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Female Representation and the Substantive Representation of Women's Interests by Male MPs.

A longitudinal study investigating the relationship between descriptive representation, critical mass and substantive representation of women's interests by male MPs in UK Parliament from 1979 to 2018.

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Abstract

The impact of female representation on the Substantive Representation of Women's Interests (SRWI) is a heavily researched field, at the same time, the importance of male involvement in gender equality is well established. However, the impacts of female representation on male involvement in gender equality has yet to be studied. This paper is the first of its kind to research the SRWI by male representatives, not as a comparison to women but investigating their involvement independently, using UK Parliament as a case study. This research uses quantitative methods for perform content analysis on UK Parliamentary speech from 1979-2018 asking; how does female representation (both descriptive and substantive) impact the substantive representation of women's interests by male Members of Parliament (MPs) in UK Parliament? This research tests the hypotheses that; the increase of female representation in Parliament will have a positive linear association with SRWI by male MPs and; the reaching of a "critical mass" of descriptive female representation in Parliament will result in a significant change in SRWI by male MPs. The results of this research find that there is no positive linear relationship between female representation and SRWI by male MPs and "critical mass" does not results in immediate change of SRWI. Further statistical modelling has allowed this research to conclude a theory of "critical points" alongside a cubic statistical model whereby the relationship between female representation and SRWI is reactive and dynamic. Previous research often assumes the (positive) change of male representative behaviour in the wake of increased female representation; the results of this research cautions against such assumptions.

Keywords: female representation, substantive representation, critical mass, UK Parliament, male representatives

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Introduction

In recent decades the study of female political representation has grown rapidly. From understanding the barriers female representatives face, to how their presence makes a difference in policy outcomes.

Many arguments are made for the importance of female political representation. Justice arguments that it is simply unfair for men to dominate representation, particularly in those countries that claim modernity and democracy (Childs and Lovenduski, 2013). Pragmatic arguments stress electoral advantage in party politics as female representatives bring legitimacy to decisions and attract the votes of women (Clayton et al., 2018). Arguments of difference come in two forms: that women bring a different approach to politics; and that women are a heterogeneous group that require equal representation for their diversity to be reflected in decision making (Childs and Lovenduski, 2013). Although it is contested whether the presences of female representatives results in meaningful representation of women's interests, there is a transformative argument that predicts the increase of women will in fact change politics by improving the democratic functioning of legislature and increase attention given to inequalities (Tremblay, 1998; Phillips, 1998). This transformation and the mechanisms behind it have come to the forefront of contemporary research on gender and politics.

This transformation is often investigated by examining how the numerical representation of women in politics (descriptive representation), translates into meaningful actions that support the female population (substantive representation). Most famously studied is the theory of critical mass which asserts that once "critical

mass" of 15-30% of a minority group is met, said group will begin to effect change (Mackay, 2004).

Prominent scholars, Childs and Krook point to the importance of the "identities and interests of female and male legislators" within the relationship of descriptive to substantive representation. Many studies conceptualise the similarities and differences between male and female legislators as measures of women's impact (Childs and Krook, 2009). Rather than operationalising the difference between male and female legislators, proven by a multitude of studies, this research takes a different approach.

This paper will use male MPs' Substantive Representation of Women's Interests (SRWI) as the measure of female representation impact. The support of men needed to achieve gender equality is now widely recognised and it is pertinent to investigate this engagement at the highest levels of policy making. This research is unique, as male representatives are frequently used as a benchmark to compare women to, but never investigated as an independent group. This paper hopes to serve as an initial mapping of the landscape as well as a case study that can be replicated for other regions or used in comparative studies.

This research asks; **how does female representation (descriptive and substantive) impact the substantive representation of women's interests by male MPs in UK Parliament?**

This research aims to:

1. Quantitatively investigate the link between representation of women and the SRWI by male MPs in UK Parliament from 1979-2018.
2. Quantitatively investigate the effect of reaching a critical mass of female representation on the SRWI by male MPs in the UK.

Research objectives to:

1. Create a Dictionary of Terms that pertain to women's interests.
2. Use the Dictionary of Terms to perform text data mining on MP speech in Parliament and create a male MP data set.
3. Complete quantitative content analysis using statistical regression methods to reveal when and which male MPs discuss women's interests and thus contribute to its substantive representation.
4. Use analysis results to determine whether female MPs have influenced SRWI by male MPs.

