter is a more complex and multidimensional term. Gender can be related to social expectations on which role male and female people should have in the society, to the kind of behaviour the community associates to an individual not because of his or her characteristics, but due to general and generic gender stereotypes.

The most enduring stereotype is the one related to feminine and masculine behavioural patterns, as defined by social sciences. According to the United Nations Human Rights, a gender stereotype is a "generalised view or preconception about attributes or characteristics, or the roles that are or ought to be possessed or performed by women and men". Even though stereotypes and over-generalizations are deeply rooted in culture and used as a simplification to understand better the complexity of society and interactions among members, they may be harmful when they lead to limitations of genders' capability to freely develop personal and individual skills, to pursue professional and personal goals and make independent choices about their lives. Some of the most known gender stereotypes are those that relate women to a more

irrational behaviour, driven mainly by her emotions than logic, or with a more nurturing attitude, making childcare responsibility as a predominant female task. Being part of a category has s direct effect in defining the identity of an individual and how he or she perceives his or her own role inside the society. According to the Pediatric Urology (2010), the gender identity is "a reductionist sense of identity" in which a person "perceives and recognizes a personal sense of internal maleness or femaleness". Once more, gender is how we act in a certain situation, how we perceive ourselves in a certain context and even how other people around perceive our behaviour. Because of the idea of gender as a social product, something constructed within the society and taught to individuals since early stages of their development, Martin (2004) has defined it a social institution. A social institution, such as family or religion, is primarily characterized by endurance, they persist across time and space. Even if the definitions had changed over time, Martin (2004) identifies twelve criteria to label a phenomenon as social institution, such as they being deeply social; existing because of creation of groups; they constraint and facilitate behaviour of members by imposing different role to different categories; social constructs have positions and relations that are characterized by expectations and norms which are internalized by group members as identities; and finally, they are in continuous evolution and change over time and across different cultural areas.

This mindset has brought to a clear distinction of gendered attributes. Females are perceived and expected to be more passive in conflictual situations, to promote cooperation among relationships and be interested in social issues. On the other side, the attributed for men are more oriented towards aggressiveness and competitiveness in social interactions as in the working sphere as much as preferences for public rules and laws. Gender role attitudes are defined as ideas held by individuals on the roles women and men should or should not play in society. The traditional and long-lasting dichotomy sees the man as the breadwinner and the woman as a homemaker. These two distinct categories started blurring once women had more access to the labour market in the 1970s. Heilman (2001) takes the distance from the theory of gender as only a social construct and links the gender role attitudes to stereotypes in biological differences. The man is described as the aggressive, independent and decisive part, in opposition to a more kind, helpful and altruistic woman. The consequences of such a categorical distinction of values and attitudes shine through even in the working environment when it is shaped and organized in ways that penalize women. This has been labelled as "gendered work" and the first studies are dated back to the 1970s, in conjunction with the increasing interest in feminism and women's studies. These researches brought attention to how different men and women were positioned and to the segregation suffered by women which had few chances to grow professionally thought job opportunities and have a successful career. Again, because of

the masculinity and femininity dichotomy, both in labour demand and supply, workers were equipped with fixed professional attitudes, applying for specific types of jobs. In the late 1970s and 1980s the studies on gender took on a more complex and multidimensional viewpoint, not only related to work but extended to the entire social life. Harding (1986) defines the gendered social life as interaction of three distinctive processes: gender symbolism which is translated into dualistic meaning, such as man as rational and woman more emotional; gender structure that recalls the previous division of labour and of the entire society on gender basis; and gender identity given by interactions, socialization and the final building up of sense of self. The interest on these topics has grown so much in the last decades to see the debut in 1994 a new journal named "Gender, Work and Organization" as an important forum of discussion on links between gender and leadership, mentoring, entrepreneurship.

The terms masculinity and femininity have been mentioned many times and their development has been an object of study in many fields as psychoanalysis theory, cognitive development theory, and learning theories. Masculinity-versus-femininity is perhaps the most notorious dichotomy in history and is often related to gender roles and sex differentiation. Although it has always been present in culture and society, masculinity and femininity have become a scientific subject of research only at the end of the ninetieth century with the publication in 1894 of "Man and Women" by Havelock Ellis that started a new period of studies on brain structure to prove the intellectual superiority of men over women. Fitrana and Srisayekti (2014) recall the shift from the late 1930s to the 1950s of the focus from sex differences to gender roles mostly because of introduction in psychology of masculinity and femininity as "global personality traits". Terman and Miles (1936) proposed the "Attitude Interest Analysis Survey (AIAS)" to measure gender roles or how men and women were expected to behave and how their behaviour was perceived by the others. Since then, gender roles and attitudes have been reinterpreted in sociological and psychological researches such the interpretation in the 1950s of male goal-oriented behaviour as opposed to a more expressive and emotional one for women. Furthermore, two other instruments were developed to link certain patterns of behaviour to gender and they are still very popular nowadays. The first one is the Bem Sex Role Inventory (BSRI) by Bem (1974) and the Short BRSI, with less dichotomous items in each category. Feminine attitude includes being warm, gentle, affectionate, sympathetic, sensitive to the need of others' and tender; in the masculine definition there are leadership abilities, strong personality, acting like leaders, dominant, defends own beliefs, easily making decisions. Another well-known personality test is called "Personal Attributes Questionnaire (PAQ) developed by Spence, Helmreich and Strapp (1973).

The innovation of these studies was to think of masculinity and femininity not as opposite ends of a continuum as the AIAS, but as two independent dimensions. Bem (1974) challenged the traditional idea of men being only masculine and women identified only with feminine attributes and proposed the androgyny as a new category, defined by high feminine and masculine traits.

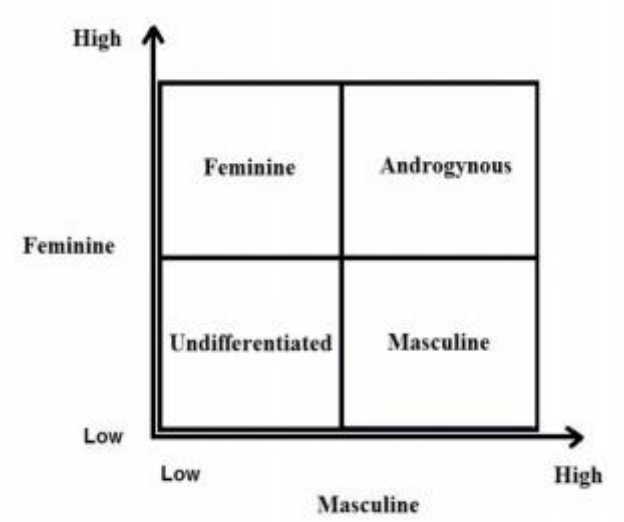

Fig.1 Gender traits. Source: Bem (1974)

Starting from the1980s the researches focus on the definition of gender as a social category, a multidimensional construct that thought cannot be explained in full by the mere dichotomy masculinity/femininity. In the last decade of the twentieth century, there was another evolution in the conceptualization of gender, it became the sixth human personality trait, together with extroversion, agreeableness, conscientiousness, neuroticism and openness. The definition of identity is far more complex in which biological differences play an important role. The different body and brain structures between two sexes due to different chromosomes, the type and quantity of hormones in circulation and other elements make almost impossible to ignore this natural dimension. Money and Ehrhardt (1972) called for a more bio-social approach, in which both nature and nurture play an important role in shaping gender identity. They claim that once born with a specific biological endowment, boys and girls develop different perceptions of themselves because of different social labelling and treatment by parents and the community more in general.

An important contribution to the definition of masculinity and femininity has been given by Hofstede (1980) in his work "Culture's Consequences: International differences in work-related values". He studied how values shared in the workplace are influenced by the culture of the country. The dimension of national culture has been ranked according to six different criteria including masculinity (MAS) defined as how much a certain society reinforces the traditional

masculine work-role models of male achievements. The other dimensions are Power Distance Index (PDI) as the degree of equality or inequality between people in the country's society; Individualism (IDV) measures how much individual or collective achievements and interpersonal relationships are encouraged by the national culture; Uncertainty Avoidance Index (UAI) is the level of tolerance for uncertainty and ambiguity within the society, Long-term Orientation (LTO) shows how much or how little a society relies on traditions and is suspicious towards future changes; the last dimension is Indulgence (IVR) on the gratification of basic human need such as enjoying life and having fun.

Score rank	*Country or region*	*MAS score*	*Score rank*	*Country or region*	*MAS score*
1	Japan	95	28	Singapore	48
2	Austria	79	29	Israel	47
3	Venezuela	73	30/31	Indonesia	46
4/5	Italy	70	30/31	West Africa	46
4/5	Switzerland	70	32/33	Turkey	45
6	Mexico	69	32/33	Taiwan	45
7/8	Ireland (Republic of)	68	34	Panama	44
			35/36	Iran	43
7/8	Jamaica	68	35/36	France	43
9/10	Great Britain	66	37/38	Spain	42
9/10	Germany FR	66	37/38	Peru	42
11/12	Philippines	64	39	East Africa	41
11/12	Colombia	64	40	Salvador	40
13/14	South Africa	63	41	South Korea	39
13/14	Equador	63	42	Uruguay	38
15	USA	62	43	Guatemala	37
16	Australia	61	44	Thailand	34
17	New Zealand	58	45	Portugal	31
18/19	Greece	57	46	Chile	28
18/19	Hong Kong	57	47	Finland	26
20/21	Argentina	56	48/49	Yugoslavia	21
20/21	India	56	48/49	Costa Rica	21
22	Belgium	54	50	Denmark	16
23	Arab countries	53	51	Netherlands	14
24	Canada	52	52	Norway	8
25/26	Malaysia	50	53	Sweden	5
25/26	Pakistan	50			
27	Brazil	49			

Table 1. Masculinity Index (MAS) value. Source Hofstede (1980)

Looking better at masculinity-femininity dimension, a country is defined as more feminine if women and men show similar modest and caring values and the distribution of roles is not that defined; instead, in a more masculine society, there will be a gap in the level of assertiveness and competitiveness of genders. Hofstede (1980) ranked the 50 countries and the 3 regions in the sample, with highest positions held by Japan (95), Austria (79) and Venezuela (73) while at the lowest spot there are countries such as Sweden (5), Norway (8) and Netherlands (14).

Fig.2 Comparison between Japan (blue), Singapore (purple) and Sweden (green).
Source: Hofstede Insides.com

Gender studies then have identified some characteristics related to masculinity and femininity, the former is defined by agentic traits such as assertiveness, courage and willingness to compete, while in the former category there are more communal qualities related to kindness, collaboration and tactful behaviour.

1.2 Gender and risk attitudes

After having analysed gender differences, both as biological and cultural products, the next step will be the review of some economic studies that have used gender as a key variable of risk attitudes. Croson and Gneezy (2009) define gender differences in risk taking at three different levels: individual risk preferences, social preferences, and reaction to competition. Economic literature has observed some gender differences in consumption, investments and mostly labour market. The main finding is that women are more risk-averse than men and that their social preferences are more driven by the specific situation they must face compared to men. This result has been confirmed by Miller and Ubeda (2012) who find that women, more than men, use fairness principles conditional to the context in which they take a decision. Even if not more socially oriented in their choices, they are more malleable. Furthermore, women seem to be more averse to competition, as previously shown by Gneezy et al. (2003) that have adopted an experimental approach to assess how women were less effective than men in a competitive environment, while not having any difference in a non-competitive one.

Very interesting is the paper by Finucane at al. (2000) which finds a gender difference among the white members of the sample, but not in the other ethnic groups. It was called "the white male effect" (Finucane et al, 2000) and stressed the idea of gender differences in risk-taking might be due to a cultural bias. The difference in risk-taking emerges even from portfolio selection where it has been found that gender is a key element in the allocation of assets in investment decisions. As shown by Charness and Gneezy (2012) women tend to invest less and to exhibit a more cautious attitude that lead them in taking less risks. Croson and Gneezy (2009) explains this gap in risk attitude as a result of "different emotional reactions to risky situations", following the concepts expressed by Loewenstein et al. (2001) of "risk as feelings". This idea is in line with psychological research that describe women as subject who experience more emotions than men and these can, in turn, affects "the utility of a risky choice". Numerous studies have shown how women respond with more nervousness and fear than men when they expect a loss or a negative outcome in general (Fujita et al. 1991) and so previous experience will make them respond in a more risk-averse way to other risky situations. Emotions play a role even in the perception of probabilities because will bring women to overweight the probability of a loss, relative to male counterparties. If in general in Prospect theory "losses loom more than gains", then it is possible, in this framework, to suppose the existence of an additional emotional bias that is stronger for women than men. A recent study by Brooks et al. (2019) has confirmed how previous negative investments experiences are related to higher levels of risk intolerance in women, more than in men.

Another explanation is given by differences in confidence. Kamas and Preston (2012) has assessed how men, even when both genders tend to be overconfident, show more confidence in their success in risky environments than female counterparties. The last factor that might have a role in gender differences in risk aversion or risk-seeking, as described in Arch (1993). In her study, different genders have different believes in what is an appropriate response for them to a risky situation. For men risk goes in pair with challenge and gives an incentive to participate, the opposite for a woman, who perceives it as a threat and tries to avoid it. An important exception to these general considerations on gender differences in risk-taking is given by managers and professionals; in studies focused on these categories, the gaps between genders were smaller. A possible explanation could be that people who have chosen these types of careers, have done it even because more prone to manage pressure and uncertainty of risky decisions (Kamas and Preston, 2012).

The second level of analysis has its focus on differences in social preferences. An individual is said to have social preferences when includes others' payoffs into his or her utility function. In economic literature social preferences are explained using concepts as altruism, envy, reciprocity or aversion to inequality. In order to understand the dynamics and the interactions among individuals, many studies have resort to the game theory, the ultimatum and dictator game. Even though the results in these kinds of studies are mixed, Croson and Gneezy (2009) claim the "differential sensitivity of men and women to social conditions in the experiment". They support this explanation by providing both data *within* the experiments, in which women and men have shown different attitudes, and *between* studies, to detect those gaps in behaviours. The hypothesis is that by analysis, the variance of female behaviour across the different experiments will be higher than male ones. Going back to the use of games as stylizations of more complex situations, one of the most famous ones is the "ultimatum game", in which two players must decide how to split a payoff. The ultimatum game admits a unique subgame perfect equilibrium and every deviation has a specific meaning. One of the players offers an amount of money to the other, which can be positive, negative or null, the other must decide if to accept or reject the offer. The rejection of a positive offer has been interpreted by researches as a response to inequality or kind of punishment of the other player. Otherwise, if one of the participants makes a positive offer, it can be explained as altruism or even risk aversion. Eckel and Grossman (2008) have found that women are more inclined to accept lower offers than men. This result is though contradicted by Solnick (2001) who claims that are women those more demanding. Croson and Gneezy (2009) link these differences in results to different methodologies used in the experiments, randomly paired in the latter and no face-to-face contact

in the former. Because the setting up of experiments is key in addressing the results obtained, even if numerous studies have tried to give a univocal answer to gender differences in other-regarding preferences, the outcomes are usually contradictory. Nonetheless, some patterns can be defined, as the attitude of women, more than men, take into consideration the gender of the partner, in the ultimatum game, or to be more sensitive to it, as in the dictator games.

As the last macro field Croson and Gneezy (2009) focused on the different behaviour towards competition. The main findings remark how women seem to be more reluctant than man to be involved in competitions such as tournaments or bargaining. Furthermore, it has been shown how men's performance improves under competition, relative to women. The backlash has been used as possible explanation for this gender difference. It might be possible that for women is a rational decision not to compete in certain situation because they could be penalized more in case of failure than male counterparties. Linked to this assumption there is the experiment by Bowles et al. (2007) that reports higher discrimination for female job candidates, in which they were penalized more for assertive negotiation behaviour. A similar bias has been previously analysed even in investment in education, with women investing less because they already knew their rewards would have been lower than men. An opposite branch of literature relates genders' different attitudes to nature and relate them to biological and psychological differences. At a certain point in evolution, men and women adopted different strategies to maximize their genes and their transmission, with different hormones correlated to different attitudes. The different levels of testosterone can equip individuals with various doses of aggression and different attitude in competitive environments. Women's competitiveness could be biased by different hormones during the menstrual period and using contraceptive pill. As shown by Chen et al. (2013), in first-stage auctions, women tend to bid higher in the follicular phase of their periods and lower in the luteal one. Both nurture and nature have proved to play a role in gender differences in competition, even though far is not clear in which proportion and weight they influence the individual's behaviour.

In some of the most recent works, researches remark the contribution given by well-known theories such as the Expected Utility and the Prospect Theory in studying decision taken under risk. Although, these theories were focused on individual payoff and on its consequences in risk taken while nowadays the topic of interest is even in the role of the group in decisions taken by the single individual. The innovation lies in the idea that when a person has to make a decision in a risky environment, he or she will take into account even the payoffs of the peers. The final choice will then depend on both how much the individual is averse to inequality and behindness, which means that someone dislikes more being behind a peer more than he or she likes being ahead of the others. Social context then plays a role not only in defining gender identities, but

also in shaping decision processes, especially when decisions are taken within groups or involve social responsibility. Related topics are conservatism and conformism, the latter captures how much a subject change his or her behaviours to meet the expected behaviours of others, but outcomes are mixed in those studies who tried to relate the group context with an increasing level of risk aversion. Finding reports attitudes as risk aversion and conservatism as gender-specific, as it was shown in the dictator game in which women showed a higher degree of inequality aversion.

Friedl et al. (2019) starts from this recent theoretical framework to analyse gender differences in social risk-taking by using an empirical experiment. Individuals must make decisions that involve some degree of risk and, most importantly, their decisions affect not only their personal payoff but even that of another individual. A previous work was been Bolton et al. (2015) that has examined the role on inequality aversion, conservatism and conformism of individuals once they were part of a group, but without specifying the role of gender. Friedl et al. (2019) stressed the idea that not excluding the role of gender means not giving importance to differences in risk aversion proved by previous literature. The experiment in this paper has been conducted in a Western and small-scale society. It is well known that culture plays a key role in gender differences in the different degrees of risk-taking between genders but also that these differences can be influenced by policy interventions, such as single-sex schools. Friedl et al (2019) uses two samples of students, one from Germany and the other from Papua New Guinea, the latter come from an egalitarian society. During the experiment the participants must choose among six different pairs of cards with different payoffs. Once the choice is made, the pair is split and put into a bag, to create the random environment. Then the subject can draw one of the cards and receive the amount of money shown in the card. Among the six pairs there is a safe option, with null variance, in which cards have the same amount of money. By increasing the proportion of payoffs between the cards in the pair, the variance will increase in a linear way.

Gamble	Probability (%)	Outcome A	Outcome B	Expected payoff	Variance
1	50/50	2.50 Euro	2.50 Euro	2.50 Euro	0.00
2	50/50	3.50 Euro	2.00 Euro	2.75 Euro	0.56
3	50/50	4.50 Euro	1.50 Euro	3.00 Euro	2.25
4	50/50	5.50 Euro	1.00 Euro	3.25 Euro	5.06
5	50/50	6.50 Euro	0.50 Euro	3.50 Euro	9.00
6	50/50	7.00 Euro	0.00 Euro	3.50 Euro	12.25

Table 2. Gambles expected payoff and risk. Source: Friedl et al. (2019)

At the beginning of each session, the players randomly receive the status of active or passive participant. The active ones have been then further divided to undertake different treatments, some will have to choose only one gamble which corresponds to the individual risk preference, without any clue of the correlation to other participants in additional treatments (IR treatment, individual risks). The other half of active players face treatment PCR (positive correlated risks) first, and NCR (negative correlated risks) second, according to if the counterpart will receive a positive or negative payoff. The members of this subgroup have to decide for another pair of cards. These pairs will affect also passive participants so this situation can be a good representation of risk decisions under social responsibility. In this case the passive one will receive the same or opposite payoff shown on the card drawn by the active player. While in the PCR, same amount, the equality between the players is not affected, in the NCR, opposite one, there is a significant increase in inequality as one player will gain the high payoff but the other will receive the low one. According to Bolton et al, (2015) because of conservatism, the subjects are expected to gamble less when the risk will be beard even by others. The social risk-taking (SR) is then computed as the average of PCR and NCR. The set of hypothesis are the following: "Individuals are conservative, more risk-averse under social responsibility; individuals are inequality averse, they take fewer risks under negative than under positively correlated risks; women are more risk-averse than men; the main driver for gender differences in social risk-taking is that women are more inequality averse in risky situations than men." (Friedl et al. 2019).

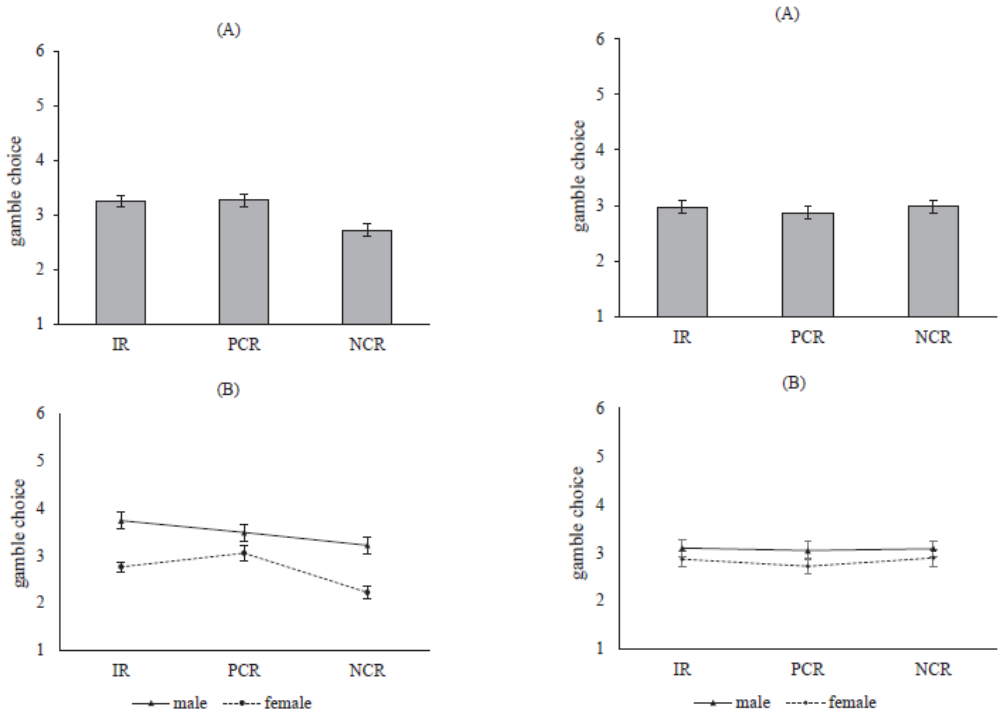

Figure 3. Gamble choices in Germany (left) and Papua New Guinea (right) Source: Friedl et al. (2019)

The Figure 3 shows the mean gambles choices for pooled data (A) in Germany, on the left and in Papua New Guinea, on the right. The part (B) shows gamble choices split per gender in the two samples. As result related to the German students, Friedl et al (2019) have noticed that "extending the risk to others only insignificantly increases risk aversion; that inequality aversion can be considered as the main driver of conservative choices; the gender differences are evident in individual and social risk-taking; and that inequality aversion is the main driver for gender differences in social risk-taking". Women from Western societies are significantly more risk-averse than men in the individual risk-taking and gender differences in social risk aversion differ significantly when the payoffs are negatively correlated, so when payoffs are distributed in an unequal way. In the second part of the experiment, the study was conducted using the sample from an egalitarian society, using the sample of participants from Papua New Guinea. In this case "the extending risk to others does not increase risk aversion in egalitarian societies; there is no significant difference across treatments, so inequality aversion has not the same effect in driving conservatism; no gender differences in individual and social risk-taking". These experiments have contributed in giving evidences on how little risk-taking both at an individual and social context are related to nature and how much they are with culture and society in which participants live.

1.3 Leadership attitudes and effects on economic performance

Since the 1970s the number of women in the labour market has dramatically increased, up to more than 60%, according to FRED data on Labour Force Participation Rate, recording a decrease after the financial crisis and start increasing again after 2015.

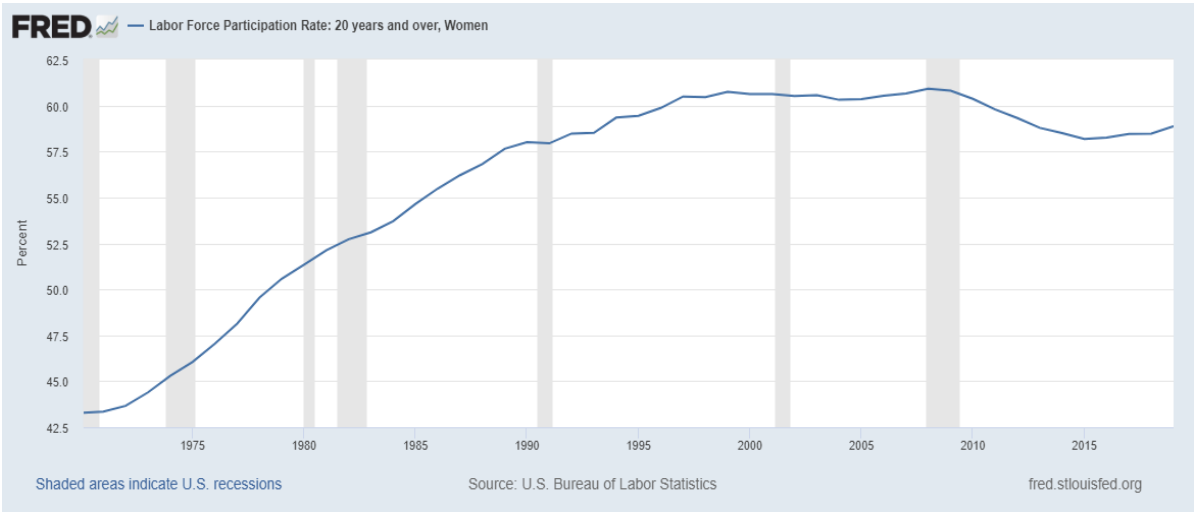

Fig 4. Female labour participation. Source: FRED

Yet, only a small percentage of top management positions, such as CEO, are females. Data in Women in S&P 500 Companies, only 29 women hold CEOs positions (Catalyst, 2020), less than 6%, starting from an initial proportion of 44.7% of total female employees.

Fig 5. Women CEOs of the S&P 500. Source: Catalyst

This phenomenon has been called “glass-ceiling” or “broken ladder”. As stressed by Powell et al. (2002), from 1979 to 1999 the proportion of women managers has more than doubled, moving from 21% to 46% of female employed at top-levels of organizations in the USA. Diouf and Pépin (2017) also contradict the idea that women are more reluctant to have a degree in finance or economic field by recalling data from the website Worldwide Guide to Women in Leadership. In the period from 2010 to 2015, more than 200 women headed the Ministry of Finance or budget departments of their countries. If the problem is not the total supply of women prepared to be at top-ranked organizational positions, then perhaps the obstacles come from the demand part, from the firms and banks and how much, or little, they allow female employees to make a successful career.

In the first part of the paragraph the gender identity was defined as product of both cognitive and social mechanisms. By means of the cognitive process of categorizing and putting individuals in certain group, there is an automatic process of attributing certain attitudes and beliefs that have traditionally defined the group itself. Hamilton and Sherman (1994) have studied how the stereotypes on gender attitudes have been advocated to justify assignment of social roles. Being a good manager implies that the individual, both man and woman, has to possess some leadership skills to be able to successfully guide a group and achieve economic goals. Eagly (2005) wonders if gender has any effect in perception the followers have on the authentic leading capacity of their managers. An authentic leader needs to behave in a self-aware and value-oriented way, in order to be able to address and persuade his or her followers. The community or the group plays a key role in the legitimation and validation of the leader, because they have to be convinced that their leader shares the values of the followers and promotes goals from which all the members will benefit. Problems may arise if the leader comes from a social group that has not a tradition of leadership such as ethnic minorities and women, especially in male-dominated industries (Eagly, 2005). Women and outsiders may lack of legitimacy and authority in group’s viewpoint. The followers might not be able to identify with the values and the role they associate with and individual just because he or she belongs to a certain group. The relational authenticity between the leader and the followers is then defined by the role and value congruity. If members of the group think of their leader as someone with masculine or agentic values like being assertive, ambitious, self-confident and competitive, they will think of a man. Women are outsiders in both senses because they are still a minority in top-level management and mostly because, in followers believes, they bring a different set of value and attitudes that is hard to reconcile with feature required in a managerial role. Heilman (2001) calls it a “lack of fit” for women. Schein (1973, 1975) talks about the idea of occupational sex-typing relies on the belief that if a job position is mainly taken by men, then it becomes a

masculine job. This feeling of disapproval in women who want to reach managerial positions which are perceived as driven by masculine attitudes, brings to a mismatch that leads the members of the group to penalize women more in case of failure, compared to male counterparties. This phenomenon was shown by the study of Eagly et al. (1992). They examined the reaction of the participants to female and male leaders, with women being devaluated in a stronger way in leadership role typically male-dominated. To assess if the expression "think manager, think man" (Schein & Mueller, 1992; Schein, Mueller, Lituchy & Liu, 1996) was still spread and shared by society, Powell et al. (2002) have conducted an experiment, like the one done in both Powel et al. (1979, 1989). They recall the concept of androgyny developed by Bem (1974, 1975) and hypothesized that compared to the previous findings, a "good manager" would have been less masculine and closer to the androgyny mix of femininity and masculinity. This thought came even from the higher percentage of women in 1999 as managers, about 46%, compared to the previous decades. Powell et al. (2002) used a sample composed of 206 undergraduate business students, whose 43% of members were females and 142 part-time graduates with and average age or 31 years and a percentage of 44% of females. The participants were asked to complete the Short BSRI for themselves and on an ideal "good manager". Surprisingly, for 44.1% of undergraduate male and 52.3% of undergraduate females and by 57.5% of graduate males and 55.8% of graduate females, a good manager has been predominantly described as equipped with more masculine than feminine characteristics. Female students tend to see the role of a manager as far from their actual description of themselves, even if in a slightly lower percentage than on the previous studies.

On leadership styles between genders there is some controversy, with House et al. (2004) finding a significant but not substantial difference in leadership dimensions, while Emrich, Denmark, & Den Hartog, (2004) called for a larger gap in those countries with more defined social roles between men and women and lower levels of gender equality. In order to assess the different impact on leadership behaviour, Van Emmerik et al. (2009) looked at the relative impact of various dimensions, such as societal culture, gender ratio and individual characteristics. They adopted the theory of Stogdill (1963, 1977) to define leadership using two different categories: consideration and initiating structure. The former refers to a supportive behaviour that aims to create a warm environment with a more approachable leader that cares about the welfare of the group; the latter is defined by a more task-oriented, directive behaviour where the leader schedule work and develop procedures. These two dimensions are linked to gender characteristics when men are expected to adopt a more initiating structure leadership behaviour and women to be more oriented towards consideration. The cultural dimension seems to play a role in shaping leadership styles, as assessed by Van Emmerik et al. (2009),

showing a similar effect to Hofstede (2001) and Hofstede and McCrae (2004). The percentage of female managers was higher in those countries defined more individualist and masculine, while the number declined in a culture with higher uncertainty avoidance and power distance.
Ertac and Gurdal (2012) have studied the different gender willingness to make decisions that imply some degrees of risk, on a social context represented by a defined group. They were also interested in capturing any difference between male and female once they take decisions as a group leader or as a stand-alone individual. Ertac and Gudal (2012) define gender as the main determinant of leadership in decisions made within a group, a research question particularly close to the main question of this dissertation, if women as board chairs take different decisions compared to male counterparties. In the experiment conducted, even if risky decisions were made by the single individual, all members of the group were affected by his or her choices. Then they compared decisions taken by willing and unwilling leaders, as those who expressed the desire to be decision-makers have higher chances to see those decisions implemented as final ones. Looking the results at an individual level, they found women being generally more risk averse than men, in line with the previous literature. The latter had placed more money in risky option and the difference increases for riskier betting tasks. The willingness to decide is also very different in the two categories, with 86% of males and only 55% of females willing to be group leaders. Surprisingly, the individual level of risk taking seems not to be correlated with leadership decisions for women but has a positive impact for males because those "who made riskier decision for themselves, are more likely to choose to decide for the group" (Ertac and Gurdal, 2012). Finally, the result on the amount of risk taken by women and men, once they have been appointed as group leaders, are measured by the amount of money put on the risky option. Self-selected female leaders on average tend to take less risk than males and there are no significant differences with those women who did not choose to lead. In terms of group decisions, women have shown a higher risk aversion than men when self-selected as leaders, but female variance is lower than male one.
The Fig.3 shows the comparison between male and female, if they have chosen to be leaders or not and the amount of risk they take as leader or as individuals.

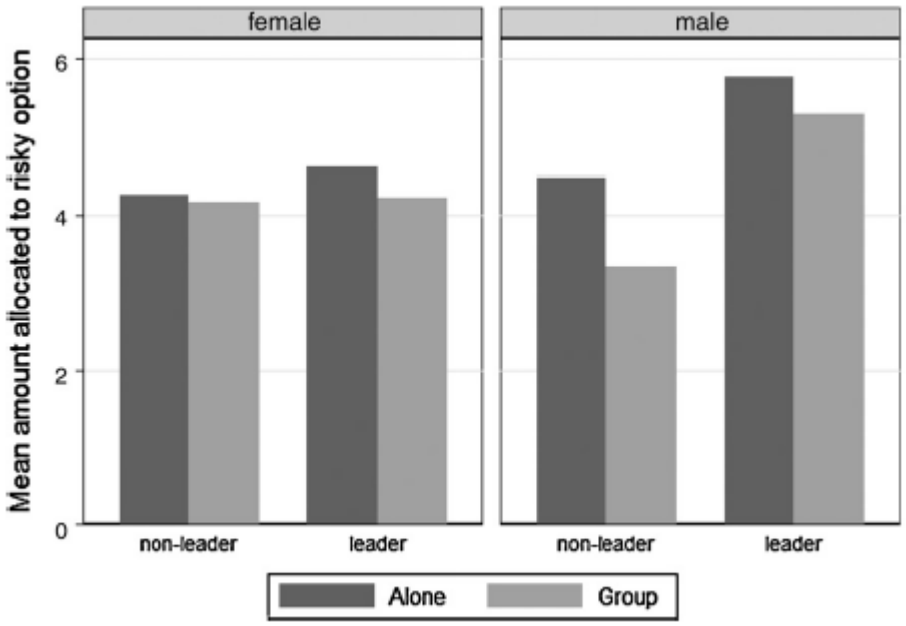

Fig 6. Mean amount of money allocated to risky asset. Source: Ertac and Gurdal (2012)

However, even though the difficulties of establish themselves as authentic leaders with the necessary values and attributes, female percentage in corporate boards, as shown in Farrell and Hersch (2005) has increased during the 1990s.

Year	N	Average number of women on the board	Percent women on the board	Percentage of firms with: 0 women on the board	1 woman on the board	2 women on the board	>2 women on the board
1990	302	0.74	5.60	47.02	36.42	13.58	2.98
1991	302	0.76	5.83	44.37	38.07	15.23	2.32
1992	303	0.80	6.31	39.60	43.23	14.52	2.64
1993	304	0.89	7.18	35.86	43.09	17.76	3.29
1994	304	0.99	8.20	27.63	49.01	20.07	3.29
1995	304	1.11	9.22	22.03	49.01	25.66	3.29
1996	305	1.18	9.96	18.36	49.51	28.85	3.29
1997	300	1.23	10.60	15.33	50.67	30.67	3.33
1998	288	1.30	11.16	14.93	47.56	32.63	4.86
1999	262	1.39	12.26	12.60	45.80	33.58	8.01

Based on a sample of non-regulated Fortune 1000 sized firms that have proxy statement data available for a minimum of the first 7 years of the sample period. Sample size (N) varies by year due to other missing data.

Table 3. Percentage of women on board in 1990- 1999. Source: Farrell and Hersch (2005)

The table 3 shows the evolution of female representation in corporate boards in the sample moving from 5.6% in 1990 to more than 12% in 1999. The percentage has doubled but is still very low if the total percentage of women in the workforce is considered.

They also find evidence on how the probability of adding another woman in a board was negatively related to the number of already present female members, also as the likelihood of having a female board director was conditioned to the gender of the leaving director. When a woman is leaving the board, even because the firm feels a pressure for diversity from external and internal factors, the chance of being replaced by a woman is higher than if the previous director was a man. Farrell and Hersch (2005) have noticed that, due to an increasing demand for female representation, the number of corporate boards with at least one woman increased from 53% in 1990 to 87% in 1999. Even supposing that women can select better performing firms, Farrell and Hersch (2005) found no evidence of a related increase in abnormal returns. The increasing trend of women in corporate boards is then, according to Farrell and Hersch (2005) driven more by the need to meet minimum diversity goal than the idea of improving performance. Although the benefits of female increasing representation in the boardroom have been reported by many studies. Campbell and Miguez-Vera (2007) contribute to this literature by focusing on Spanish firms and investigating the relationship between board diversity and firm performance. Spain has been a country with low female participation in the workplace, but political reforms have promoted a higher inclusion of women, especially in the top-ranked management positions. The results confirm the existence of a positive relation between gender diversity, measured as the proportion of women on total members of the board, and firm value. Nielsen and Huse (2010) chose Norway as country of interest and used survey data from 120 Norwegian firms to assess that the contribute of women in decision making is not much given by their gender, per se, but much because of their previous professional experiences. They also stressed how the perception of being treated in un unequal way in the board might limits their contribution to the board and, in turn, to the strategic involvement. No significant effect related to gender or ethnic minorities as board directors and firm performance have been found by Carter et al. (2010) on a sample of major US companies. However, more recent studies have assessed a positive and significant relationship between board gender diversity and firm performance, with a stronger effect in case of female executive than female independent directors (Liu et al. 2014). While Faccio et al. (2016) recorded a lower leverage and earnings' volatility in firms run by female CEOs.

After the financial crisis in 2007-2009, institutions such the Basel Committee on Banking Supervision has encouraged researches and studies to better understand and improve the mechanisms behind the corporate governance of banks. As quality of policies and operations undertaken by banks are related to the board decisions, a good degree of diversity of the members may bring positive effect on the portfolio selection of the banks. Berger et al. (2014) supported the hypothesis that female presence in corporate boards is not a window dressing

policy but has economic implications. Their sample was composed by German firms and at that time there were not yet regulations on gender quotas on bank boards, as in France or Norway (The Economist, 2011a). Berger et al. (2014) contributed to demonstrate that the female representation affects portfolio risk in a significant way, as much as the average age of the board and the educational level of the members. Garcia-Meca et al. (2015) have conducted an analysis on board diversity and performance on a sample of 159 banks during the period 2004-2010. As elements of diversity have been used both nationality and gender. The findings related to nationality of board members show an inhibition of bank performance. This has been explained by authors as due to a lack of internalization of the negative effects of potential disruption while encouraging managers to increase the level of risk taken. On the other hand, boards with more women exhibit less volatility in stock price and higher performances.

The previous mixed results on the contribution given by female representation on the economic performance of banks seems to have find an explanation in Owen and Temesvary (2018). They used a sample of 90 US bank holding companies over the period 1999-2015 and claim the existence of a not linear U-shaped link between gender diversity and performance measures. Owen et al. (2018) used the Blau Index as measure of gender diversity with an average level of female shares on board or about 12.5%.

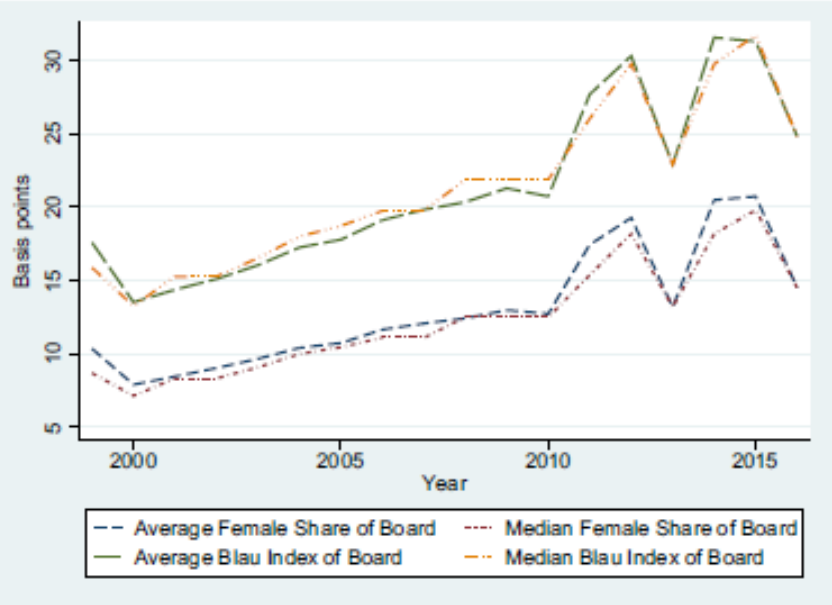

Fig 7. Average and median female share over 1999-2015. Source: Owen and Temesvary (2018)

Owen et al. (2018) report that increasing gender diversity on banks' boards has a positive effect only below a certain threshold level. After that share, only well capitalized or better managed banks will report a positive effect on performance measures. The non-linear relationship was confirmed even by Fan et al. (2019).

Gender differences researches have started with the dichotomy of masculine or feminine behaviour. These concepts are important because they affect the self-perception of individuals together with the beliefs of the others on what job position would be more appropriate for a man or a woman. Therefore, women are not considered good leaders because they lack those masculine traits such as willingness to compete and fast decision-making. However, in the last decades women have climbed up the "broken ladder" into firms and bank holdings, showing how their different approach to board dynamics contributes in reducing the level of overall risk taken by firms and financial institutions

2. Women and monetary policy preferences

2.1 Women underrepresentation in central banking

When in July 2019 the European Council nominated the managing - director of the International Monetary Fund, Christine Lagarde, as the new president of the European Central Bank, she became the first woman to head the central bank since its creation in 1998. The last year has been an eventful period when it comes to women at the top positions in monetary and political institutions. The successor of Christine Lagarde at the head of the International Monetary Fund will be Kristalina Georgieva, a Bulgarian economist with a previous position as the second in command at the World Bank. Furthermore, on the second of July, the German politician Ursula Von der Leyer was elected as President of the European Commission, succeeding Jean Claude Junker. Another first time for a woman in a European institution. Meaningful is even the presence of two women, Minouche Shafik, director of the London School of Economics and Shriti Vadera, chair of Santander UK, in the shortlist of possible successors of Mark Carney at the top of Bank of England (Chris Giles, Financial Times, 2019).

There has been an increasing trend in the last years in the presence of female chairs in the boards of central banks, but it remains a men's world. As reported by the Gender Index Balance 2019, central banks' score is still strongly unbalanced. This review is produced by the Official Monetary and Financial Institutional Forum (OMFIF), an independent think tank that calculates the rate of female and male components, weighted by their level of seniority, A value of 100% in the score would mean that the institution under examination has reached a perfect gender balance. The analysis is based on a sample of 2,058 individuals at the top levels, such as governors, deputy governors, members of policy-setting committees and executive board directors, from 173 central banks. For the central banks' in the sample the score calculated in 2019 was 25% (the ECB was excluded by the analysis), better than sovereign funds 17% but much lower than pension funds 41%. There is an increased compared to the previous year which had a score of 19.4%, but the result is still under the peak of 30.6% reached in 2017.