This paper will first discuss the theories of substantive representation and critical mass being investigated in this research, followed by the methodology section outlining the processes of obtaining and creating the dataset. The dataset will then be presented in graphic form preceding the statistical analysis results and discussion sections. The paper finishes with concluding remarks on the research findings with comments on limitations and further research directions.

Female Representation in UK Parliament

The UK is a developed country ranking highly on gender equality measures in the global context and is historically known to be a more progressive country in terms of gender equality; however, in terms female representation in parliament the UK only passed 30% in 2017 much later than Scandinavian countries which now boast nearly equal representation.

Scholarly interest in the UK started to gain momentum with the notable doubling of female representatives in 1997, partly attributed to all-women shortlists adopted by the Labour Party and the rapid growth of female representation in devolved institutions of Scotland and Wales (Mackay, 2004; Childs and Krook, 2006).

Figure 1 shows the growth of female representation in UK parliament from the late 1970s (when Margret Thatcher was Prime Minister with 3% female representation) to 2018, highlighting 1997, when representation doubles from 9.2% to 18.2%, and 2017, when 30% representation is achieved.

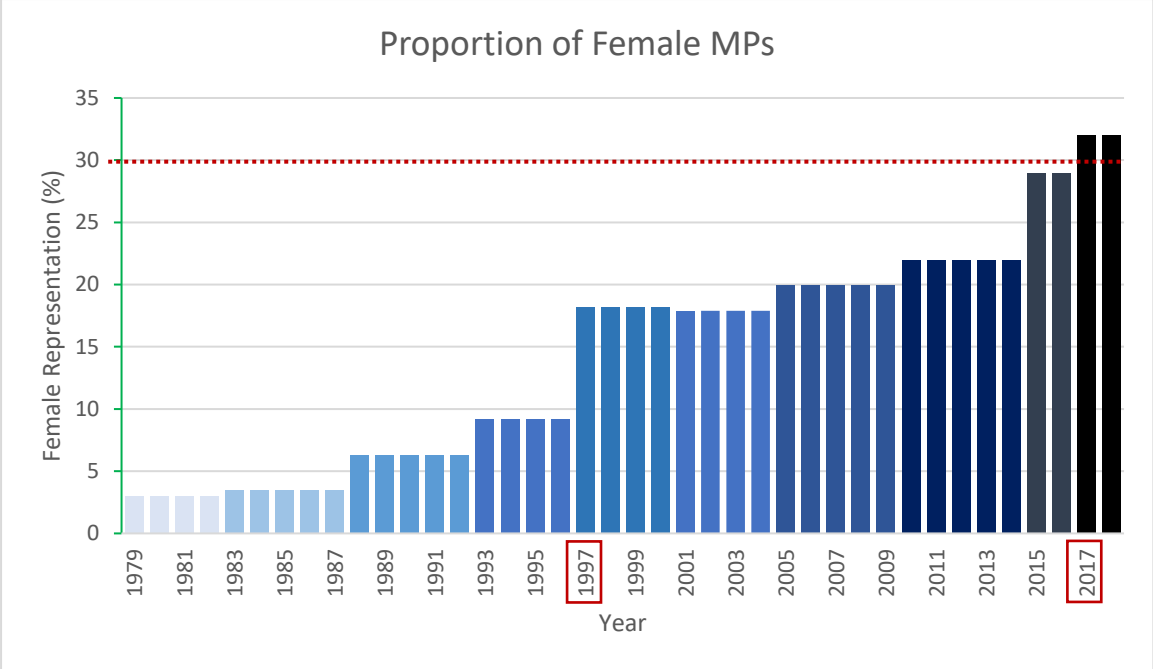

Figure 1: Female Representation in the UK

Post 1997, notable feminist scholars Norris and Lovenduski investigated under what conditions women leaders in elected office have the capacity to make a meaningful difference, finding that once controlling for party there is no significant difference among male and female leaders. It was found that within each party, men and women differed hugely in their support for women's interests with party affiliation rarely making a large impact of female representatives' stance (Norris and Lovenduski, 2001).

Some discuss the deficit of women in parliament as a supply issue - not enough women running for public positions. However, in the UK, research shows it is clearly a demand side issue rather than supply, with studies exposing the gender bias and discrimination in British politics (Lovenduski, 2005). Moreover, in devolved institutions, Wales was the first legislative body in the world to achieve 50/50 representation and Scotland also has high levels of female representation (Kenny, 2015). These achievements undermine the argument for lack of supply.