Looking at the number of women in the boards, out of 173 central banks, 138 have at least one woman in their senior positions, the other 35 have none (20%). Narrowing the lens to the number of banks with a woman as governors or deputy governors, the count drops to 63 central banks (36%), higher than 2018 with 55 central banks. Out of these 63 central banks, in 2019 only 14 have a chairwoman. Since last year, Malaysia, North Macedonia and San Marino appointed a woman, while Israel stepped down. The OMFIF counted the highest percentage of women in charge of central banks around the world in 2013, with 19 chairwomen and the trend

decreased with 15 seats in 2015 and only 12 in 2018, even because of the departure of Janet Yellen as governor of the Federal Reserve in the USA.

Excluding the ECB, 14 chairwomen from small countries represent only 8.1% of the 173 central banks analysed by OMFIF. As shown by the figure below, the overall score has increased since last year, with North America leading the rise due to the weight of its economy. The top regional score of 38.1% is owned by Europe even if the actual distribution within the countries is quite uneven. The score is boosted by Iceland (93%), Albania, Bulgaria and Spain above 80% of Gender Index Balance, but is equally important to notice that nine central banks have no women in senior positions. Curious is the case of the Central Bank of Serbia which has a low score because the distribution is skewed in favour of women. Taking together the ECB and national central banks, the Euro Area has a score of 29.2%, below the European average of 38.1%.

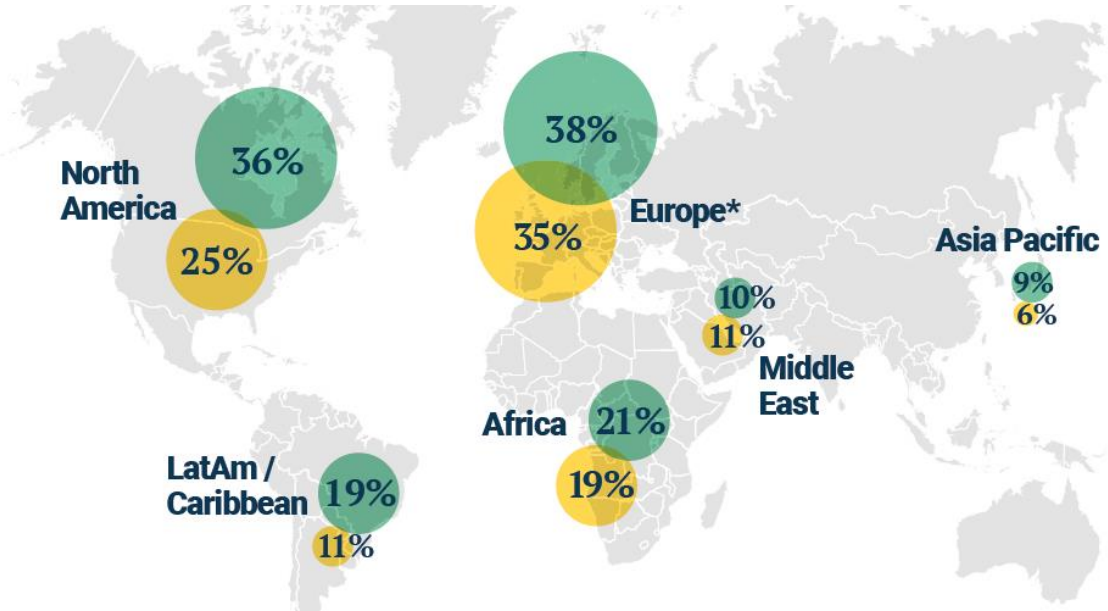

Fig.8 Gender Balance Index score by regions. Comparing 2019 (green) and 2018 (yellow) values. *Excluded ECB. Source: OMFIF

Istrefi and Sestieri (2018) have analysed women underrepresentation in central banking and more specifically inside the decision- making policy committees.

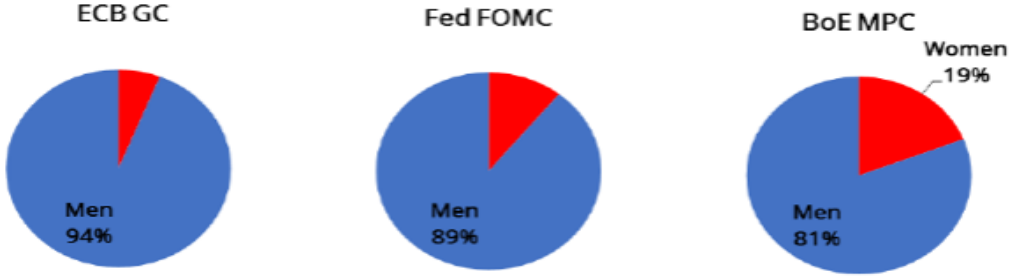

Fig 9. Percentage of women in the MPC of three major central banks. Source: Istrefi and Sesteri (2018)

Using data available in 2018, they have estimated a share of about 6% in the European Central Bank Governing Council (ECB GC) since 1998. The Federal Open Market Committee of the Federal reserve (Fed FOMC) in the period between 1960 to 2015, has had only 14 women (10%) out of 130 members of the committee. The Bank of England has performed a slightly better proportion, with a female representation share of about 19% from 1997 until 2018.

Istrefi and Sesteri (2018) computed a different measure of women percentage including general and governing councils or board of directors. The share of women, as shown by the graph below, has not changed much in the past fifteen years in the European Union, with a ceiling around 20% of the total members. In 2012 there has been a peak of 6 woman out of 23 Deputy Governors of the Euro Area.

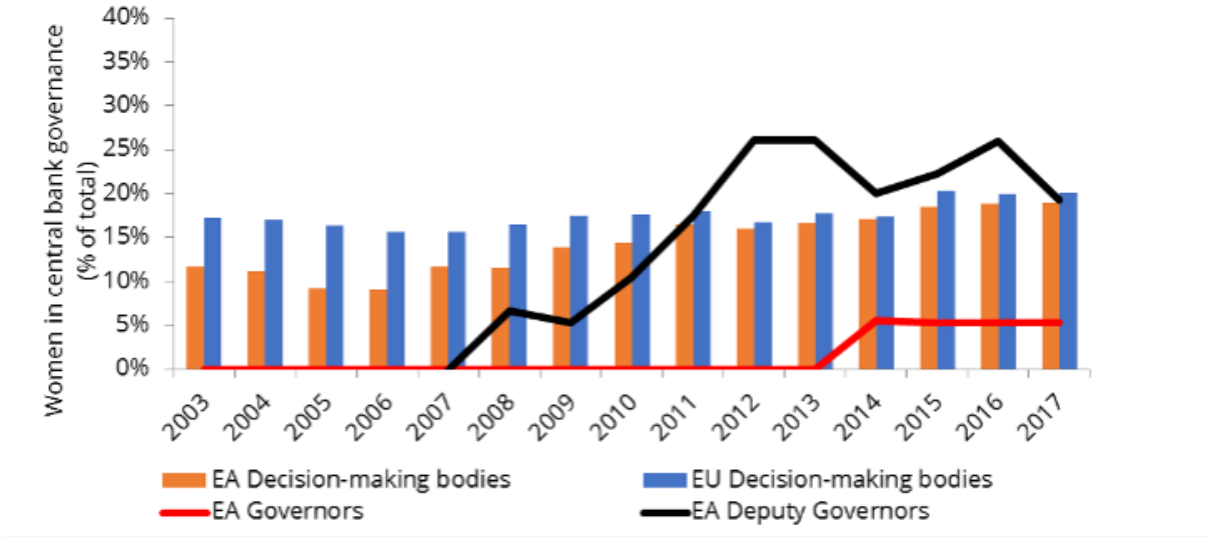

Fig 10. Women in central banking governance. Source: Isftrefi and Sestieri (2018)

The last year has seen a downturn in absolute numbers and in total share of female participation in central banking sector. Two events are tell-tale signs, the replacement of Janet Yellen as head of the FOMC from president Trump and of Karnit Flug at the Bank of Israel. In both cases the successor was a man. However, Bodea (2018) has collected data from 1998 to 2014 in 114 countries, showing an increasing trend during the years in the number of female governors or chairs.

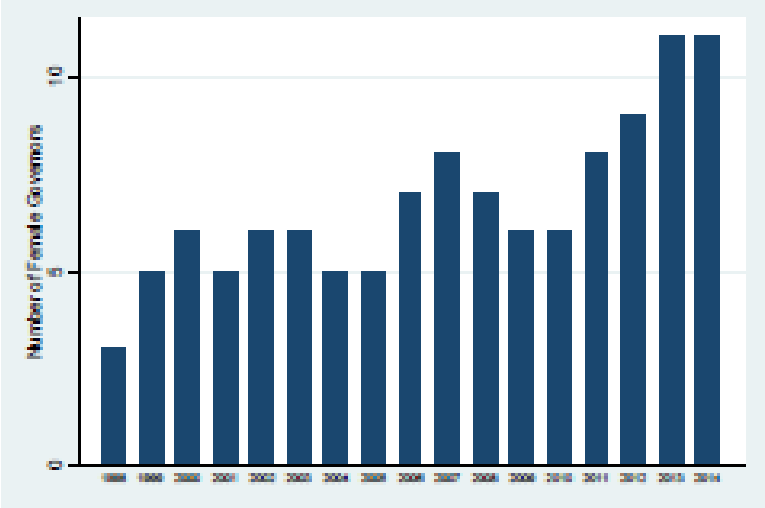

Fig 11. Number of female governors. Source: Bodea (2018)

Another interesting topic from Bodea (2018) is the link she claims exists between the gender disparity on the monetary policy board and the imbalance in the central bank senior management position within the same central bank. The latter indeed has the important task to provide information to the board and in doing so senior managment stuff plays a key role even in contribution to the committee's deliberations.

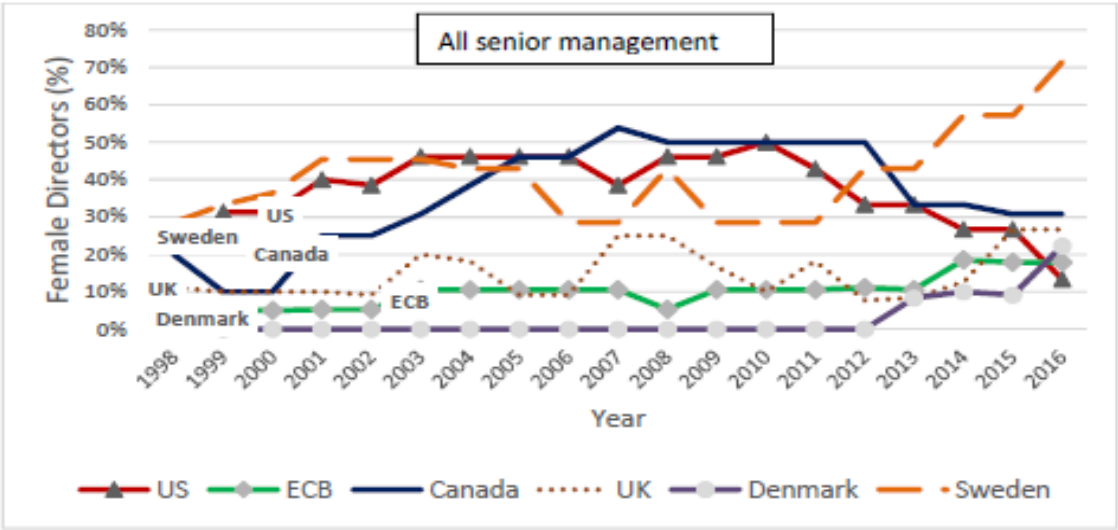

Fig 12. All senior management. Source: Bodea (2018)

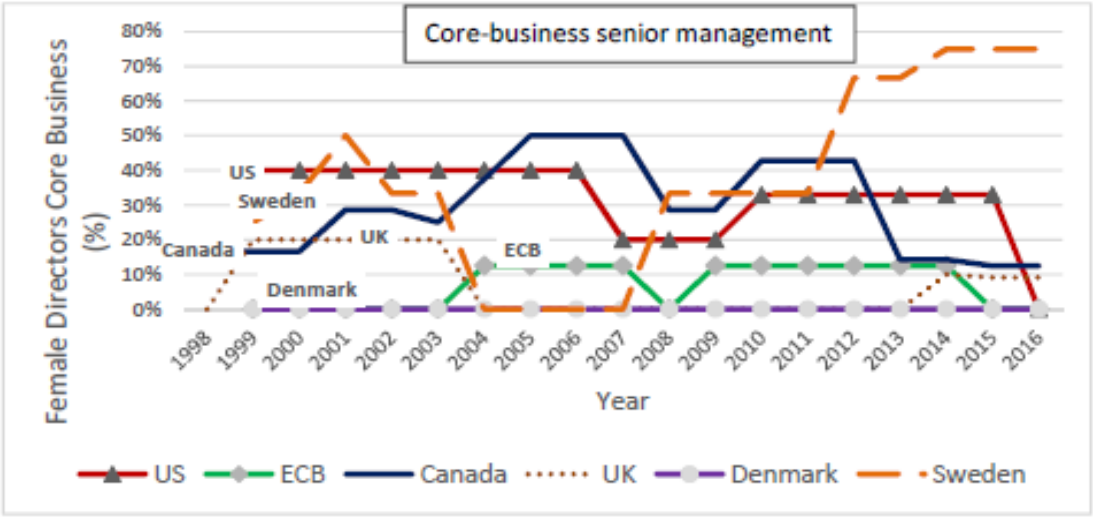

Fig 13 . Core Business senior management. Source: Bodea (2018)

Referring at the Fig13, looking at the Bank of England, ECB and Danish Central Bank, the values of gener diversity both in overall and core business senior management are very low. The picture improves until reaching 40% to 50% female representation at the US Federal Reserve, Bank of Canada and Swedish Riskbank.

A shorter gap period has been used by Masciandaro et al. (2018) to qualify the presence of women in monetary policy committees around the world. The sample of 2,133 members has been create using data from103 countries in the period from 2002 to 2016. In their data, around 40% of the countries had an MPC without any woman and where female chairs are present, they have a mean of about 14%. As stressed by the GBI Index, the countries with the highest share of women are Canada, Sweden, Serbia and Bulgaria. The last ones with a share that goes from 55 to 60%. More interesting is the evolution of female representation on Monetary Policy Committees. As shown in the below graph, there trend is upward sloping, with 2012 as a key year.

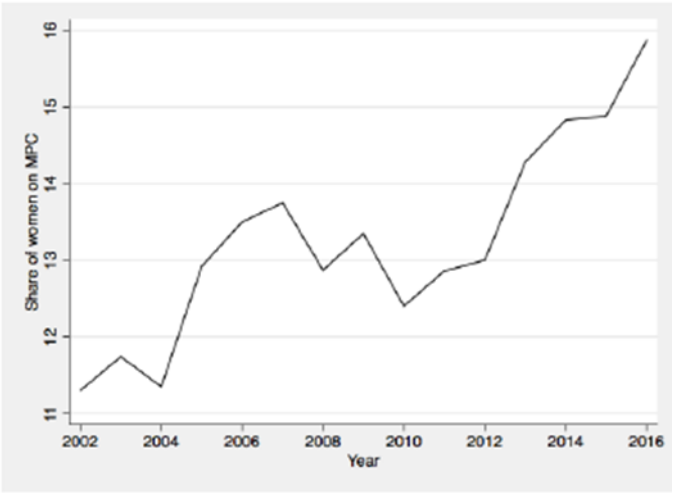

Fig 14. Share of women on the MPC. Source: Masciandaro et al. (2018)

2.2 Monetary policy preferences

Since the foundation of the first central bank in the world, the Sweden's Riskbank in 1668 followed by the Bank of England in 1694, these institutions have evolved during the centuries, from the range of tasks assigned to the interaction with different stakeholders and in their internal organization. As reported by Crowe and Meade (2007), in the last decades the changes have been remarkable, as for example the creation of 15 new central banks after the fall of the Berlin Wall, in those countries that were part of the Soviet Union or the creation of the super national European Central Bank. The main changes are related to a greater degree of independence from the governments, especially after the high levels of inflations recorded in the 1970s, and transparency in the efficient communication of the policies implemented and the goals of the policymaker. Even the organization of central bank governance structure has developed with milestones events such the reforms in UK and Japan in the late 1990s meant to replace a single policymaker with a monetary policy committee. Nowadays, only a few central banks, including the Reserve Bank of New Zealand, have a single member in charge for the setting of short-term interest rates. The optimal size of a monetary policy committee has been then the research question of a part of the economic literature. Berger et al (2008) used data on de jure membership size of 84 monetary policy committees at the of 2003. They started assuming that the size of monetary policy boards differs according to an evaluation on the marginal benefits and marginal costs of additional members. On the costs side there is the increasing need to prolong the time of decision taking due to the increased number of members and because some might free ride on the information collected by others, without giving any contribution.

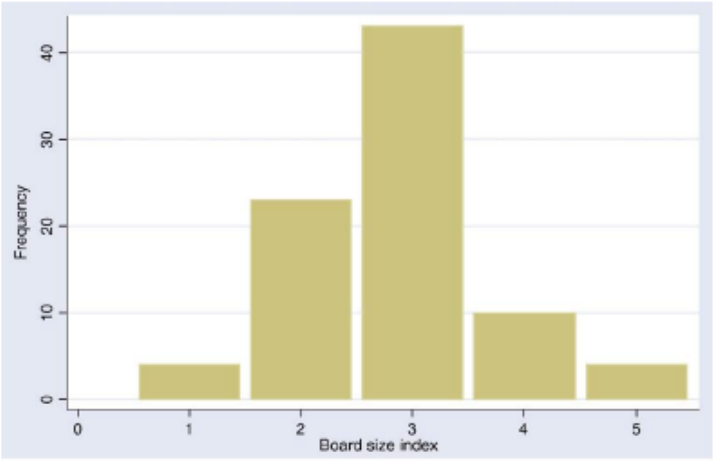

Fig. Board size Index. Source: Berger et al (2008).

On the other side, according to the Condorcet's jury theorem, a larger board could improve the quality of information and be able to take better policy decisions. Possible determinants for board size suggested by Berger et al (2008) are size of the country and its heterogeneity, the level of development and openness, together with the exchange rate regime and degree of independence of the central banks itself. Larger democratic countries, with floating exchange rate and independent central banks, tend to have boards of large size. They also developed a Board size Index that takes value one the number of monetary policy committee goes from one to three, the value is two if the from 4-6 and three, which has the highest frequency, from 7 to 9 members. Erhart et al. (2010) investigated a link between the size of monetary policy committees and the volatility of the inflation.

Low volatility		Medium volatility		High volatility	
Country	Standard deviation	Country	Standard deviation	Country	Standard deviation
Euro Area	0.22	Latvia	0.76	Israel	1.21
Japan	0.27	Trinidad and	0.77	Seychelles	1.26
Switzerland	0.31	Malta	0.79	Egypt	1.26
Denmark	0.35	Croatia	0.83	Armenia	1.30
Saudi Arabia	0.39	Czech Republic	0.84	Slovak Republic	1.33
Malaysia	0.41	Lithuania	0.85	South Africa	1.34
Slovenia	0.45	Peru	0.85	Brazil	1.36
Colombia	0.45	Hungary	0.88	Romania	1.38
Belize	0.49	Tonga	0.90	Uganda	1.45
United Kingdom	0.49	Estonia	0.91	Solomon Islands	1.45
New Zealand	0.50	Tanzania	0.91	Indonesia	1.56
United States	0.50	Guyana	0.92	Sri Lanka	1.59
Sweden	0.54	Nepal	0.93	Malawi	1.63
Bhutan	0.55	Pakistan	0.95	Papua New Guinea	1.73
Aruba	0.57	Macedonia	0.95	Kyrgyz Republic	1.86
Singapore	0.58	Albania	0.96	Sierra Leone	1.87
Canada	0.59	Barbados	0.99	Venezuela	1.94
Mexico	0.62	Iceland	1.01	Nigeria	1.97
Honduras	0.66	Poland	1.06	Moldova	2.07
Chile	0.68	Botswana	1.09	Madagascar	2.27
Cyprus	0.69	Russian Federation	1.09	Turkey	2.40
Australia	0.69	Mauritius	1.11	Argentina	2.51
Norway	0.72	Kazakhstan	1.15	Lesotho	2.62
Vanuatu	0.74	Philippines	1.15	Ecuador	2.80
Kuwait	0.74	Bulgaria	1.16	Belarus	3.35

Table Volatility of consumer price inflation 2000-2005. Source: Erhart et al. (2010)

If in a small monetary policy committee the risk is having an inefficient information pooling, in a large one the benefit for better information may be offset by a cost in terms of coordination. In both cases, the effect on central bank performance will be negative. The ideal size, according to Erhart et al. (2010) should be not more or less than five members per committee and when the size differs from this optimum the monetary policy response to external shocks will be inefficient. The loss in policy performance will not be reflected much by the average level of inflation, but from the deviations from the target, so the volatility. Countries with less than five members in the monetary policy committee, in the sample of 75 countries analysed, tend to have larger deviations of inflation from the target, while rising the size more than optimum does not contribute to reduce the volatility. Taking the Euro Area as example, with a large committee and at the same time lowest volatility, they suggested that it can be possible to reduce the size without sacrificing the inflation goal. Size has been taken into account even by Farvaque et al. (2014) as one of the determinants of performance of central banks.