Already some of the complexities surrounding women's representation have revealed themselves. The next section will discuss the key theoretical arguments of representation in politics and underpinnings for this paper, particularly that of substantive representation and critical mass theory.

Literature Review

Political representation developed as a form of democratic participation by delegating or entrusting the advocacy of citizen interests to a smaller number of individuals or representatives to make decisions in assemblies; however, it can be seen across history that this group has been homogeneously dominated (Childs and Lovenduski, 2013). As society has developed, the importance of a diverse group of representatives reflecting the represented has grown, particularly in the case of women as in numbers they make up an equal portion of the population being represented. It is commonly acknowledged that politics, and political process, is male dominated. Policy is mainly made in the interest of men, historically neglecting women's interests (Dahlerup, 2014). With the rise of women's rights and the feminist movement, the case of female representation in political institutions has been problematised. The following literature review outlines the main theoretical arguments in gender politics focussing on substantive representation and critical mass theory.

Substantive Representation

The most influential of representation theories is Pitkin's "The Concept of Representation". Here Pitkin puts forward four different types of representation:

1) authorized – where representatives are legally empowered to act for another;
2) descriptive – where the representative stands for a group by virtue of sharing similar characteristics such as race, sex or ethnicity;
3) symbolic – where a leader stands for national ideas;
4) substantive – where representatives take meaningful actions to seek the advancements of the group's policy preferences or interests (Pitkin, 1967).

Although not originally intended for explicit use in gender and politics, since its publication many feminist scholars have made use of this framework, most popularly the concepts of descriptive and substantive representation. The connection between proportion of representation and policy has been widely discussed, generally concerning the conditions and relationship between "representation" and "representiveness"; which in essence is the relationship between descriptive and substantive representation (Mackay, 2004). Although this is drawn from Pitkin's original theory, it is an area that is not explicitly discussed in Pitkin's work (Dahlerup, 2014). In light of some feminist scholarship, Pitkin has dismissed the importance of descriptive representation, rejecting its key assumption that there is a link between characteristics and actions, contending that a narrow focus on characteristics is made at the expense of attention to the action of representatives (Childs and Lovenduski, 2013).

Although Pitkin rejected descriptive representation there are key feminist writings that advocate for a politics of presence, most notably Phillips' seminal work which focuses explicitly on gendered political representation. Phillips argues that political deliberation requires the participation of key groups if democratically representative decisions are to be made and that women need to be first present for realisation and insertion of their interests (Philips, 1995). Due to this, feminist scholars have contended that a necessary condition of representation of women's interests is the presence of women in political institutions and other decision-making bodies (Masnbridge, 1999; Phillips, 1995).

It is widely agreed that there are grounds to presume a relationship between the proportion of women in political office and the passing of legislation that benefits

women, these mechanisms are not clear, nor are past studies conclusive (Childs and Krook, 2006). Furthermore, the definition of what constitutes SRWI or "good" SRWI is unclear; is it the support of women's interests by representatives or broadening the range of women's interests (Celis, 2009)? Dahlerup points out that the criterion for "women's interests" is not clear cut, particularly regarding, for example, non-feminist, right-wing female representatives who do not support such policies as free abortion but are still representing a group of women's interests (Dahlerup, 2014). These considerations contribute to the complex decisions that are taken by gender and politics researchers when conducting their investigations and the development of the rich literature in this field (Childs et al., 2010).

From the development of literature around the work of Pitkin and Phillips, studies exploring representative have now started to shift focus away from descriptive representative (the counting of numbers of women present) to SRWI and the transformative relationship between the two. It is established that women do intend to substantively represent women's interests, thus literature has shifted focus from asking "when women make a difference" to "how SRWI occurs" (Dahlerup, 2014; Clayton et al, 2018; Childs and Lovenduski, 2013). This shift has only been possible since the dramatic rise of female presence in political institutions through the introduction of quotas and initiatives informed by theories on the importance of descriptive representation. Most widely used is the theory of critical mass.

Critical Mass Theory

Research on the relations between descriptive and SRWI have often been informed by or add to the development of critical mass theory – the concept where the presence

of a “critical mass” of women, defined by most institutions as 30%, explains the capacity or presence of SRWI whilst the absence of critical mass explains the lack of SRWI (Childs and Krook, 2006; Mackay, 2004). In short, critical mass is seen as a benchmark of descriptive representation for SRWI. The origins of this theory lie in nuclear physics and developed first in gender relations by Kanter who looked into the effects of proportions on group life in industrial corporations. Kanter claims increased representation can result in:

a) women forming coalitions and affecting the culture of the group; women becoming individuals differentiated from one another;
b) women developing close alliances, refusing to turn against each other with strong identification with the feminist cause or other women (Kanter, 1977).