Central banks differ even in the macroeconomic goals and strategies adopted, which can be described by a set of monetary policy preferences. These preferences usually are related to how much aversion the central banks have for inflation, compared to other macroeconomic variables.

$$E_t \sum_{i=0}^{\infty} \delta^i L_{t+i}$$

$$L = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda x_t^2 + \mu\,(i_t - i_{t-1})^2\right]$$

According to Svensson (1997) the policy preferences of a committee can be described by the intertemporal loss function which describes the expectations formed using the information available at time *t* on the Loss Function (L_{t+1}) multiplied by a discount factor δ^i .While the Loss function (L) is given by the output gap x_t , the squared difference between inflation rate π_t and its target level π^*, and the policy instrument, the short-term interest rate i_t..

$$x_{t+1} = c_1 x_t - c_2\,(i_t - \pi_t) + u_{t+1}^d$$

$$\pi_{t+1} = \pi_t + c_3 x_t + u_{t+1}^s$$

The two parameters λ and μ are the weights respectively for output stabilization and interest rate smoothing. When both the parameters take value zero, then the central bank is said to be conducting strict inflation targeting, with inflation as the only policy goal; otherwise when only $\mu=0$, the inflation targeting becomes flexible. The intertemporal optimization problem needs the specification of the aggregate supply (AS) and aggregate demand (AD) functions, as described in the following

The solution is given by minimizing the losses rose from the deviations of inflation and output, in case of flexible inflation targeting, subject to the constraints of the AD and AS curves. Svensson (1997) has shown as a solution the Euler equation written in terms of Taylor rule.

$$i_t = \pi_t + B\left(\pi_t - \pi^*\right) + Cx_t$$

Once decided which is the best interest rate to implement, it will affect the economy and inflation thought the monetary policy transmission mechanism.

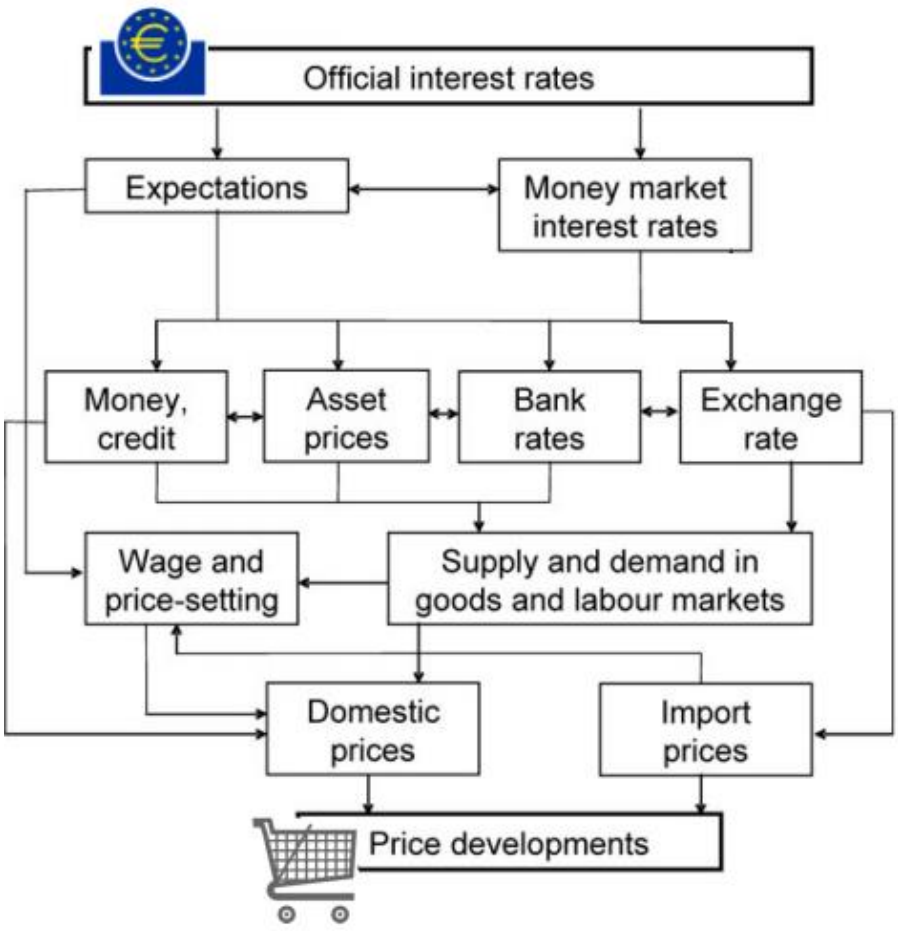

Fig. The monetary transmission mechanism for the ECB. Source: Strasser ECB (2018)

Favero et al. (2001) used the intertemporal optimization problem to identify the degree at which the US economy has improved its performance in terms of inflation and output stabilization. The former has declined from an average level of 4.5% during the 1960s and 1970s, to a 3.6% in the 1980-1989. The results show how the inflation target of the Federal Reserve has dropped from 5.79% to 2.63%, during that period, accompanied however by a small change of 18% in the stabilization of the output. These factors, according to Favero et al. (2001) signal a change in the central bank preferences during the Volcker-Greenspan era. The change of monetary policy regime in the US economy during the Greenspan's era has been empirically studied by Castelnuovo et al. (2003) that showed how controlling for the output gap was not important per se, but only as instrumental for future stabilization. A change in the monetary policy has been detected also by Ozlale (2003) who has found a structural break in the loss function parameters at the time of Volcker as chairman of the Fed, with a shift form an accommodative to a more active policy focused on the control of the inflation. Cecchetti et al (1999) wondered if the choice to target inflation, adopted by an increasing number of central banks, beyond achieving the primary objective of reducing the inflation rate, has also reduced output volatility. Their analysis was conducted on a sample of 23 countries, the average inflation fell from 8.7% to 3.5% while the real growth in industrial production moved from 3.2% to 4.3% per year. The trade-off between these two macroeconomic variables is the idea that in the presence of a supply shock in the short run that moves output and inflation in different and opposite directions, the monetary policy have to allow one of them to deviate from the long-term level.

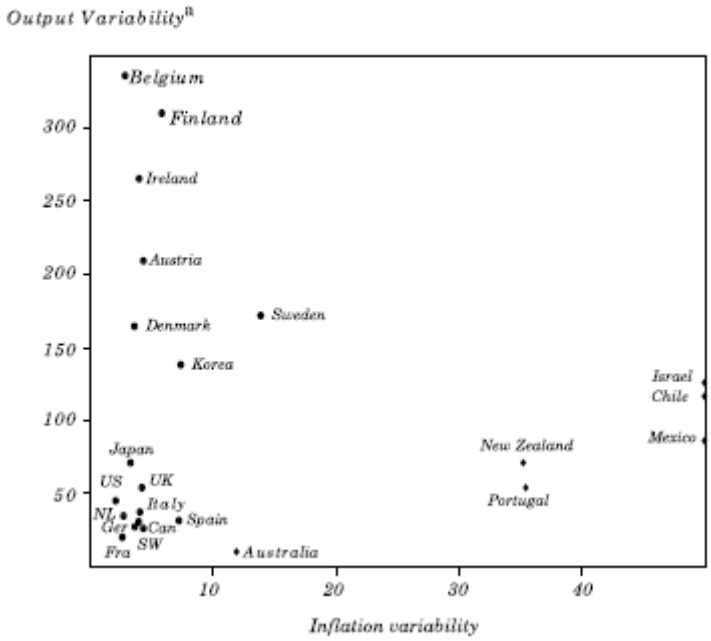

Fig. Plot of the variance of inflation and volatility of the output .Source: Cecchetti et al. (1999)

Cecchetti et al. (1999) then estimated the parameter that measures the aversion to inflation in inflation-targeting countries and in non-inflation targeting ones, using the following loss function.

$$L = \mathrm{E}\left[\alpha\left(\pi - \pi^*\right)^2 + \left(1-\alpha\right)\left(y - y^*\right)^2\right],$$

	Aversion to inflation variability (α)	
Country	*Assuming desired output = trend output, and desired inflation = average inflation*	*Assuming desired output = trend output, and desired inflation = 2 percent per year*
Inflation-targeting countries		
Australia	0.81	0.78
Canada	0.75	0.72
Chile	0.55	0.49
Finland	0.96	0.96
Israel	0.72	0.56
New Zealand	0.53	0.49
Spain	0.67	0.55
Sweden	0.86	0.84
United Kingdom	0.97	0.96
Average	0.76	0.71
Other countries		
Austria	0.50	0.49
Belgium	0.43	0.43
Denmark	0.61	0.59
France	0.95	0.94
Germany	0.94	0.93
Ireland	0.94	0.93
Italy	0.91	0.85
Japan	0.84	0.83
Korea	0.79	0.71
Mexico	0.12	0.08
Netherlands	0.84	0.84
Portugal	0.99	0.99
Switzerland	0.92	0.92
United States	0.74	0.70
Average[c]	0.75	0.73

Table. Estimated aversion to inflation variability. Source: Cecchetti et al (1999)

A high value of the parameter (α) is a measure of the commitment of the central bank in fighting inflation. Looking at the second column on the table, if the inflation target is assumed to be 2%, then 14 out of 23 countries have values of α higher than 0.70 and 7 out of 23 even above 0.90. Curious is the case of Mexico, with an estimated parameter of α = 0.08, the less risk averse in the sample. Taking inspiration from this last study, Tachibana (2004) estimated the monetary policy preferences of UK, Japan and US, reporting a general trend in dislike of inflation after the oil crisis in the late 1970s, with the UK being the most averse to output variability. Economic objectives such as preferences on inflation or unemployment could be deducted even from

public opinion. As assessed in Scheve (2004) who has used survey data from 20 advanced economies, the individual preferences of the citizens on monetary policy goals depends on national-level factors that bring the inflation aversion to differ across countries.

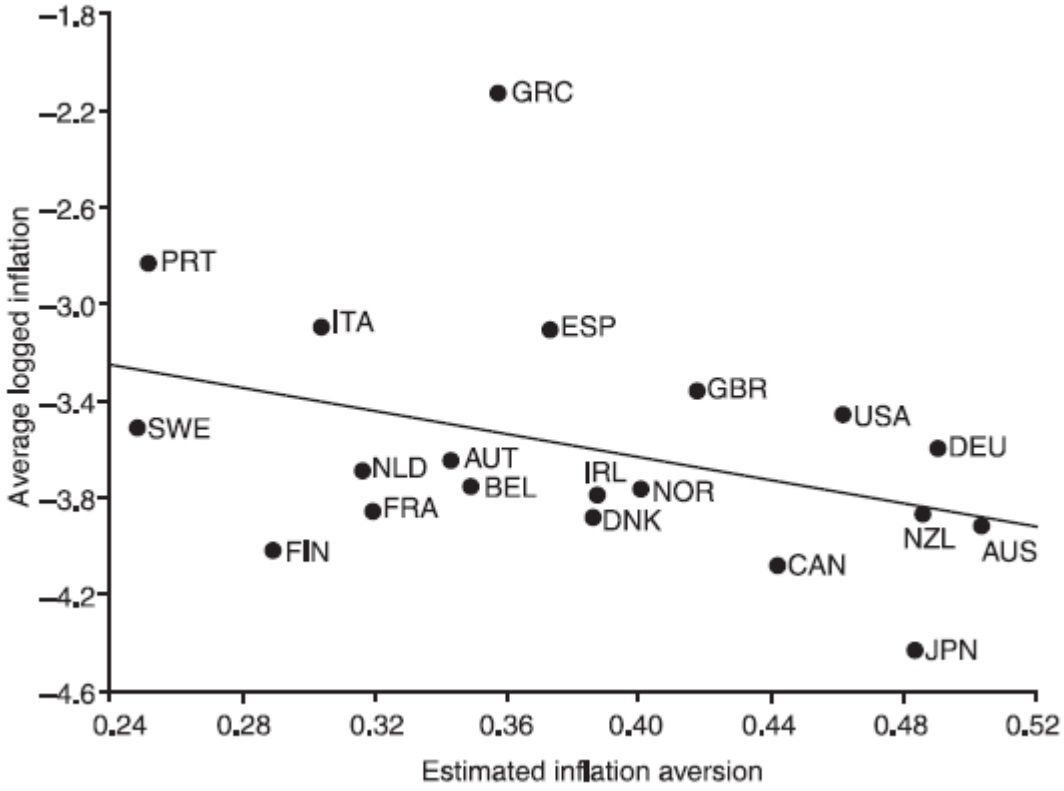

Fig. Average logged inflation by estimated inflation aversion. Source: Scheve (2004)

There is though another branch of the monetary policy literature that link the goals of the central bank not much to an intertemporal optimization problem, as to the bureaucratic theory, One of the first contributions has been given by Acheson et al. (1973) that explained the behaviour of the central bank with the role of a bureau. The bureau is essentially concerned with his own prestige given by the position in social hierarchy and the self-preservation of that role, avoiding conflicts with powerful and influential groups. The central bank has then a preference function given by prestige and self-preservation but constrained by the degree of freedom given by the legislation. An important consequence will be the gap between the policy preferences of a central bank as a bureau and those that would maximise the social welfare. Then by maximizing the utility function of the central bank might not lead to a social optimum in terms of price stability and low unemployment. Walsh (1995) proposed a model on the optimal contract for the central bank as align its objective with the social ones. The issue of central bank monetary policy preferences has been studied by Rogoff (1985), as a solution for the time inconsistency problem. This problem, as proposed in Kydland and Prescott (1977) and Barro and Gordon

(1983), explains how a central bank with a high degree of discretion in the kind of monetary policy implemented would be tempted to use unexpected changes in inflation rate to boost economy and reduce the level of unemployment. But this policy will produce the desired result until the unemployment reaches its natural level, ending up with a higher level of inflation in the long run. Rogoff (1985) proposed as a solution the appointment of central bankers highly averse to inflation, with a high degree of conservatism. Schellekens (2000) also stressed the need for credibility of monetary policymakers, acquired by implementing politics with caution, as a neutral stance of policy given by the interaction of an uncertain environment and policy preferences, and conservatism referred to preferences that are unrepresentative from a social point of view. Given the trade-off between inflation and output stabilization seen above, the challenge has been to reduce the credibility problem of central banks that might be inflationary bias, without sacrificing the stabilization of the output of an economy. Going back to Rogoff (1985), there was the proposal of a "weight-conservative" central banker to solve the problem of credibility, by having a monetary policy authority that puts more emphasis on inflation stabilization, rather than on unemployment or output volatility, the society will be better off. However, a complete removal of the inflationary bias would happen at a too high cost for output, leading to a suboptimal but feasible equilibrium with lower inflation target (Svensson, 1997).

After the change central bank governance form a few people to the delegation of monetary policies to a larger committee, it is interesting to notice is there is still room for concepts such as credibility and reputation. Sibert (2003) and Mihov et al. (2006) analyse the monetary policy committees to analyse the policy preferences on inflation of the members once they are part of a group. Sibert (2003) uses a model of reputation building to explain the committees' dynamics when the preferences of each member are private information. The policy makers are divided into two categories, doves and hawks. Using an avian terminology, dove policymakers are opportunistic in the sense that try to use unexpected changes in inflation to increase employment, if wages are in nominal terms, but ending up with a too high level of inflation and no gains in terms of output. On the other side, hawks central bankers are more mechanistic, they always vote for zero inflation and are not interested in compromises. An example has been the Fed President Paul Volcker during his tenure form 1979 until 1987. When the types of central bankers are unknown to the public, then, as explain in Mihov et al. (2006), an independent monetary policy committee is better than a single central banker, either if he or she implements a zero-inflation or discretionary policy. These results are possible because once in a committee, the incentive of members to build a reputation will change, the temptation of the opportunistic type to act as a mechanistic one in order to build up a reputation for inflation

toughness. Instead, the committee will be able to produce smoother levels of inflation and increase the welfare of the economy by being, on average, more conservative with respect to inflation compared to the society.

Even more studies have investigated the degree of dovishness or hawkishness of member of monetary policy committees of the most important central banks. Chappell and McGregor (2000) focused on the voting behaviour on 84 members during the period 1966-1996 to identify the individual preferences of a monetary policy reaction function. It describes empirically the relation between the macroeconomic variables and individual preferences on the setting of monetary policy instruments, which in the case of the Fed is about the federal funds rate. During the meetings of the FOMC, after the presentation of forecast on economic scenario and of alternative policy options, the chairman proposes a target for the federal funds rate on which the committee members are called to vote in favour of ease, tightness or just assent. Bennani et al. (2015) report that different preferences of the FOMC members might depend on education and previous professional background, but most important notable source of heterogeneity is due to different regional they are representative of. Different unemployment rates and price index have a strong impact on presidents and governors. They also reported that disagreement on the dovish side, so to ease the federal fund rate, were more frequent in those members who have previous professional experience in central banks and had higher educational levels, such as professors or MBA holders. The different background of monetary policy members has been investigated even by Farvaque et al (2014), in order to find a link with the ability of the central bank to manage the trade-off between inflation and output volatility. The sample used is composed by 9 major central banks for a total of 194 committee members during 1999-2010.

Riboni et al. (2008) used the voting records of the monetary policy committee of the Bank of England to study heterogeneity in their preferences, finding confirm that members behave in agreement with economic theory. They vote in favour of higher interest rates when inflation is expected to increase, while will be more prone to a reduction if higher unemployment is predicted. A certain degree of heterogeneity has been detected in relation of the type of membership, if internal or external member, with the latter reacting more strongly to change in unemployment than the latter.

Monetary Policy Committees: Education and Professional Experience*

	Education					Professional Experience					
	Bachelor	Master	MBA	PhD	Professor	Financial sector	Public sector	Private sector	Academia	Central bank	Other
European Central Bank	0.1	38.3	0.0	26.3	35.3	5.3	60.9	0.0	14.1	16.8	2.9
Reserve Bank of Australia	30.7	27.2	0.0	31.2	11.0	11.5	11.5	43.6	11.0	22.4	0.0
Bank of Canada	3.6	42.3	3.2	39.7	11.2	9.2	21.4	0.0	10.5	58.9	0.0
Bank of Japan	51.2	5.7	4.1	12.8	26.2	19.4	4.9	26.4	28.1	17.5	3.7
Reserve Bank of New Zealand	0	0	0	100	0	0	68.8	0	0	0	31.2
Sweden's Riksbank	2.8	23.7	8.0	33.7	31.8	28.3	29.9	0.0	17.2	16.5	8.0
Swiss National Bank	0.0	0.0	0.0	70.1	29.9	20.8	0.0	0.0	29.9	49.3	0.0
Bank of England	15.1	24.6	9.7	13.7	36.9	13.0	11.5	12.4	28.7	31.9	2.5
Federal Reserve Board	7.8	11.1	11.0	40.9	29.3	25.6	11.8	8.9	20.5	27.6	5.7
Average	13.7	24.2	4.2	30.4	27.4	14.5	26.2	11.3	18.7	25.9	3.5

*All variables expressed as percentage of the total number.

Fig. Education and Professional experience of MPC. Source: Farvaque et al (2014)

All in all, the differences in preferences have been studied using various tools of macroeconomic theory and the elements of heterogeneity have been investigated by different determinants, such the size of the monetary policy committee, the educational or professional background of each member. The elements considered so far have suggested a benefit of diversity in conducting an efficient e less biased monetary policy. The next step will be the review of those researches that so far have used as discriminant even the gender element, showing different policy preferences of women compared to men.

2.3 Women and monetary policy preferences

The gender factor has been taken under consideration by literature together with other elements of possible heterogeneity on preferences of monetary policy members. One of the first attempts has been done by Farvaque et al. (2011) using a sample of nine OECD central banks: the ECB, the Reserve Bank of Australia, the Bank of Canada , the Bank of Japan , the Reserve Bank of New Zealand, the Swedish Riksbank , the Swiss National Bank , the BE and the Fed. Five follow an inflation-targeting strategy. The authors have chosen a time period relatively stable regarding inflation, 1999-2008, during which most monetary policy committees was by politicians and trade unionists. In order to assess the impact of each policymaker on the final outcome of the central banks, Farvaque et al. (2011) have collected data on curriculum vitae of 175 members and included a wild range of factors in their analysis, such as the age and gender, social, professional and educational profiles, together with external elements as size and turnover or the committee members.

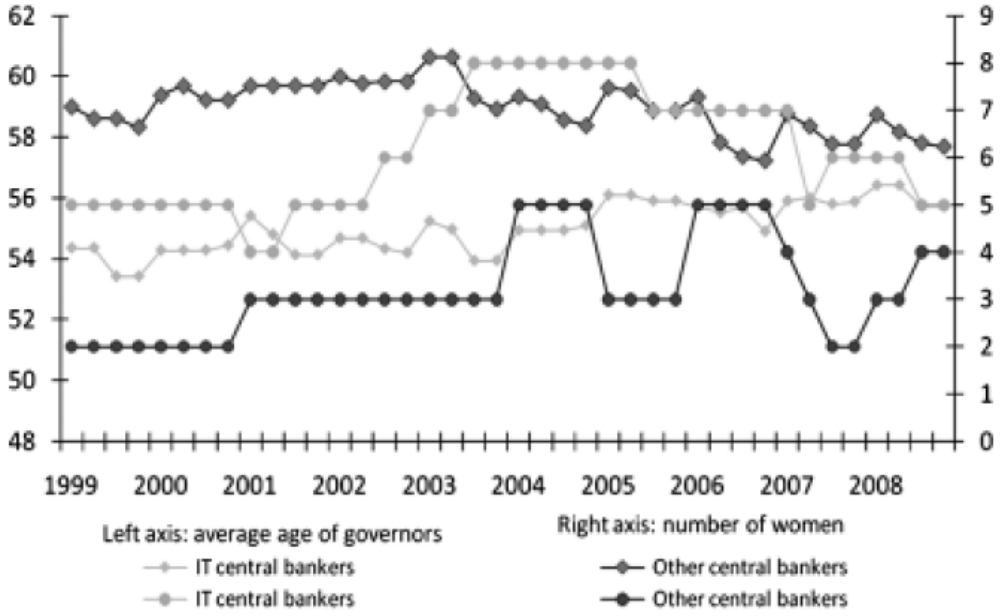

Fig. Demographic features of the MPC members. Source: Farvaque et al (2011)

Some statistics on the demographic features show how the average year of birth was 1946, with the oldest members in Japan and USA while the youngest in Sweden and Switzerland. There has been an increase in the number of women in the committees, even if the total number is 20 out of 175, with the highest percentage in Sweden (50%). During some periods, women represented a third (three out of nine committee members) of the Bank of England. On the other hand, in Switzerland and New Zealand there were no women members during the whole period, while the European Central Bank, the Royal Bank of Australia, the Bank of Canada and the

Bank of Japan had only one female member, not necessarily the same one during the whole period, but usually the female member was replaced by another woman. Inflation-targeting countries tend to have a higher presence of women on their monetary policy committees. The following estimated equation regresses the inflation level on macroeconomic indicators such as lag of variation of inflation, country-specific fixed effects and the output gap. The equation is similar to the Philipps curve at this point. The additional explanatory variable MPC includes different characteristics, in terms of demographics and size, of the committee. When the coefficient of MPC is positive, it indicates a more inflation prone committee, more dovish, while a negative one suggests a hawkish committee keen on fighting inflation.

$$\Delta\pi_{jt} = \sum_{p} \rho_p \Delta\pi_{jt-p} + \kappa + \lambda x_{jt} + \sum_{l} \alpha_l MPC_{ljt} + \varepsilon_{jt} \quad \text{with } j = 1 \ldots 9;\ t = 1 \ldots 40$$

The results for academics and professionals in the committee are negative and strongly significant, assessing their hawkish attitude. The gender factor enters the estimation as share of women in monetary policy committee, but contrary to the results proposed by Chappell and McGregor (2000), the value of the coefficient is negative and then associated with a hawkish attitude. A higher share of females in the boards of central banks contributes in making the committee more prone in lowering inflation levels. As possible explanations for this result has been claimed the general trend during the period 1999-2008 of a more conservative monetary policy or, as explained in the first chapter, women need to have stronger credential in order to be appointed and a reputation for being tough on inflation can help to this extent. The impact is even stronger in inflation-targeting central banks, perhaps because the monetary policy has adopted a standard for the inflation path to be followed and women try and follow it in a more mechanistic way. Farvaque et al. (2014) expanded the sample of observations to 194 committee members on a period 1999-2010, although the proportion of women banks remain still low with 23 out of 195 members (12.5%).

Monetary Policy Committees: Size and Demography

	Legal size	Real average size	Turnover rate	Average age	Women's share
European Central Bank†	22	18.8	1.34	59.0	5.3%
Reserve Bank of Australia	9	8.7	1.05	56.9	11.5%
Bank of Canada	6*	6.1*	2.01	53.8	14.3%
Bank of Japan	9	8.8	1.87	61.2	11.4%
Reserve Bank of New Zealand	1	1	1.00	56.9	0%
Sweden's Riksbank	6	5.9	1.28	56.6	38.5%
Swiss National Bank	3	3	1.00	54.3	0%
Bank of England	9	8.9	2.28	53.2	18.1%
Federal Reserve Board	12	10.6	5.57	58.4	13.0%
Average	8.6	8.0	1.93	56.7	12.5%

Fig. Size and demography of MPC. Source: Farvaque et al. (2014)

The research method this time consisted in a Data Envelopment Analysis (DEA) to evaluate the performance of each central bank in terms of reduction of volatility of both inflation and output. Then comparing the results from each bank with the others it has been created an efficient frontier of best practice. Farvaque et al. (2014) have studied then even the possible determinants of efficiency in terms of diversity of the human capital of the central banks.

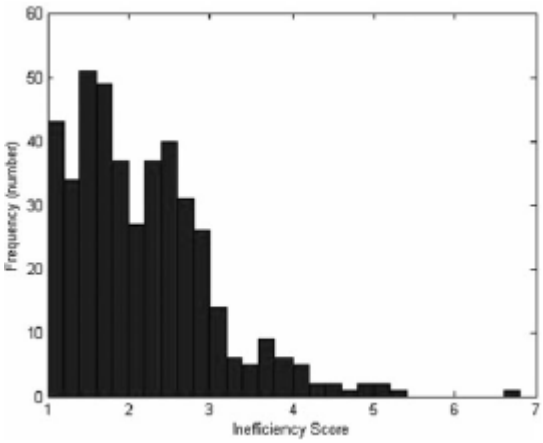

Fig. Distribution of Inefficiency scores for all countries. Source: Farvaque et al. (2014)

The results on the performance were reported in terms of inefficiency score, with the best possible monetary policy for value equal to one, becoming worse for higher numbers. The contribution to gender in this analysis is significant and positive but it has to be interpreted in terms of inefficiency, with a higher share of women increasing inefficiency because they are more inflation averse. In general, a good committee should have, as said Farvaque et al. (2014), a small size, with members not differing much in terms of age and with a limited turnover.

In more recent year even more researches have shown an interest in the role of different gender attitudes in conducting monetary policy, especially after the appointment of the first one Janet Yellen at the lead of the Federal Reserve. Masciandaro et el. (2016) elaborated an index to evaluate gender representation in monetary policy, the so-called Gender diversity in Monetary Policy Index (GMP Index) which measures the share of women on monetary policy committees on total members of the board. The sample used includes macro data on 112 countries and the GMP Index has an average value of 16% (SD 0.17). The graph shows a slight increase of around 1% from the average index computed in 2010 and 2015. Masciandaro et al (2016) analysed even the geographical distribution across regions and country income. The distribution by regions shows the highest values for the Caribbean and Africa together with North America. Surprisingly, the distribution of the GMP Index with respect to income levels, shows that low income economies are the ones with higher shares of women in monetary policy committees.

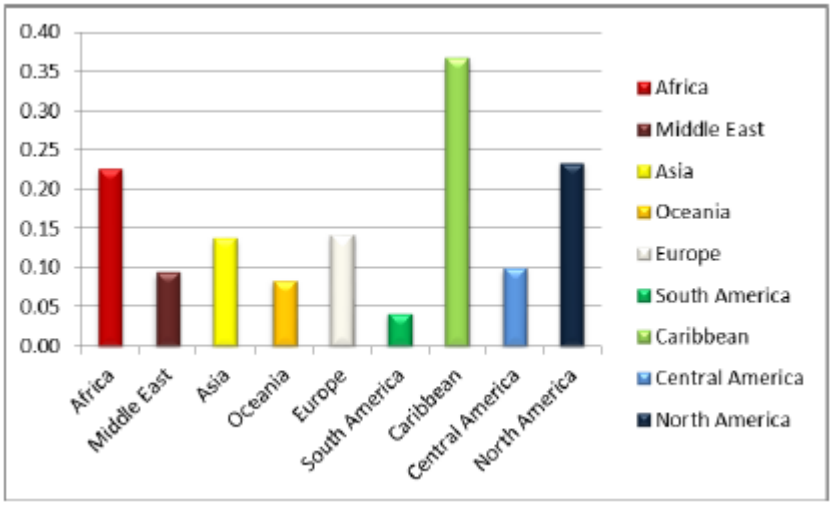

Fig. Geographical distribution of the GMP Index. Source: Masciandaro et al. (2016)

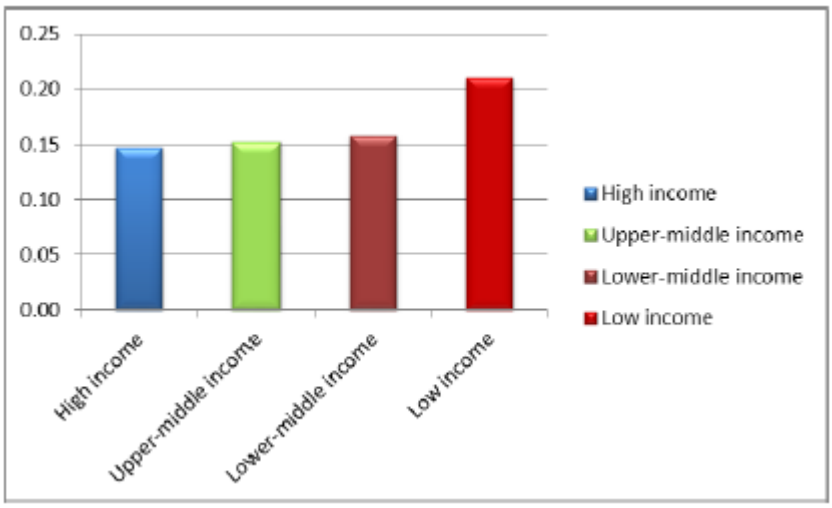

Fig. GMP Index distributed by income classes. Source: Masciandaro et al (2016)

The role of gender has been studied starting with the initial assumption of women as more dove than hawks. This idea is taken by previous studies, as shown in the first chapter, that associate women with a more dovish behaviour in terms of higher concern about social welfare than male counterparties. Masciandaro et al (2016) want to check for a correlation between dovish or hawkish attitude and gender diversity. When the central bank uses monetary policy tools to fight inflation, then it associated with a more hawkish than dovish attitude. On the other side, a dovish behaviour is related to a more active policy from the central bank, even in terms of other task such as supervision role in the financial sector. The empirical study on the influence of women share in the type of monetary policy conducted by the central banks is divided into two different regressions. The first one has as dependent variable the average inflation rate in the last 5 years in a given country which is explained by the share of female in monetary policy committee in 2010 and 2015, the lagged average inflation, the average output gap in the

previous 5 years and a vector X of country-specific factors. The latter includes dummy variables as level of central bank independence, the degree of trade openness, the OECD membership and the inflation targeting regime, when possible. (Masciandaro et al, 2016).

Table 2: Inflation rates and women in monetary policy boards

The dependent variable is the average inflation rate over 5 years intervals, [*t-4, t*], where *t* is the year of calculation of the GMP index, namely 2010 and 2015. GMP is the share of women members in monetary policy committees. GMT is an index of central bank independence from Romelli (2015). Lagged Average Inflation Rate is the average value of inflation over the period [*t-5, t-9*], Average Output gap is the output gap over the period [*t-4, t*]. Columns (2), (4), (6) and (7) exclude countries members of a monetary union, while Column (7) does not include OECD members. Robust standard errors in parentheses. ***, **, * represent significance at a 1%, 5% and 10% level, respectively.

Dependent variable: Average Inflation Rate	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GMP	-2.5624***	-2.3342***	-1.0774	-1.6405**	-1.8092**	-2.2319**	-1.5277*
	(0.872)	(0.872)	(0.795)	(0.644)	(0.838)	(0.867)	(0.858)
GMT			-2.0434**	-0.8607	-2.7179***	-2.6055***	-3.4279***
			(0.853)	(0.933)	(0.700)	(0.700)	(1.075)
Lagged Average Inflation Rate	0.4138***	0.3692***	0.3709***	0.3745***	0.4568***	0.4334***	0.4232***
	(0.066)	(0.068)	(0.062)	(0.069)	(0.062)	(0.069)	(0.069)
Average Output gap			30.6087***	40.3226**	8.3488	-3.9413	10.9421
			(10.561)	(16.724)	(14.593)	(16.306)	(17.366)
Inflation Targeting Regime	-0.1779	-1.1641**	-0.3634	-0.7657	-0.0932	-0.1751	-0.2519
	(0.362)	(0.559)	(0.392)	(0.495)	(0.305)	(0.439)	(0.551)
Trade (% of GDP)	-0.0051*	-0.0070*	-0.0048*	-0.0064*	-0.0055*	-0.0070	-0.0069
	(0.003)	(0.004)	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)
OECD Member Dummy	-1.9318***	-1.6215***	-1.2650***	-0.9888*	0.1819	-0.1566	
	(0.412)	(0.587)	(0.401)	(0.535)	(0.370)	(0.482)	
Constant	4.0052***	5.1719***	4.8565***	4.5892***	3.8415***	4.1763***	4.7226***
	(0.709)	(0.857)	(1.029)	(1.144)	(0.744)	(0.891)	(1.141)
Observations	158	109	120	86	58	42	30
R-squared	0.510	0.486	0.606	0.586	0.770	0.759	0.739

Table Results of regression on Average inflation rate. Source: Masciandaro et al. (2016)

The results of the model, as in the table above, show a negative and highly significant coefficient of GMP Index on average level of inflation, ceteris paribus. This output is in line with the previous literature that associates women with a higher degree of risk averse towards inflation and leading them to have a more conservative behaviour inside the monetary policy committee. The negative coefficient has been confirmed even by the sensitivity check when the dependent variable inflation rate has been corrected by the weighted average of world inflation rate in the same year.

The second regression uses as proxy of monetary policy the average of money growth over the last 5 years. The explanatory variables, differently from the first equation, include the lagged average money growth and the average lending rate.

Table 3: Money growth and women in monetary policy boards

The dependent variable is the money growth rate over 5 years intervals, *[t-4, t]*, where *t* is the year of calculation of the GMP index, namely 2010 and 2015. GMP is the share of women members in monetary policy committees. GMT is an index of central bank independence from Romelli (2015). Lagged Average Money Growth is the average value of the money growth rate over the period *[t-5, t-9]*, Average Lending interest rate and Average Output gap are the averages over the period *[t-4, t]* of the lending rate and output gap, respectively. Columns (2), (4) and (6) exclude countries members of a monetary union. Robust standard errors in parentheses. ***, **, * represent significance at a 1%, 5% and 10% level, respectively.

Dependent variable: Average Money Growth	(1)	(2)	(3)	(4)	(5)	(6)
GMP	-6.1414**	-6.9873***	-5.9185**	-6.4773**	-13.9744**	-13.9884**
	(2.338)	(2.208)	(2.865)	(2.757)	(6.255)	(6.450)
GMT			-3.8008	-1.0796	-5.7605	-4.8728
			(3.920)	(3.946)	(7.365)	(7.673)
Lagged Average Money Growth	0.1595**	0.1690**	0.1843*	0.1838*	0.0129	0.0047
	(0.073)	(0.073)	(0.107)	(0.107)	(0.158)	(0.164)
Average Lending interest rate (%)	0.2112*	0.1879*	0.3094*	0.2575	0.4682	0.4640
	(0.112)	(0.104)	(0.182)	(0.163)	(0.301)	(0.301)
Average Output gap	0.9447	1.0680	-7.1919	-3.8474	-103.9567	-105.1752
	(26.021)	(26.267)	(66.069)	(69.595)	(127.197)	(133.023)
OECD Member Dummy	-4.9892***	-4.8792***	-3.7265**	-3.9542***	-5.1433**	-4.8158*
	(1.266)	(1.082)	(1.444)	(1.209)	(2.550)	(2.570)
Constant	10.5120***	11.2398***	10.4613***	10.1394***	11.3040**	10.9795**
	(2.011)	(1.730)	(2.840)	(2.788)	(4.796)	(4.828)
Observations	109	105	85	81	44	42
R-squared	0.358	0.362	0.352	0.350	0.372	0.349

Table Results of regression on Average money growth. Source: Masciandaro et al. (2016)

The coefficient of interest GMP Index is still high and significant and, more importantly, negatively related to the money growth. Again, the higher presence of women in central bank boards, suggests a more hawkish approach in monetary policymaking.

The analysis by Diouf et al. (2017) recalls the idea of optimal central banker as a more conservative one developed by Rogoff (2008) and aims to investigate how much differ female's chairs approach compared to male counterparties in deciding the goals of monetary policy. The preferences on the monetary policy to be conducted are linked even to past career background. A past experience as staff of the central bank might contribute to align personal preferences with those of the institution, in order to acquire higher reputation and credibility by following a strategy of maintaining price stability. By looking at the female career background, 71.4% have been working within the Central Bank and 51% in the public sector against the 39.6% for the private. To find confirms that the preferences of female chairs of monetary policy boards go towards price stability more than output gap reduction. Diouf et al. (2017) started defining the optimization problem of minimizing the loss function. The losses rise when the objective variables such as output and inflation rate deviate from their targets. Differently from previous work who have quantified the deep parameters by specifying the supply and demand curve, Diouf et al. (2017) use a forward-looking Phillips curve equation where the output gap affects the inflation rate with one-year lag.

$$\pi_{t+1} - \bar{\pi} = \lambda x_t + \beta(E_t\pi_{t+2} - \bar{\pi}) + u_{t+1}, \ \lambda > 0,$$

After running the individual regression for each of 33 countries in the sample, the authors keep only those compatible with a model of inflation vs output trade-off model. The subsample of 8 countries includes Argentina, Belarus, Guatemala, Guyana, Kyrgyzstan, Paraguay, Salvador and Turkmenistan. The innovative idea was not to calculate the parameter on monetary policy preferences for male and female chairs, but only how much they differ from each other, to see how much or less women care about output stabilization compared to male countries. The non-linear model is estimated by a non- linear SUR method which exploits the errors correlation of different countries. As a result, ρ-hat is significantly different form zero and it is negative, confirming the results of the individual regressions that female chairs put more emphasis on the price stability then output stability, compared to male chairs. More specifically, women are 73% less attached to the stabilization of output objective than men. In terms of monetary policy, it will be less accommodative because of a larger degree of conservativeness associated with female chairs.

The analysis of Masciandaro et al. (2018) confirms the relation of women and more conservatism in monetary policy. They examined 103 countries during the period 2002-2016 and used an augmented forward-looking Taylor rule to include even the share of women in monetary policy committees in the variable Xt

$$i_t = \alpha + \phi_1\pi_{t+k} + \phi_2\tilde{y}_{t+q} + \theta' X_t + \sum_{j=1}^{n} \rho_j i_{t-j} + \epsilon_t,$$

Masciandaro et al. (2018) want to estimate the role of female board members in influencing the target rates, for a given level of interest rate. The results show higher interest rates with a higher proportion of women in monetary policy boards.

This general correlation between women and hawkish and more conservative monetary policy preferences has an important exception in the person of Janet Yellen. As studied by Wilson (2019), her term as chair of the Fed from February 2014 to 2018 has been ranked as one of the most dovish since the Martin era. A dove then is defined as a policymaker willing to live with high inflation in order to favour other goals such as to lower the unemployment level.

Rank	Fed Chair	Tenure	Unemp.
1	Paul A. Volcker	Aug. 6, 1979 - Aug. 11, 1987	7.7
2	Ben S. Bernanke	Feb. 1, 2006 - Jan. 31, 2014	7.3
3	Arthur F. Burns	Feb. 1, 1970 - Jan. 31, 1978	6.3
4	G. William Miller	Mar. 8, 1978 - Aug. 6, 1979	6.0
5	Alan Greenspan	Aug. 11, 1987 - Jan. 31, 2006	5.5
6	Janet L. Yellen	Feb. 3, 2014 - Feb. 3, 2018	5.1
7	William McChesney Martin, Jr.	Jan. 1, 1958 - Jan. 31, 1970	5.0

Table Unemployment ranking. Source: Wilson (2019)

During the period 2009-2016 Bernanke first and then Yellen implemented a policy of very low interest rates, with the Fed Funds rate target between zero and 0.25%.

At a ranking of Fed Governors, Janet Yellen takes the first spot.

Dove Rank	Fed Chair	Tenure	Dove Score
1	Janet L. Yellen	Feb. 3, 2014 - Feb. 3, 2018	2.17
2	G. William Miller	Mar. 8, 1978 - Aug. 6, 1979	1.19
3	Arthur F. Burns	Feb. 1, 1970 - Jan. 31, 1978	0.79
4	Ben S. Bernanke	Feb. 1, 2006 - Jan. 31, 2014	0.60
5	William McChesney Martin, Jr.	Jan. 1, 1958 - Jan. 31, 1970	-0.34
6	Alan Greenspan	Aug. 11, 1987 - Jan. 31, 2006	-1.08
7	Paul A. Volcker	Aug. 6, 1979 - Aug. 11, 1987	-2.96

Table Dove Ranking. Source. Wilson (2019)

3. The Empirical analysis

3.1 The theoretical framework and the database

After reviewing the literature on policy preferences and the group of researches on the effect of the diversity brought by gender in the monetary policy, the next chapter will explain how the empirical analysis will be conducted. The researches of main interest are those of Masciandaro et al. (2016) and Diouf et al. (2017). Diouf et al. (2017) aims to prove that female preferences in monetary policy goes towards price stability, more than for other macroeconomic variables such as unemployment of output gap. They adopted a forward-looking New Keynesian Phillips curve in which the output gap affected the inflation rate with a one-year lag. They have used data for 33 countries in the sample over the period 1980-2014 on annual GDP, on the output gap and the inflation rate with the assumption of inflation target equal to zero. They also used a dummy variable which takes value one if in a given year a woman has been chair of the central bank for at least 6 months and zero otherwise. Diouf et al. (2017) provided a list of female monetary policy committee chairs from 1985 to 2014, with two additional observations in East Germany in 1950 and 1967. For each female chair, there are data on the year of appointment and end of tenure for a total number of 60 individuals. On the other hand, the method used in Masciandaro et al. (2016) consists in using as proxies on monetary policy the inflation rate or the money growth in the past 5 year in a given country. As explanatory variables on the inflation rate have been used the GMP Index, which is a measure of the proportion of women in a monetary policy committee on total members, the average lagged inflation rate, the average level of the output gap and a set of country specific variables. The latter category includes the level of independence of the central bank (GMT), the trade openness of the country, a dummy variable of OECD members and inflation targeting regimes. The second regression run by Masciandaro et al. (2016) uses the money growth as proxy of preferences in the monetary policy conducted by the central bank. In this last regression are used independent and control variables such as average lagged money growth and average lending rate, in addition to the GMP Index, GMT, and OECD membership. The main findings of both regressions relate a higher percentage of women in the monetary policy board to a negative effect on the inflation rate or money growth rate (Masciandaro et al.2016). While Diouf et al. (2017) shows how female chairs in central banks are more interested in fighting inflation than keeping under control the output gap, compared to their male counterparties; even though their results are retrieved on analysis run only on eight countries.