Norris and Lovenduski theorise that when a group is a minority within the larger, its members will adapt to the environment and conform to the predominant rules of the game; however, once critical mass is reached the minority groups will evoke qualitative change in the nature of group interaction and start to assert itself, transforming institutional culture, norms and values (Norris and Lovenduski, 2001).

Work applying critical mass theory to the position of women in public office, argues that presence will evoke change. If the assumption is made that male and female politicians differ in underlying values and political style then when parliaments shift from a skew representation to a more even balance there will be transformations in institutional culture and policy agenda (Lovenduski and Norris, 2003). Critical mass use in political institutions has been widely contested in the academic community for many reasons. Most research focuses on the result of increased representation and the cooperation between women to affect substantive change, however this creates

methodological problems of ignoring micro-level behaviours and assuming that all female representatives act for women (Childs and Krook, 2006). The underpinning assumption of critical mass theory is that it will lead to the promotion of women's interests, however studies point to at least four different scenarios:

1) the rise in descriptive representation leads to women influencing men's behaviour causing both male and female representatives to give more attention to women's interests;
2) the increased presence of women causes backlash amongst male representatives, who thus employ tactics to obstruct policies pertaining to women's interests;
3) lower proportions of women may be more effective in promoting women's interests as they are not seen to undermine male domination;
4) the rise in descriptive representation is a result of increased electoral diversity which may or may not be interested in women's interests (Bratton, 2005; Krook, 2015; Schwindt-Bayer and Mishler, 2005; Childs and Krook, 2009).

As a proponent of presence, Phillips argues for critical mass as numbers are important in representation. Men and women occupy different social and economic positions generating different policy concerns and as such women's presence as elected politicians will affect the deliberation of all elected representatives (Phillips, 1995, 1998). This raised two key questions: how many women are necessary for SRWI; and does it matter who the women are (Childs and Krook, 2009)?

Chaney conducts mixed methods on representation in Scottish and Welsh governments to address the question of "how many". These studies make use of key term searches within spoken words of female MPs. The results of these studies

suggest that critical mass is not the main indicator for SRWI, rather, it is the acts of "critical actors" – individuals who champion women's interests to advance gender equality – that create SRWI (Chaney, 2006; 2012). However, arguments have been made that individual women are not sufficient to guarantee the substantive representation of all women, as individuals care rarely completely account for obstacle confronting the whole group (Weldon, 2002). These arguments of "how many" although opposing each other, generally conclude that Kanter's original claims for critical mass theory can only operate if female politicians differ significantly from men and from each other which comes back to the necessity of presence (Norris and Lovenduski, 2003).

Informed by critical mass theory many countries have implemented gender quotas in order to achieve presence. Large comparative studies on quotas infer that quotas are not a "fast track" to SRWI, even when the proportion of representation is above the upper critical mass threshold, 30% (Dahlerup and Freidenvall, 2006). However other longitudinal studies have found that although quotas for public office elections do not change the highest levels of legislature it does help to increase SRWI in lower levels of legislative institutions (Paxton et al., 2010). Many institutions backlash against quotas asserting that quotas or "all-women shortlists" will lower the entry standards into political office, however this has proven to be the contrary in the case of female representation. A study in the UK found that there was no statistically significant difference between "quota women" and male representatives and that they were equally qualified for office (Allen et al., 2014). Studies in Scandinavia also show an increase effectiveness of government bodies once gender quotas were introduced as the "mediocre" men were replaced by more qualified "quota women" (Besley et al., 2013).

The question of “who” these women are is complex. Even if quotas are implemented the women chosen will be chosen with the same criteria as the men before them who dominate the political legislature; in this case the women elected will hold broadly similar social, educational and political backgrounds (Allen et al., 2014). More crucially, once elected into office, what legislative spaces do these women occupy? In the first instance it is more difficult for women to gain ministerial positions than men, and when they get there, they are often confined to responsibilities defined by traditional gender norms such as welfare, healthcare and education, whereas traditionally masculine roles stay out of reach. Studies on the appointment of female defence ministers show that these appointments only emerge when expectations about women’s roles in politics change (Barnes and O’Brien, 2018). This further adds to the support of the importance of presence.