In the theoretical framework of the previous literature, women in central bank boards are portraited as more conservative in the sense of Rogoff (1985) and more willing to keep low level of inflation as primary policy goal, especially in those institutions with an explicit inflation target. The bureaucratic theory defines female central bankers as hawks, in opposite of doves, because are more mechanistic in the way they set their preferences. Hawks do not accept any kind of compromises on the target level of inflation, even if it is done at the cost of higher volatility in the other macroeconomic measures such as the output gap or the level of unemployment in the economy. The main question of this dissertation is whether this relationship between female monetary policy chairs and hawkish attitude can be confirmed by using updated information. Before specifying a model for the empirical analysis, it was necessary the collection of data on those variables on interest mentioned in the previous analysis made by Masciandaro et al. (2016) and Diouf et al. (2017).

As source of all the central banks around the world, it was been used the list provided by the Central Bank Hub on the website of the Bank of Institutional Settlements (BIS). The total count is for 179 central banks and related countries to be analysed. Before collecting data on the other variables, it was crucial to decide the time period to consider in the empirical model. The period of analysis, according to data retrieved from Diouf et al. (2017), goes from 1980 to 2018 for the female monetary policy chairs. As shown in the Table 2 in Appendix, the data has been checked and updated at the last information available. The first column "Date of Appointment" represents the beginning of the tenure for the chairwomen at the board of the central bank or monetary authority of a specific country. These dates have been updated to include the exact month of appointment, while the day, if not specified, is the first of the month by default. The name of each monetary policy body has not been reported due to the focus being on the entire country. The countries in blue are those never been included in the original table, such as Belize, Cuba, San Marino, North Macedonia (former Macedonia) and Euro Area. The names of female monetary policy chairs have been updated from 2016 on, with Christine Lagarde as the last one available at the end of 2019. As for the initial date, even the end of the tenure has been updated. Starting from the original table provided by Diouf et al. (2017), the last column "End of tenure" reports the exact date, when available, of the end of the mandate. If the specific policymaker is still in charge, the wording is "Incumbent". The total count is of 66 female chairs on the monetary policy board of central banks in 52 countries all around the world. The information about female monetary policy committee chairs have been translated into a dummy variable, which takes value one the year a woman is chair of the central bank and zero otherwise. Initial information on East Germany have not been considered, as much as the last observation on the European Union, although very interesting for the purpose of the dissertation, it is too recent to

retrieve quantitative effects of the monetary policy. The total number of observations is of 306 Female MPC chair, distributed across the five continents. The highest percentage belongs to Centre South America with 32% of observations, followed by Europe (20%), Asia (19.5%), Africa (18%), Oceania (6.15%) and the North America (4.2%).

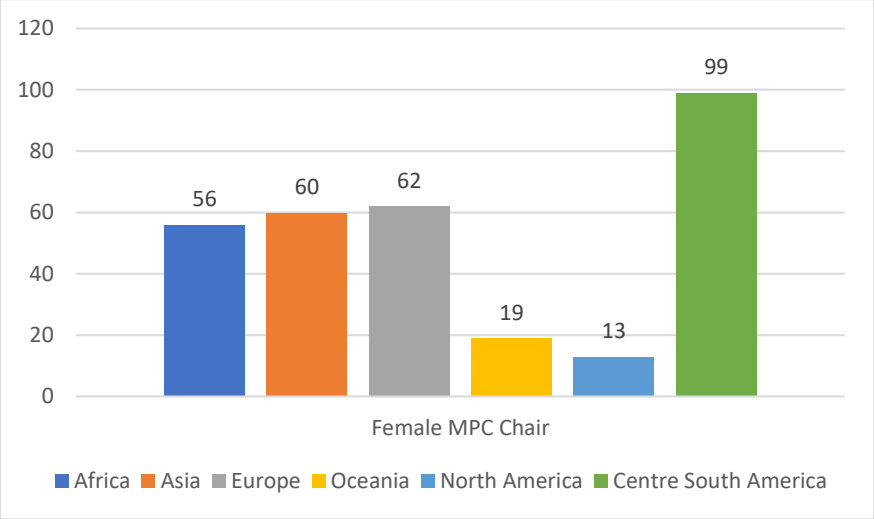

Fig 1. Female Chairs by continents

The next step in the building of the database to list all the 179 countries, each observed for 39 periods within the time from 1980 to 2018, and then matching them with the dummy variable on monetary policy female chairs. The need to identify each country in an immediate and unambiguous way brought to the creation of the column named “code”. The codes are made up of three letters and have been taken from the databases of the World Bank. For the empirical analysis, it was necessary to collect data according to the inflation rate during the period under exam. The data from two different institutions have been used for this purpose. The variable “InflationWB” represents data from the World Bank where inflation rate is measured by the consumer price index: “it reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.” (World Bank). A similar measure was taken by the International Monetary Fund Data, called “InflationIMF”, which describes the inflation rate simply as average consumer prices. The reason of taking into account both these information on inflation rate from different sources was due to the differences in terms of values and availability during the period considered.

Variable	Obs	Mean	Std. Dev.	Min	Max
InflationWB	5512	30.72783	406.1378	-18.10863	23773.13
InflationIMF	6083	48.43599	950.0738	-72.7	65374.1

Table 1: Inflation rates from World Bank and International Monetary Fund

Another macroeconomic variable used in the previous analysis is the output gap computed as the difference between the potential outcome of an economy and its actual level of production. The data on the gross domestic product from the datasets of the World Bank were about the current level of the GDP, expressed in US dollars. To compute the GDP in real terms, it has been used a GDP deflator referred to the US economy with 2010 as reference year. The GDP Real has been then computed as the ratio between the GDP current and the GDP deflator, for all the countries in the database. As long as GDP potential and the output gap cannot be observed directly, to compute then it will be adopted the methodology suggested by Masciandaro et al. (2016). They have used the statistic Hodrick-Prescott (HP) filter to estimate the trend of the gross domestic product. The HP filter identifies the cyclical component by detrending the time series of the Real GDP.

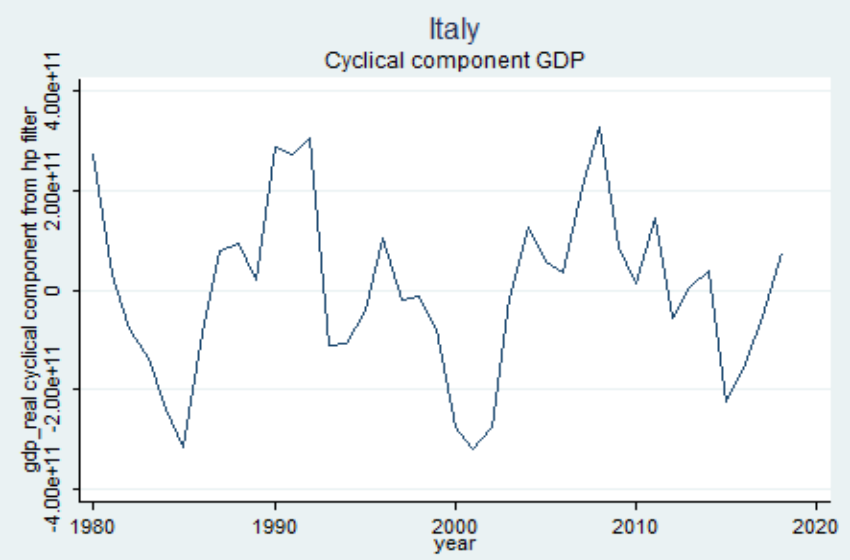

Fig. Cyclical components of the GDP for Italy.

Source: Owe elaboration from the database

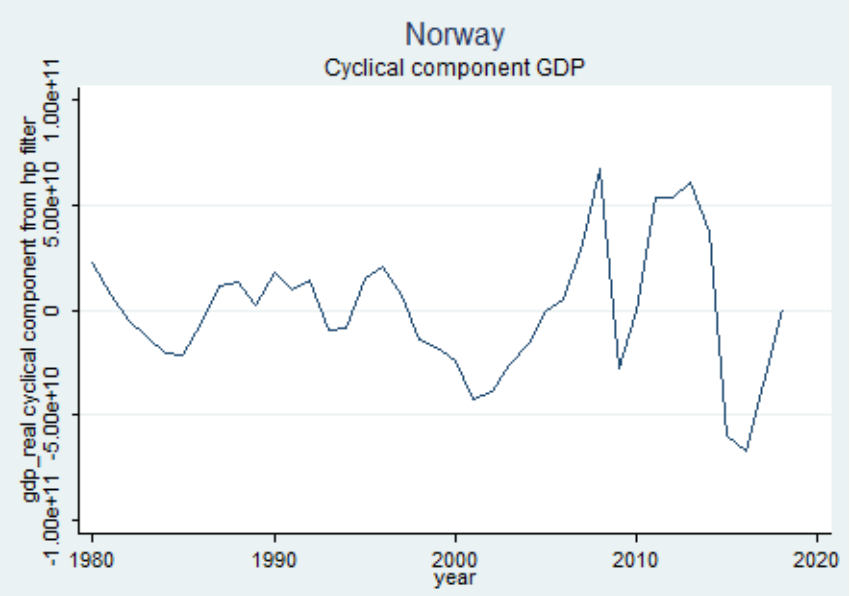

Fig. Cyclical components of the GDP for Italy.

Other techniques would have been multivariate methods used such as estimates based on the production function, or survey-based measures. The next step was subtracting the cyclical component as computed by the HP filter, from the GDP real, in order to have a final trend which represents the GDP Potential of the economy. It can be defined as the maximum amount of goods and services that an economy is able to produce working in the most efficient way, without wasting resources.

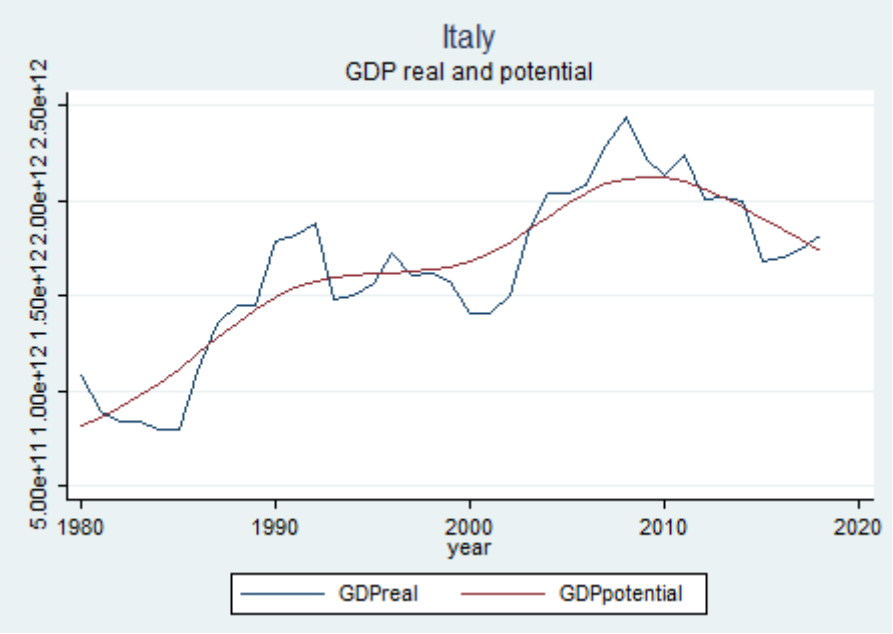

Fig. Real and Potential GDP for Italy. Source: Own elaboration

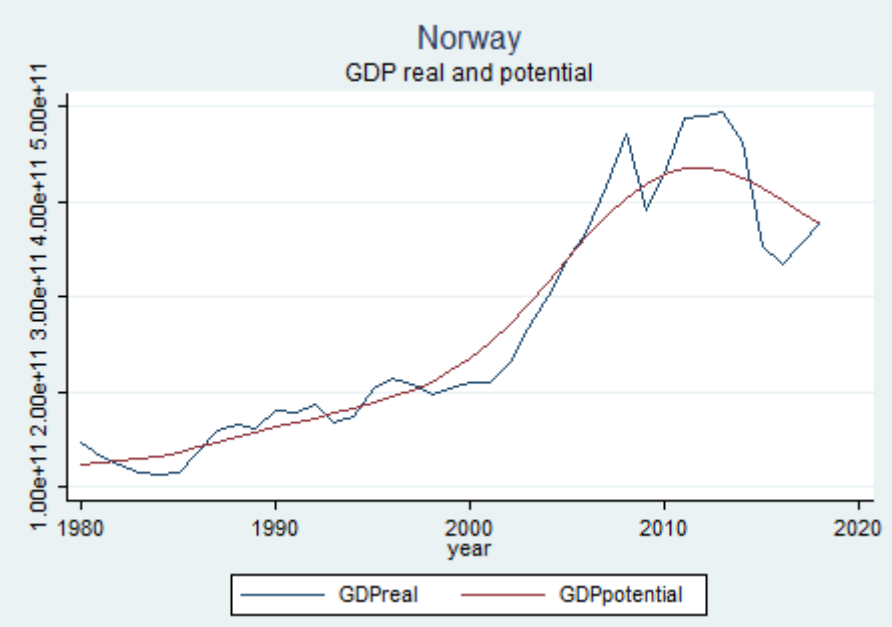

Fig. Real and Potential GDP for Italy. Source: Own elaboration

Finally, the output gap is calculated as the difference between the Actual level of GDP and the potential trend.

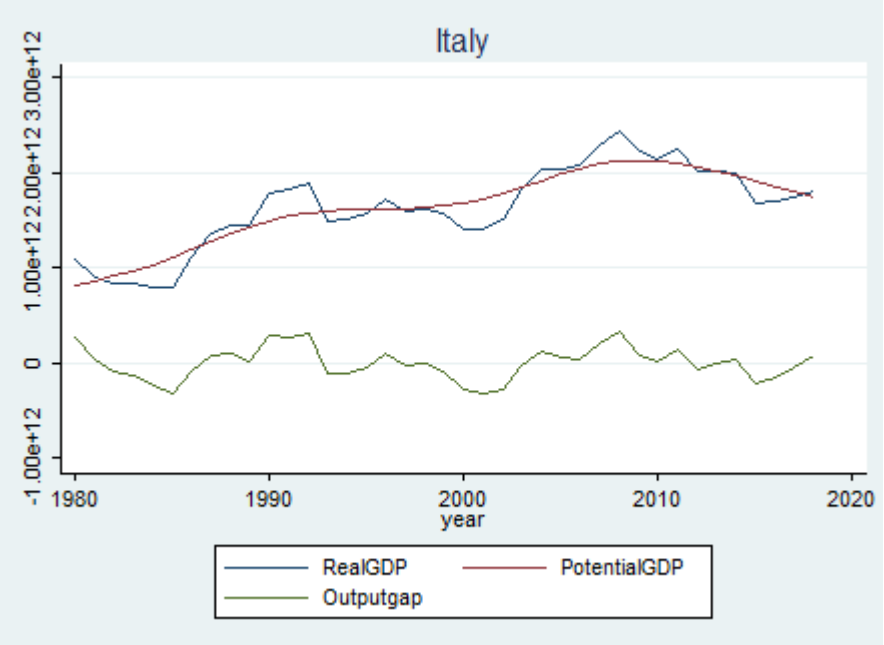

Fig. GDP real and potential and Output Gap for Italy.

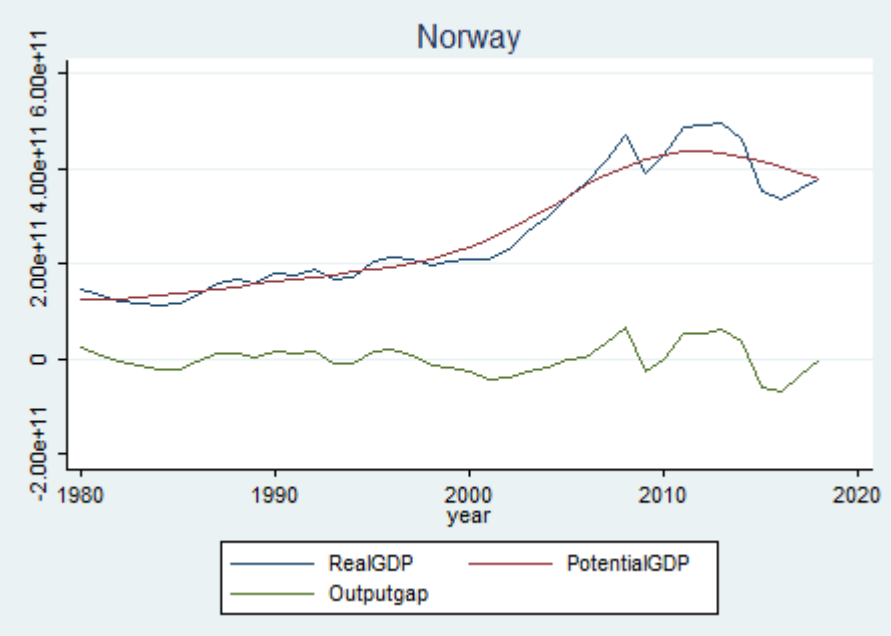

Fig. GDP real and potential and Output Gap for Norway

A healthy economy is supposed to have the actual level of output close to its potential one, in order to have an output gap as narrow as possible. A zero level of the output gap means that the real and the potential GDP are equal. As shown in the graphs above, Italy has had very large fluctuations around zero from 1980 to 2018 but in a theoretical point of view, neither a positive nor negative gap is desirable for the economy. Another interesting variable was level of trade openness of an economy, defined as "the sum of merchandise exports and imports divided by the value of GDP, all in current U.S. dollars." (World Bank).

The previous computations have been made for all the countries, except for Afghanistan, Iran and Iraq because of gaps in the data. Furthermore, even Palestine and Organization of Eastern Caribbean States (OECS) have been removed from the database due to lack of data. One additional country, Sao Tome and Principe has been added as present in the list of female chairs provided by Diouf and Pepin (2017). The final result is a database that covers 175 countries in the period from 1980 to 2018 and collects information on the following variables. The variables Africa, Asia, Europe, Oceania, North America and Centre South America are dummy variables for the continents.

Variable	Obs	Mean	Std. Dev.	Min	Max
year	6825	1999	11.25545	1980	2018
year2	6825	3996128	44999.44	3920400	4072324
FemaleChair	6825	.0452747	.2079213	0	1
InflationWB	5236	32.24405	416.6512	-18.10863	23773.13
InflationIMF	5807	50.6539	972.3377	-72.7	65374.1
Trade	6119	64.12472	46.73262	4.909436	944.4795
OutputGap	6230	-.0230444	.1740525	-1.82082	2.162322
Africa	6825	.2742857	.4461863	0	1
Asia	6825	.2514286	.4338661	0	1
Europe	6825	.24	.4271144	0	1
Oceania	6825	.0457143	.2088801	0	1
NorthAmerica	6825	.0171429	.1298131	0	1
CenterSout~a	6825	.1714286	.3769106	0	1

Table Sum of variables in the original database. Own elaboration

3.2 The model specification

The theoretical framework for the empirical analysis then requires the adoption of a methodology that allows to capture the differences in monetary policies when the gender of the board chair changed from man to woman. The Difference-in-Differences estimation method helps in solving the problem that different outcomes might be due to different characteristics of the members of the groups, rather than to the effect of the treatment, because many variables are assumed to be time invariant. By being constant over time, even if they are assumed to have an impact on the final outcome, it is possible to cancel then out from the analysis by just taking the difference between the two periods, before and after the treatment. The estimation method than can estimate this kind of changes without computing explicitly the loss function in order to identify the preference parameters of the central bank, is the so-called differences-in-differences model. The Differences-in-differences (DD) estimation method is a quasi-experimental design, as named by Campbell and Stanley (1966), or natural experiment in which the assignment of an individual to a group has happened in a completely random way. It is used to estimate the effects of a specific intervention between two different groups in the population. It compares the differences or changes in outcome over time between a group enrolled in a program that undergoes a treatment. As shown in the Fig.1, the first difference will be given by the different outcomes before and after the treatment in the intervention group. This first difference controls for constant factors in the intervention group as long as the comparison is made between the group and itself, but there is the role of time-varying factors.

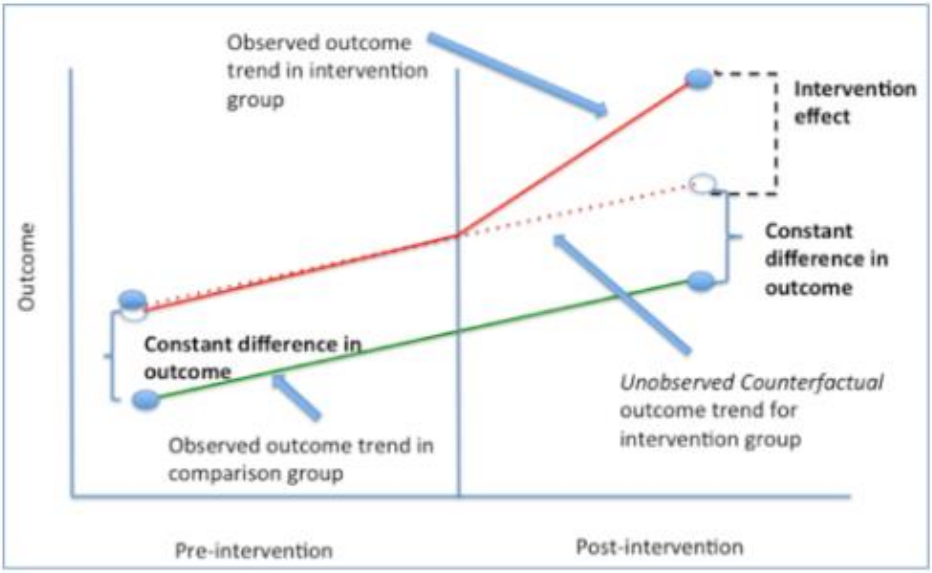

Fig. 1 Graphical representation of the DD estimation method. Source NBER, 2007

To solve this problem another difference takes place by computing before-and-after change in the outcome of those countries that have not been treated but were exposed to the same set of environmental conditions. This is the second difference. Then is possible to clean the first difference of time-varying factors by subtracting the second difference.

The main purpose is to use both differences in order to estimate a better counterfactual outcome trend for the intervention group. The estimation will give a counterfactual which measures the change in outcomes for the intervention group, but the two intervention and control group do not need to have the same conditions before the treatment, however, the comparison group must represent the change in outcomes that the treatment countries would have experienced in case of no treatment After controlling for observed and also unobserved fixed effects, the comparison is not anymore between the final outcomes of the two groups, but between the trends on the differences that change over time. An important assumption is the one of "equal trends" for the method to provide a valid estimation of the counterfactual. It is assumed then that in the absence of the treatment, the two outcomes would increase or decrease at the same rate in both groups by moving in tandem. The key issue when estimating the impact of a treatment is the construction of the unobserved counterfactual outcome that would have happened in the absence of the application of the treatment (Heckman and Smith, 1999). The DD estimation method, differently form the other impact evaluation methods such as Instrumental Variables (IV), has an additional unknown when estimating the counterfactual, given by a less clear assignment rule. In this case the treatment consists in the change of gender of the central bank governor and the appointment process varies form country to country, without a well-defined pattern.

The general regression model represents the interaction between time and dummy for treatment groups.

$$Y = \beta 0 + \beta 1 * \text{Time} + \beta 2 * \text{Intervention} + \beta 3 * \text{Time} * \text{Intervention} + \beta 4 * \text{Covariates} + \varepsilon$$

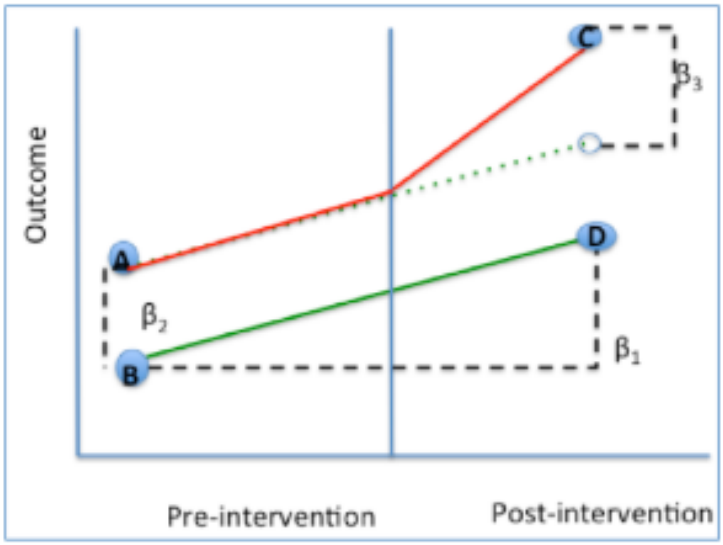

Fig. 2 Graphical representation of the regression. Source NBER, 2007

Referring to Fig.2, the constant β0 is equal to the point baseline average (B); while β1 is given by (D-B) and describes the time trend in control group; β2 refers to the difference between (A-B) the two groups before the intervention and finally β3 is computed as the difference in the outcome in the intervention group (C-A) minus the difference (D-B). The variable of interest is when β3 that captures the intervention effect on the dependent variable Y.

The adoption of the DD estimation method requires to make changes in the setting of the original database in order to create the two variables "Time" and "Intervention" and identify the coefficient of interest (β3) given by their product.

The first step was the selection of the observations of the variable Female Chair. To this purpose a new dummy variable was created, named "Treated" that takes value one the year when a woman has been chair of the monetary policy committee for at least three year, for the entire period of appointment; zero if the mandate was shorter or for the second female chair in the same country. The reason is to be able to capture the full effects of different preferences in monetary policy, knowing that the transmission mechanism of the different interest rates set by the central bank, will affect the real economy with a temporal lag. As for the dummy Female Chair, even the variable Treated has different percentages in different continents, passing from a total number of 309 observations to a lower total of 272 ones.

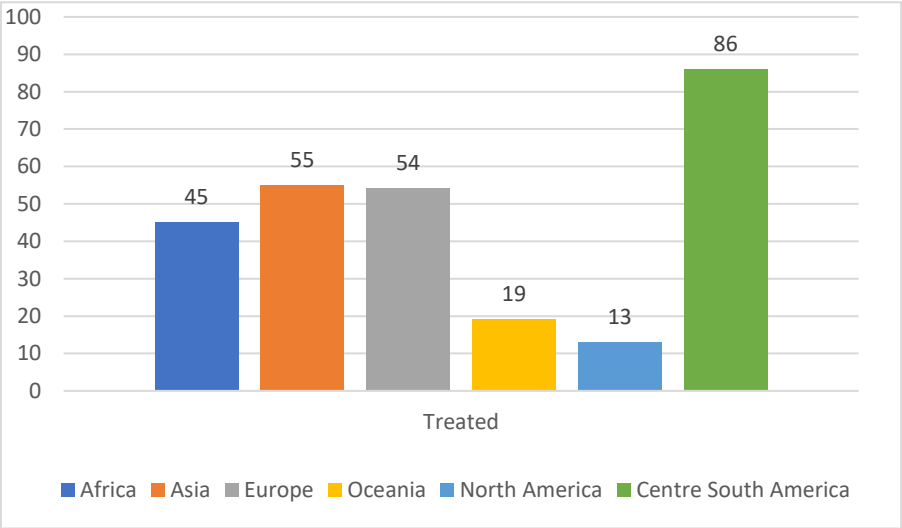

Fig. 1 Treated countries by continents. Own elaboration

Another critic decision was how to tread those countries in Europe that are part of the European Monetary Union and have adopted the euro as currency which is controlled by the European Central Bank and not by the single national central banks. For those countries that became members of the Euro Area in 1999, such as Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, The Netherlands, Portugal and Spain, they have been considered as part of the macro area "Euro Area" only from the year of effective use of the euro, so since 2002. Before that year, are taken into analysis the observations on inflation, both InflationWB and InflationIMF related to the single countries, while are generated missing data from 2002 until 2018. The previous treatment has been applied even to Greece that joint the Euro Area only in 2001. For those countries that are part of the Euro Area., but adopted the euro as currency in different year, the missing value starts from the year of actual adoption of the new currency. Some countries such as, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania and Sweden, have not adopted euro yet, so the data on inflation are the national ones. Finally, single national values of inflation are used even for Denmark and the United Kingdom, because of their agreements to be part of the European Union keeping their own currencies. After these adjustments, the value of the both variables of inflation rates are the following:

Variable	Obs	Mean	Std. Dev.	Min	Max
InflationWB	5236	32.24405	416.6512	-18.10863	23773.13
InflationIMF	5807	50.6539	972.3377	-72.7	65374.1

Table. Inflation rates in the modified database

The general formulation of the empirical model will have as dependent variable the inflation rate of each country, explained on a constant variable, on the variable "time" which takes value zero and one respectively the year before the appointment of the female monetary policy chair and one the third year of tenure. The variable "intervention" identifies those countries that have experienced a female as chair of the central bank, from the control group. The third explanatory variable "time_intervention" is the product of the two explanatory variables and is the one of major interest because given the measure of how inflation rate has changes in interventions countries during the first three years of the female chair. The other explanatory variables are the Output Gap, Trade, year expressed in a linear way and dummy variables for Africa, Asia, Europe, Oceania and Center South America. The dummy on North America has been excluded because of collinearity with the constant variable and even due to the relative high weight of the USA and Canadian economies on the global macro variables. The linear regressions will be run for both Inflation rate from the World Bank data and the ones from International Monetary Fund.

$$InflationWB_{tc} = cons + \beta_1 time_t + \beta_2 intervention_t + \beta_3 time_t * intervention_t + \beta_4 OutputGap_t + \beta_5 Trade_t + \beta_6 year + \beta_7 Africa + \beta_8 Asia + \beta_9 Europe + \beta_{10} CenterSouthAmerica + \varepsilon$$

$$InflationIMF_{tc} = cons + \beta_1 time_t + \beta_2 intervention_t + \beta_3 time_t * intervention_t + \beta_4 OutputGap_t + \beta_5 Trade_t + \beta_6 year + \beta_7 Africa + \beta_8 Asia + \beta_9 Europe + \beta_{10} CenterSouthAmerica + \varepsilon$$

In order to obtain the variable “time”, the starting point has been the variable “treated” and a set of additional variables have been generated to be able to identify, though different steps, the two years that represent the year before the appointment (t0) and the third period of tenure (t3). The following table shows the variables for the country Argentina from 2004 to 3018. In 2010 Mercedes Marco del Pont became the chair of the Central Bank of Argentina, the variable “Female chair “takes value one from 2010 to 2013 and so does the column “treated”. For treated country, it has been generated the variable t1=treated[_n+1], which shifts by one period backwards the value of the variable “treated” and “t0” takes the difference between “treated” and “t1”, showing a value of -1 in 2009, the year before the change of the chair from man to woman. This result means that the variable “time” = 0 in 2009 with t = 0 for Argentina.

year	Female~r	treated	t1	t0	t_3	t3
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	0	0	1	-1	3	0
2010	1	1	1	0	0	0
2011	1	1	1	0	0	0
2012	1	1	1	0	0	3
2013	1	1	0	1	1	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	1
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0

Table: Values for Argentina from 2004 to 2018. Own elaboration

To be able to identify the second moment of the variable "time" = 1 the analysis was the following. The variable "t_3" replicates "t0" but takes value equal three when "t0" = -1, while "t3" has been generated as t3=t_3[_n-3], so shifting forward the values of "t_3" with three lags. In the case of Argentina, "t3" = 3 in 2012 which represent exactly the third year of Mercedes Marco del Pont as chair of the Central Bank of Argentine.

year	Female~r	treated	t1	t0	t_3	t3
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	0	0	0
2007	0	0	0	0	0	0
2008	0	0	0	0	0	0
2009	0	0	1	-1	3	0
2010	1	1	1	0	0	0
2011	1	1	1	0	0	0
2012	1	1	1	0	0	3
2013	1	1	0	1	1	0
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	0	0	0	1
2017	0	0	0	0	0	0
2018	0	0	0	0	0	0

Table. Values for Argentina from 2004 to 2018. Own elaboration

To summarize, for Argentina the variable "time" will take value t_0 = 2009 and t_1 = 2012. In order to identify those countries of the treated group that have had a female central bank chair from 1980 to 2018, the variable "intervention" takes value one when "t0" = -1 and "t3" = 3.

year	treated	t0	t3	interv~n	time
2004	0	0	0	0	0
2005	0	0	0	0	0
2006	0	0	0	0	0
2007	0	0	0	0	0
2008	0	0	0	0	0
2009	0	-1	0	1	0
2010	1	0	0	0	0
2011	1	0	0	0	0
2012	1	0	3	1	1
2013	1	1	0	0	0
2014	0	0	0	0	0
2015	0	0	0	0	0
2016	0	0	1	0	0
2017	0	0	0	0	0
2018	0	0	0	0	0

The other variables of interest were the level of output gap and the percentage of trade openness of treated countries. The level of output gap computed as difference between the potential GDP and the actual real value has been related to the real GDP for each country to have a more stable measure. Both variables “Output Gap” and “Trade” for treated countries are referred to the year corresponding to time = 0. For Argentina the values are the following

year	country	t0	t3	interv~n	time	OutputGap	Trade
2009	Argentina	-1	0	1	0	-.1008266	28.36777
2012	Argentina	0	3	1	1	-.1008266	28.36777

Table. Values for variable “time” for Argentina

The next step was the treatment of the control group, of those countries included in the database because have a central bank or monetary policy authority, but they have never had a woman as chair in the temporal gap considered. The total number of countries with a female monetary policy chair for at least three years is 38 out of 175 countries, about 21% of the sample, while the control group counts 137 countries. The dummy variable “intervention” is always zero, while the definition of the two periods for the variable “time” required the period 1980-2018 to be staged into nine subperiods 1983-1986, 1987-1990, 1991-1994, 1995-1998, 1999-2002, 2003-2006, 2007-2010, 2011-2014, 2015-2018. The first year of each subperiod represents the time = 0 while the second one given the value of time = 1, as shown below for Norway.

year	country	treated	t0	t3	interv~n	time	OutputGap	Trade	Europe
1983	Norway	0	0	0	0	0	.1169744	51.10565	1
1986	Norway	0	0	0	0	1	.1169744	51.10565	1
1987	Norway	0	0	0	0	0	-.073868	46.83113	1
1990	Norway	0	0	0	0	1	-.073868	46.83113	1
1991	Norway	0	0	0	0	0	-.0558113	48.9684	1
1994	Norway	0	0	0	0	1	-.0558113	48.9684	1
1995	Norway	0	0	0	0	0	-.0751816	49.30618	1
1998	Norway	0	0	0	0	1	-.0751816	49.30618	1
1999	Norway	0	0	0	0	0	.0853523	49.06261	1
2002	Norway	0	0	0	0	1	.0853523	49.06261	1
2003	Norway	0	0	0	0	0	.0984899	47.35502	1
2006	Norway	0	0	0	0	1	.0984899	47.35502	1
2007	Norway	0	0	0	0	0	-.0762882	54.03616	1
2010	Norway	0	0	0	0	1	-.0762882	54.03616	1
2011	Norway	0	0	0	0	0	-.1091776	50.41187	1
2014	Norway	0	0	0	0	1	-.1091776	50.41187	1
2015	Norway	0	0	0	0	0	.1699039	46.70691	1
2018	Norway	0	0	0	0	1	.1699039	46.70691	1

Table. Variables for Norway in the subsamples

After defining “time” and “intervention”, the following table sum the variables that will be used in the first two linear regressions. The total number of observations is 2542 from the initial database with 6826 observations. The observations for the Output Gap and Trade are slightly lower with respectively 2332 and 2282 observations.

Variable	Obs	Mean	Std. Dev.	Min	Max
year	2542	2000.623	10.41268	1983	2018
InflationWB	1992	37.17901	577.8637	-17.64042	23773.13
InflationIMF	2186	46.13381	629.7861	-72.7	23773.1
time	2542	.5	.5000984	0	1
intervention	2542	.0298977	.1703387	0	1
interventi~e	2542	.0149489	.1213721	0	1
OutputGap	2332	-.0180141	.1722202	-1.091084	2.099944
Trade	2282	62.79931	42.8351	4.909436	395.1143
Africa	2542	.3084186	.4619313	0	1
Asia	2542	.2549174	.4359005	0	1
Europe	2542	.2470496	.4313807	0	1
Oceania	2542	.0440598	.2052684	0	1
NorthAmerica	2542	.0086546	.0926449	0	1
CenterSout~a	2542	.1369001	.3438095	0	1

Table Sum of variables in the modified database

3.3 The empirical results and sensitivity checks

Once defined the theoretical framework and the specification of the empirical model, in this paragraph will be reported the results of the regressions, together with the sensitivity analysis. The first regression will have as dependent variable the inflation rate from the World Bank data, by filtering for values of inflation rate lower than 500 because of some outside rates as the peak of 23773% inflation rate for the Democratic Republic of Congo in 1994. Furthermore, the error terms are clustered in countries due to the repetition of countries in different subperiods. The "North America" has been excluded because of collinearity with the constant and the global importance of USA and Canada central bank's monetary policies.

```
Linear regression                               Number of obs =    1894
                                                F( 11,   159) =    4.29
                                                Prob > F      =  0.0000
                                                R-squared     =  0.0792
                                                Root MSE      =   28.69

                                    (Std. Err. adjusted for 160 clusters in country)
------------------------------------------------------------------------------
             |               Robust
InflationWB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        time |  -2.371638   1.004299    -2.36   0.019    -4.355125   -.3881516
  intervention |  -4.547537   2.585022    -1.76   0.080    -9.652945    .557871
intervention_time |   4.171187   1.912096     2.18   0.031     .3948046    7.947568
   OutputGap |  -13.82047   7.354078    -1.88   0.062    -28.34475    .7038055
       Trade |  -.0217698   .0286078    -0.76   0.448      -.07827    .0347305
        year |  -.5901091   .1071503    -5.51   0.000    -.8017305   -.3784876
      Africa |   8.130946   2.043726     3.98   0.000     4.094595    12.1673
        Asia |   6.591814   2.410405     2.73   0.007     1.831273    11.35235
      Europe |    5.02073   2.503423     2.01   0.047       .07648    9.964981
     Oceania |   1.502632   1.383709     1.09   0.279    -1.230188    4.235451
CenterSouthAmerica |   18.73162   4.411612     4.25   0.000     10.01871    27.44454
       _cons |   1186.361   214.8768     5.52   0.000     761.9797    1610.742
------------------------------------------------------------------------------
```

The results are based on 1894 observations and the F test rejects the null hypothesis of the coefficients of the independent variables being zero. As specified above, the inflation rate has been computed on the explanatory variables "time", "intervention" and their product "intervention_time" and controlled for the output gap, the measure of trade openness and the year taken in a linear way. Controlling also for the different continents. The coefficients on "time" and "intervention" are both negative, but only "time" is significant. The negative coefficient of the variable "time" can be explained as the change in the inflation rate in those countries that have had a woman as chair of the central bank, with inflation decreasing during the first three years of her tenure.

However, the variable of major interest "intervention_time" has a positive and significant coefficient. This result gives the measure of the difference between the counterfactual unobserved outcome that would have happened if the treated countries never had a female chair, and the actual outcome. The positive coefficient on the variable "intervention_time" means that having a woman in the lead of the monetary policy, brings to more accommodative and flexible preferences towards inflation rate in the economy. Recalling the avion terminology in Sibert (2003), the female monetary policy chair would be defined as a dove and not a hawk. The two macroeconomic variables of output gap and trade openness have different effects, the "OutputGap" has a negative impact on the inflation rate, while the trade openness has a negative but not significative effect. This result can be explained using the inverse relationship between inflation rate and output gap by Kydland and Prescott (1990).

The second regression has as dependent variable the InflationIMF with the following results.

```
Linear regression                               Number of obs =    2075
                                                F( 11,   164) =    4.96
                                                Prob > F      =  0.0000
                                                R-squared     =  0.0786
                                                Root MSE      =  29.469

                                   (Std. Err. adjusted for 165 clusters in country)
------------------------------------------------------------------------------
             |               Robust
InflationIMF |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        time |  -2.819291   1.009022    -2.79   0.006    -4.81164   -.8269411
      intervention |  -5.370937   2.421138    -2.22   0.028   -10.15156   -.5903169
intervention_time |   4.272105   2.102298     2.03   0.044    .1210443    8.423165
   OutputGap |  -9.275219   6.267675    -1.48   0.141   -21.65096    3.100521
       Trade |  -.0558997   .0209307    -2.67   0.008   -.0972281   -.0145714
        year |  -.6136831   .1007075    -6.09   0.000   -.8125336   -.4148327
      Africa |   8.894152   2.140453     4.16   0.000    4.667754    13.12055
        Asia |   9.272304    2.57475     3.60   0.000    4.188372    14.35624
      Europe |   5.490159   2.534999     2.17   0.032    .4847158     10.4956
     Oceania |   2.048731   1.521676     1.35   0.180   -.9558714    5.053333
CenterSouthAmerica |   17.82274   3.856759     4.62   0.000    10.20744    25.43804
       _cons |   1235.568   202.4209     6.10   0.000    835.8809    1635.255
------------------------------------------------------------------------------
```

Compared to the regression on InflationWB, the number of observations has increased to 2075, even though the signs of the coefficients are the same, they show a different magnitude. The variable "Trade" has a negative and significative effect on the inflation rate this time, in line with the literature that links an increasing trade openness to a decline in prices.

In the first two regressions run so far, the coefficient on the variable "intervention_time" has been positive. This can be interpreted as the fact that in those countries that have had a woman as chair of the monetary policy committee, the inflation rate has increased during the female tenure and not decreased, as suggested by the previous literature, due to a more hawkish attitude of chairwomen. The results are more in line with a dovish and accommodative behaviour when the female chair is in charge.