The literature regarding gender and politics, substantive representation and critical mass is rich. This paper acknowledges the different mechanisms suggested by scholars for the achievement of SRWI and the difficulties in conclusively defining SRWI. It is the opinion of this paper that assessing the theory of presence is a crucial starting point for the exploration of SRWI. As this research is taking a new perspective, by investigating male MP behaviours, it starts with the fundamental assumption that descriptive representation affects SRWI, assessing macro-level beahviour.

Rationale

The case for Quantitative Methods

There are varied critiques on the use of critical mass theory in investigating "how, when and for whom" SRWI occurs, with scholars suggesting it is not pertinent to investigate the "when" but more importantly the "how", and thus abandon macro-level, large scale quantitative analysis (Childs and Krook, 2006, 2009). However, it is difficult to access the "behind-the-scenes" actions within political institutions to research the micro-level behaviours that generate the "how" (Childs and Lovenduski, 2013). It is the opinion of this research that without investigating "when" on a macro-level it is difficult to narrow the research parameters for the micro-level "how" investigation. This is particularly the case when introducing new variables, as this study aims to do with the use of male MP speech for SRWI.

The case for Studying Male MPs

SRWI is widely researched. The majority of research concludes that increased representation of women in parliament results in higher likelihood for women to act for women and implement gender sensitive policies; to introduce bills addressing issues related to family, children and healthcare and; stretch the border of women's interests to fit better with the needs of women themselves (Bratton and Haynie, 1999; Wängerud, 2000; Tremblay, 1998; Chaney, 2006; Celis, 2008). Although this gives a general indication to female representatives' intents in government it does show how male representatives interact in this process. Volden and colleagues followed the outcomes of "women's interests" bills in US congress assessing their success rate in becoming legislation and found that women's interests bills sponsored by male representatives overcame committee hurdles 8% of the time whilst those sponsored by female representatives less than 5% (Volden et al., 2018). From the results of

these studies it is clear that male representatives play a vital role in the progression of women's interests and their engagement in women's interests can lead to substantive change.

This research draws from the work done with critical mass theory on "when" SRWI happens yet hope to bring new findings to the literature by taking a more nuanced perspective on the definition of SRWI. Previous literature does not define SRWI as having to be conducted by women yet most research focuses solely on the behaviours of women, only using men as a comparison. Past research has exhausted questions of when women advocate for women yet are not conclusive in their findings even within the UK context. Thus, this research asks a different question, when does SRWI by *male* representatives occur? Dahlerup argues that the fundamental concepts of women's interests can only be derived from feminist theories on male dominance, concluding the parallel concept of "substantive representation of men" could not exist; thus, it is pertinent to investigate the SRWI by male MPs as an investigation into the reverse would not be theoretically sound (Dahlerup, 2014). Furthermore, this question speaks to the lesser explored area of critical mass theory that predicts the change of male behaviour. This research hopes to serve as a map to indicate when SRWI by male MPs occur and further ask by which male MPs.

It is important to note that this research does not come from the stand point that women do not need women representatives. On the contrary, the assumption is that the presence of women will change the preferences of male representatives to represent the interests of their female constituents supporting the literature for increased presence of female representatives.

Methodology

Hypotheses

H1: The increase of female representation in Parliament will have a positive linear association with Dictionary Term use (SRWI) by male MPs.

H2: The reaching of a critical mass of descriptive female representation in Parliament will result in a significant change in Dictionary Term use (SRWI) by male MPs.

Methods

This research is a case study of women's representation in UK Parliament, using the UK Parliament House of Commons Hansard, an official verbatim report of parliamentary proceedings, to assess the representation of traditional women's interests in UK Parliament. This research is grounded in quantitative content analysis methodology, making use of software developments that allow for computer-aided text analysis, by coding for the presence of terms pertaining to women's interests in MP speech as an indicator of SRWI in UK Parliament (Schreier, 2014; Neuendorf, 2017; Krippendorff, 2013).

Studies on gender and politics have been criticised for mainly making use of qualitative methods resulting in concerns of objectivity (Childs and Krook, 2006). This research makes use of quantitative methods to maintain objectivity and process large amounts of data; however, acknowledges the limits in understanding the institutional and unobservable variables in quantitative research.