An alternative specification uses the variable "year2" as the product of year*year, to capture any no linear relation between the parameters of interest.

$$InflationWB_{tc} = cons + \beta_1 time_t + \beta_2 intervention_t + \beta_3 time_t * intervention_t + \beta_4 OutputGap_t + \beta_5 Trade_t + \beta_6 year2 + \beta_7 Africa + \beta_8 Asia + \beta_9 Europe + \beta_{10} CenterSouthAmerica + \varepsilon$$

$$InflationIMF_{tc} = cons + \beta_1 time_t + \beta_2 intervention_t + \beta_3 time_t * intervention_t + \beta_4 OutputGap_t + \beta_5 Trade_t + \beta_6 year2 + \beta_7 Africa + \beta_8 Asia + \beta_9 Europe + \beta_{10} CenterSouthAmerica + \varepsilon$$

The results of the specifications are almost the same as in the first specification, with very similar coefficients.

```
Linear regression                               Number of obs =    1894
                                                F( 11,   159) =    4.29
                                                Prob > F      =  0.0000
                                                R-squared     =  0.0792
                                                Root MSE      =   28.69

                                   (Std. Err. adjusted for 160 clusters in country)
------------------------------------------------------------------------------
             |               Robust
InflationWB |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        time |  -2.371596   1.004335    -2.36   0.019    -4.355155   -.3880375
      intervention |  -4.552894   2.585891    -1.76   0.080     -9.66002    .5542313
 intervention_time |   4.176204   1.912592     2.18   0.030     .3988425    7.953565
         OutputGap |  -13.82174    7.35397    -1.88   0.062     -28.3458    .7023265
             Trade |  -.0217795   .0286087    -0.76   0.448    -.0782816    .0347227
             year2 |  -.0001475   .0000268    -5.51   0.000    -.0002003   -.0000946
            Africa |    8.12833   2.044571     3.98   0.000      4.09031    12.16635
              Asia |   6.589379   2.411022     2.73   0.007     1.827619    11.35114
            Europe |   5.017214   2.503955     2.00   0.047      .071913    9.962515
           Oceania |   1.500396   1.385093     1.08   0.280    -1.235156    4.235949
CenterSouthAmerica |   18.72961   4.411848     4.25   0.000     10.01623    27.44299
             _cons |   595.9844   107.6016     5.54   0.000     383.4716    808.4972
------------------------------------------------------------------------------
```

Linear regression

Number of obs	2075
F(11, 164)	4.96
Prob > F	0.0000
R-squared	0.0786
Root MSE	29.47

(Std. Err. adjusted for 165 clusters in country)

InflationIMF	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-2.819566	1.009079	-2.79	0.006	-4.812028	-.8271033
intervention	-5.374854	2.421328	-2.22	0.028	-10.15585	-.5938585
intervention_time	4.275586	2.102728	2.03	0.044	.1236766	8.427496
OutputGap	-9.277064	6.267622	-1.48	0.141	-21.6527	3.098573
Trade	-.0559172	.0209343	-2.67	0.008	-.0972526	-.0145817
year2	-.0001533	.0000251	-6.10	0.000	-.0002029	-.0001037
Africa	8.892445	2.141122	4.15	0.000	4.664726	13.12016
Asia	9.270133	2.575051	3.60	0.000	4.185605	14.35466
Europe	5.487106	2.535362	2.16	0.032	.4809453	10.49327
Oceania	2.047462	1.522755	1.34	0.181	-.9592702	5.054194
CenterSouthAmerica	17.82097	3.857058	4.62	0.000	10.20507	25.43686
_cons	621.4483	101.5472	6.12	0.000	420.9399	821.9567

In the Appendix there are reported the results on another specification that uses dummy variables for all the years of the modified database, excluding the dummy variable for the year 2014 to avoid collinearity. The results on the variable of interest are positive and significative in the setting of the variable "time" as t = 0 the year before the appointment of the woman as chair of the monetary policy committee and t = 1 the third year of tenure. But they turn negative in the sensitivity analysis.

For the sensitivity checks the focus was on the different specification of the two periods, t0 and t1, in the variable "time". In the past regressions, the assumption has been taking t0 as the year before the appointment and referring the time variant variables to that period, and t1 as the third year after the appointment. In order to test the effectiveness of the results, the first sensitivity analysis is run by taking as t0 the year before the appointment, but as t1 the second period of the mandate. The temporal gap considered has been reduced by one year.

Linear regression

Number of obs	1893
F(11, 158)	4.90
Prob > F	0.0000
R-squared	0.0781
Root MSE	28.763

(Std. Err. adjusted for 159 clusters in country)

InflationWB	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-2.370916	1.004214	-2.36	0.019	-4.354331	-.3875014
intervention	-4.506772	2.580608	-1.75	0.083	-9.603711	.5901675
intervention_time	7.189025	3.10575	2.31	0.022	1.054883	13.32317
OutputGap	-13.77746	7.355104	-1.87	0.063	-28.30447	.7495449
Trade	-.0226811	.0287305	-0.79	0.431	-.0794264	.0340642
year	-.5901102	.1073982	-5.49	0.000	-.8022316	-.3779888
Africa	8.35743	1.902366	4.39	0.000	4.600083	12.11478
Asia	6.879782	2.306809	2.98	0.003	2.323621	11.43594
Europe	5.416183	2.406209	2.25	0.026	.6636989	10.16867
Oceania	1.719314	1.158101	1.48	0.140	-.5680416	4.00667
CenterSouthAmerica	18.83917	4.34886	4.33	0.000	10.24977	27.42856
_cons	1186.166	215.3696	5.51	0.000	760.7916	1611.541

Linear regression

Number of obs	2075
F(11, 164)	5.99
Prob > F	0.0000
R-squared	0.0779
Root MSE	29.501

(Std. Err. adjusted for 165 clusters in country)

InflationIMF	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-2.814138	1.009292	-2.79	0.006	-4.80702	-.8212565
intervention	-5.263453	2.409555	-2.18	0.030	-10.0212	-.5057039
intervention_time	8.118624	2.953078	2.75	0.007	2.28767	13.94958
OutputGap	-9.462329	6.284781	-1.51	0.134	-21.87185	2.947188
Trade	-.0576146	.0210002	-2.74	0.007	-.0990803	-.0161489
year	-.6154784	.1006291	-6.12	0.000	-.814174	-.4167828
Africa	9.166217	1.971878	4.65	0.000	5.272676	13.05976
Asia	9.710156	2.4325	3.99	0.000	4.9071	14.51321
Europe	5.935287	2.412459	2.46	0.015	1.171804	10.69877
Oceania	2.346589	1.277231	1.84	0.068	-.1753482	4.868526
CenterSouthAmerica	17.82374	3.759441	4.74	0.000	10.4006	25.24689
_cons	1238.95	202.2624	6.13	0.000	839.5754	1638.324

The variable of interest “time”, “intervention” and “intervention_time” have kept the same signs but the magnitude of the last coefficient has improved together with the significance. In the second year of her tenure, the female chair is even more dovish in the choices of monetary policy goals.

The second analysis changes the initial year of the variable “time”, not considering the year before the appointment, but the exact period the female chair started her mandate, while keeping the time = 1 at the third year after the appointment.

Linear regression

Number of obs	= 1894
F(11, 159)	= 4.21
Prob > F	= 0.0000
R-squared	= 0.0780
Root MSE	= 28.711

(Std. Err. adjusted for 160 clusters in country)

InflationWB	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-2.376109	1.004635	-2.37	0.019	-4.360259	-.3919587
intervention	-2.218198	3.071429	-0.72	0.471	-8.284259	3.847862
intervention_time	.8504508	1.892435	0.45	0.654	-2.887101	4.588003
OutputGap	-13.60776	7.194134	-1.89	0.060	-27.81614	.6006325
Trade	-.0194112	.0285094	-0.68	0.497	-.0757171	.0368947
year	-.5879021	.1072324	-5.48	0.000	-.7996858	-.3761184
Africa	8.085233	2.079552	3.89	0.000	3.978125	12.19234
Asia	6.428434	2.442937	2.63	0.009	1.603641	11.25323
Europe	5.0329	2.541029	1.98	0.049	.014377	10.05142
Oceania	1.481714	1.44067	1.03	0.305	-1.363603	4.327031
CenterSouthAmerica	18.59495	4.433269	4.19	0.000	9.839265	27.35064
_cons	1181.88	215.0435	5.50	0.000	757.1699	1606.59

Linear regression

Number of obs	= 2093
F(11, 164)	= 5.26
Prob > F	= 0.0000
R-squared	= 0.0755
Root MSE	= 29.398

(Std. Err. adjusted for 165 clusters in country)

InflationIMF	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-2.806048	1.002839	-2.80	0.006	-4.786189	-.8259078
intervention	-2.466134	2.741774	-0.90	0.370	-7.879862	2.947595
intervention_time	3.172262	2.014462	1.57	0.117	-.8053628	7.149887
OutputGap	-9.191852	6.079056	-1.51	0.132	-21.19516	2.811454
Trade	-.0580505	.0215061	-2.70	0.008	-.1005152	-.0155859
year	-.6072158	.0994382	-6.11	0.000	-.8035599	-.4108717
Africa	8.994958	2.046529	4.40	0.000	4.954016	13.0359
Asia	9.519545	2.501046	3.81	0.000	4.581143	14.45795
Europe	5.723869	2.471768	2.32	0.022	.8432783	10.60446
Oceania	2.160423	1.39882	1.54	0.124	-.6015952	4.922441
CenterSouthAmerica	16.74506	3.74551	4.47	0.000	9.349418	24.1407
_cons	1222.596	199.8945	6.12	0.000	827.8975	1617.295

Conclusion

Wilson (2019) ranked Fed President Janet Yellen as an outsider among other women in central banks, being a dove among hawks. The empirical results in this dissertation prove that perhaps a dovish chairwoman is not such a rare event. The results of the regressions show a positive effect of the coefficient of the variable "intervention_time" that measures the effect on inflation rate in those countries that experienced gender diversity at the top position of the central bank. The variable has been isolated through the differences-in-differences estimation method. When the responsibility of the direction of the monetary policy committee passes from a man to a woman, the effect is an increase in volatility. The result can be interpreted as female chair being more accommodative and tolerant towards higher volatility of inflation, in opposition to the previous literature that has related women in central banks with a more conservative and hawkish attitude. The dovish attitude can be explained by those traits associated with femininity, such as being more tolerant and supportive of the community and the needs of the others. Previous studies on social responsibility have shown as women are more affected by social inequality than men. When applied to a female monetary policy chair, this last assumption can be seen in the need to use monetary tools to prevent the rise of unemployment, which would increase when the goal of the central bank is to keep inflation as close as possible to the target.

Further researches can focus even on the other macroeconomic variables such as the unemployment level and see if it changes when a woman is appointed as chair of the monetary policy board. The educational and professional background has been proved to shape the policy preferences and these variables could be included in another research to better capture the preferences of the women compared to men.

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Appendix

Table 1: List of Countries by continents

Africa	Asia	Europe	Oceania	North America	Center South America
Tunisia	Afganistan	Albania	Australia	Bermuda	Aruba
Algeria	Armenia	Austria	Fiji	Canada	Bahamas
Angola	Azerbaijan	Belarus	New Zealand	United States	Barbados
Benin	Bahrain	Belgium	Papua New Guinea		Cayman Islands
Botswana	Bangladesh	Bosnia and Herzegovina	Samoa		Cuba
Burkina Faso	Bhutan	Bulgaria	Solomon Islands		Curacao
Burundi	Brunei	Croatia	Vanuatu		Dominican Republic
Cameroon	Cambodia	Czech Republic	Tonga		Haiti
Cape Verde	China	Denmark			Jamaica
Central African Republic	Cyprus	Estonia			Trinidad and Tobago
Chad	Georgia	Euro area			Belize
Congo, Democratic Republic	Hong Kong SAR	Finland			Costa Rica
Congo, Republic	India	France			Guatemala
Egypt	Indonesia	Germany			Honduras
Uganda	Iran	Greece			Mexico
Zambia	Iraq	Hungary			Nicaragua
Equatorial Guinea	Israel	Iceland			Panama
Eswatini	Japan	Ireland			Argentina
Ethiopia	Jordan	Italy			Bolivia
Gabon	Kazakhstan	Kosovo			Brazil
Gambia	Korea, Republic	Latvia			El Salvador
Ghana	Kuwait	Lithuania			Chile
Guinea	Kyrgyz Republic	Luxembourg			Colombia
Guinea-Bissau	Laos	Malta			Ecuador
Ivory Coast	Lebanon	Moldova			Guyana
Kenya	Macao	Montenegro			Paraguay
Lesotho	Malaysia	Netherlands			Peru
Liberia	Maldives	North Macedonia			Suriname
Libya	Mongolia	Norway			Uruguay
Madagascar	Myanmar	Poland			Venezuela
Malawi	Nepal	Portugal			
Mali	Oman	Romania			
Mauritius	Pakistan	Russia			
Zimbabwe	Palestine	San Marino			
Morocco	Philippines	Serbia			
Mozambique	Qatar	Slovak Republic			
Namibia	Saudi Arabia	Slovenia			
Niger	Singapore	Spain			
Nigeria	Sri Lanka	Sweden			
Rwanda	Syria	Switzerland			
Sao Tome and Principe	Tajikistan	Ukraine			
Senegal	Thailand	United Kingdom			
Seychelles	Turkey				
Sierra Leone	Turkmenistan				
South Africa	United Arab Emirates				
Sudan	Uzbekistan				
Tanzania	Vietnam				
Togo	Yemen				

Table 2: Female Monetary Policy Committees Chairs

Date of appointment	Country	Name of female MPC Chair	End of tenure
1950	East Germany	Margaretha Kuckhoff	1958
1967	East Germany	Margarete Wittkowski	1974
1985	Bolivia	Tamara Sanchez Pena	1985
01/03/1985	China	Chen Muhua	01/04/1988
1988	Laos	Pany Yathotou	1992
01/05/1990	Austria	Maria Schaumayer	01/05/1995
01/03/1992	Poland	Hanna Gronkiewics-Waltz	01/12/2000
01/04/1992	Finland	Sirkka Hamalainen	01/05/1998
01/04/1992	Venezuela	Ruth de Krivoy	01/04/1994
01/07/1993	Ecuador	Ana Lucia Armijos	01/08/1996
01/10/1994	Russia	Tatiana V Paramonova	01/12/1995
1995	Laos	Pany Yathotou	1997
01/11/1995	Denmark	Bodil Nyboe Andersen	01/10/2005
01/02/1996	Belarus	Tamara D. Vinnikova	01/01/1997
1998	Honduras	Victoria Asfura de Diaz	01/06/1999
01/04/1998	Guyana	Dolly Sursattie Singh	01/12/2014
1999	Bermuda	Cheryl Ann Lister	01/12/2006
1999	Sao Tome and Principe	Maria do Carmo Trovoada Silveira	01/05/2005
01/10/1999	Botswana	Linah Mohohlo	2016
01/11/1999	Barbados	Marion Williams	01/11/2009
01/05/2000	Malaysia	Zeti Akhtar Aziz	30/04/2016
01/06/2002	Cayman Islands	Cindy Scotland Bush	n.a.
01/08/2002	El Salvador	Luz Maria S. de Portillo	01/05/2009
2003	Turkmenistan	Mukhammedova Shakersoltan	n.a.
01/07/2003	Serbia	Kori Udovicki	01/02/2004
01/07/2003	Tonga	Siosi Cocker Mafi	01/07/2013
01/05/2005	Paraguay	Monica L. Perez dos Santos	01/02/2007
01/06/2005	Bahamas	Wendy Craigg	31/12/2015
2006	Honduras	Gabriela Nunez de Reyes	2007
01/01/2006	Pakistan	Shamshad Akhtar	01/01/2009
01/03/2006	Kenya	Jancinta Mwatela	01/03/2007
01/10/2006	Guatemala	Maria A. Del Cid Navas de Bonilla	01/09/2010
01/11/2006	Thailand	Tarisa Wantanagase	01/09/2010
01/09/2008	Aruba	Jeanette R. Semeleer	Incumbent
2009	Honduras	Sandra Regnia de Midence	2010
2009	Marshall Islands	Ann Marie Muller	n.a.
01/11/2009	South Africa	Gill Marcus	01/11/2014
01/01/2010	Honduras	Maria E.M. de Villar	01/01/2014

03/02/2010	Argentina	Mercedes Marco del Pont	18/11/2013
01/07/2010	Kyrgyzstan	Jeenbaeva Baktygyl	01/06/2011
01/03/2011	Sao Tome and Principe	Maria do Carmo Trovoada Silveira	2016
01/06/2011	Kyrgyzstan	Zina Asankojoieva	01/04/2014
01/07/2011	Belarus	Nadejda Ermakova	01/12/2014
11/08/2011	Samoa	Atalina Ainuu Enari	Incumbent
01/01/2012	Lesotho	Retselisitsoe A. Matlanyane	Incumbent
01/08/2012	Serbia	Jorgovanka Tabakovic	Incumbent
01/04/2013	El Salvador	Marta Evelyn A. de Rivera	01/05/2014
01/04/2013	Venezuela	Edmee Betancourt	01/08/2013
01/06/2013	Russia	Elvira Sark.Nabiullina	Incumbent
01/09/2013	Somalia	Yussur Abrar	01/12/2013
01/10/2013	Madagascar	Vonimanitra Razafimbelo	01/10/2014
01/02/2014	Nigeria	Sarah Alade	01/06/2014
01/04/2014	Cyprus	Chrystalla Georghadji	01/04/2019
01/11/2019	European Union	Christine Lagarde	Incumbent

Source: elaboration from Diouf et al. (2017)

Table 3. Alternative regression with dummy variables for every single year.

Linear regression

Number of obs	1894
F(27, 159)	5.28
Prob > F	0.0000
R-squared	0.1143
Root MSE	28.258

(Std. Err. adjusted for 160 clusters in country)

InflationWB	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-4.245195	3.355607	-1.27	0.208	-10.87251	2.382116
intervention	-5.833042	3.640248	-1.60	0.111	-13.02252	1.356434
intervention_time	5.540411	3.564271	1.55	0.122	-1.49901	12.57983
OutputGap	-24.38823	10.64235	-2.29	0.023	-45.40682	-3.369632
Trade	-.0194422	.0282323	-0.69	0.492	-.0752009	.0363165
Africa	8.464682	1.823517	4.64	0.000	4.863244	12.06612
Asia	6.828929	2.214851	3.08	0.002	2.454607	11.20325
Europe	5.355685	2.311306	2.32	0.022	.7908643	9.920506
Oceania	1.879483	.9133599	2.06	0.041	.0756005	3.683365
CenterSouthAmerica	19.09957	4.375207	4.37	0.000	10.45855	27.74058
y_1983	8.152393	5.399145	1.51	0.133	-2.510898	18.81568
y_1986	7.415998	4.327329	1.71	0.089	-1.13046	15.96246
y_1987	4.052514	3.973492	1.02	0.309	-3.795117	11.90014
y_1990	8.269078	2.079691	3.98	0.000	4.161695	12.37646
y_1991	20.80687	7.457219	2.79	0.006	6.078886	35.53485
y_1994	17.95011	4.55536	3.94	0.000	8.953293	26.94693
y_1995	16.13085	5.521479	2.92	0.004	5.225947	27.03575
y_1998	4.334332	1.510448	2.87	0.005	1.351203	7.317462
y_1999	-.9921329	4.06159	-0.24	0.807	-9.013758	7.029492
y_2002	-1.540561	1.351738	-1.14	0.256	-4.21024	1.129117
y_2003	-8.122041	3.990905	-2.04	0.043	-16.00406	-.2400195
y_2006	-4.462129	2.582409	-1.73	0.086	-9.562377	.638118
y_2007	-3.744425	3.382102	-1.11	0.270	-10.42406	2.935214
y_2010	-1.140828	.8309725	-1.37	0.172	-2.781996	.5003395
y_2011	-2.446983	3.286962	-0.74	0.458	-8.93872	4.044755
y_2015	-8.111266	3.609189	-2.25	0.026	-15.2394	-.9831315
y_2018	-3.819754	1.47193	-2.60	0.010	-6.72681	-.9126983
_cons	3.206003	3.305492	0.97	0.334	-3.322332	9.734338

Linear regression

Number of obs	= 2075
F(27, 164)	= 7.00
Prob > F	= 0.0000
R-squared	= 0.1044
Root MSE	= 29.167

(Std. Err. adjusted for 165 clusters in country)

InflationIMF	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
time	-4.373844	3.127456	-1.40	0.164	-10.54911	1.801425
intervention	-5.831436	3.262278	-1.79	0.076	-12.27292	.6100445
intervention_time	4.589719	3.550348	1.29	0.198	-2.420565	11.6
OutputGap	-16.9321	8.229189	-2.06	0.041	-33.18092	-.683278
Trade	-.0532367	.0203574	-2.62	0.010	-.0934332	-.0130403
Africa	9.248017	1.949142	4.74	0.000	5.399369	13.09667
Asia	9.644403	2.405621	4.01	0.000	4.894422	14.39438
Europe	5.983647	2.355999	2.54	0.012	1.331646	10.63565
Oceania	2.37672	1.110225	2.14	0.034	.1845412	4.568898
CenterSouthAmerica	18.10533	3.788857	4.78	0.000	10.6241	25.58655
y_1983	9.038331	4.720212	1.91	0.057	-.2818902	18.35855
y_1986	9.889981	4.108486	2.41	0.017	1.777634	18.00233
y_1987	11.44808	5.204619	2.20	0.029	1.171384	21.72478
y_1990	9.279917	2.48113	3.74	0.000	4.380841	14.17899
y_1991	20.80108	6.161714	3.38	0.001	8.634562	32.9676
y_1994	14.90311	2.930573	5.09	0.000	9.116594	20.68963
y_1995	15.17307	5.403252	2.81	0.006	4.504165	25.84198
y_1998	4.051284	1.385369	2.92	0.004	1.315825	6.786743
y_1999	-.6789464	3.827044	-0.18	0.859	-8.235577	6.877684
y_2002	-1.201251	1.196487	-1.00	0.317	-3.563756	1.161255
y_2003	-6.730513	3.482224	-1.93	0.055	-13.60628	.1452576
y_2006	-2.647502	2.065328	-1.28	0.202	-6.725565	1.43056
y_2007	-4.125055	3.123838	-1.32	0.189	-10.29318	2.043071
y_2010	-.6134012	.7353345	-0.83	0.405	-2.065345	.8385422
y_2011	-2.166785	3.019367	-0.72	0.474	-8.128629	3.795059
y_2015	-7.569277	3.251546	-2.33	0.021	-13.98957	-1.148987
y_2018	-1.955912	1.105249	-1.77	0.079	-4.138264	.2264404
_cons	4.32264	3.060656	1.41	0.160	-1.720731	10.36601