This research follows the definition of content analysis given by Berelson as "a research technique for the objective, systematic and quantitative description of the

manifest content of communication", where the communication in question is MP speech as recorded in the Hansard (Berelson, 1952). This type of methodology has been used heavily in the study of representation in government and content analysis of political speech is a common method to identify substantive inclinations (Saafeld, 2011; Osborn and Mendez 2010; Chaney, 2006, 2012; Tremblay 1998, Clayton, 2017).

A set-back of many studies on SRWI is the murky criteria on how to measure SRWI, as compared to descriptive representation, making comparative research difficult (Wängnerud, 2009; Franceschet and Piscopo, 2008). This research draws from previous research, specifically in the UK context, to inform the criteria assessing SRWI by male MPs for ease of future comparison and use in wider literature. This research uses the speaking of predetermined terms, identified from previous research, as an indicator of SRWI by the speaker.

A positive linear relationship is assumed in H1. Although previous qualitative literature notes that this may not be the case, those studies imply that "backlash" occurs after 30% critical mass is reached. As the UK only reached this recently the simple linear association is investigated in the first instance.

Content analysis was performed on all available years of electronic Hansard data using the Quanteda package in R statistical software (Odell, 2019; Welbers et al., 2017). This research followed 4 main steps; (1) the creation of a dictionary of "women's interests" terms; (2) text data mining to extract quantitative data from MP speeches; (3) the consolidation of text data mining results to form a final dataset; (4) statistical analysis of the final dataset to address the original hypotheses.

1. Dictionary Creation

A Dictionary of Terms was created for key terms pertaining to traditional women's interests. Key terms were identified in reference to existing literature and research briefing topics commissioned by UK Parliament in line with traditional feminist definitions of women's interests (Chaney, 2006; Beveridge et al., 2000; Dahlerup, 2014; Mackay, 2004; Childs and Krook, 2009; Researchbriefings.parliament.uk, 2019). It is possible to take these Dictionary Terms from the speech themselves, for example using the most used words by female MPs as the Dictionary thus removing pre-assigned assumption of private interests of women. To aid in future comparison, established women's interests that are assessed in previous literature were used. Using predetermined terms also removes elements of bias and accounts for matters that are inherently women's issues but may not be spoken by female MPs for other systemic reasons (Mackay, 2004; Childs et al., 2010). The Dictionary is divided by six themes: domestic violence, childcare, equality in the labour market, gender and criminal justice, women's health and equal representation (Appendix 1 for full Dictionary).

2. Data Mining

Text data mining was performed searching all speeches made in the Houses of Commons from 1979 to 2018 to determine how often, when and by whom Dictionary Terms were spoken (see Appendix 2 for code).

All those MPs who did not speak more than three times in their time(s) as elected MPs were automatically removed in the first instance, to eliminate the possibility of two different meanings for the value of 0 in the final data set.

Sentimental analysis was conducted on a random selection of speeches with Dictionary Terms to identify if women's interests are discussed positively or negatively, the majority of outcomes were positive. As a result, it was decided to keep results of all speeches with Dictionary Terms regardless of sentiment as the nature of parliamentary speech is to be discursive, therefore, negative engagement is inevitable, however, it is engagement nonetheless and can speak to the change of overall group engagement in such issues. Furthermore, as discussed in the theoretical sections of this paper, what is considered "for women" is ambiguous. Although this research focuses on the SRWI by male MPs, adjustments are not made for the sentiment of representation for the same reasons.

Data points with missing values or N/A values from the original dataset were discarded. Due to programming issues approximately 20 speeches were lost across the whole dataset. Final results from 2 286 177 speeches were extracted. Dictionary Terms spoken per speech is the dependent variables for this research.

3. Dataset Creation

Using the results of text data mining and other meta-data collection, a dataset was created listing the following information for each speech:

Table 1: List of Variables

Variable	**Description**
MP	*Full name of MP making speech.*
Time	*Coded values for number of years since year 1 (1979) that speech was made.*
Gender	*Dummy variable (0, 1), 1=male and 0=female.*
Party	*Party affiliation of MP at the time of speech.*

Conservative	*Dummy variable, 1=Conservative party membership and 0=not Conservative party membership.*
Labour	*Dummy variable, 1=Labour party membership and 0=not Labour party membership.*
Liberal Democrat (Lib Dem)	*Dummy variable, 1=Lib Dem party membership and 0=not Lib Dem party membership.*
Plaid Cymru	*Dummy variable, 1=Plaid Cymru party membership and 0=not Plaid Cymru party membership.*
Scottish National Party (SNP)	*Dummy variable, 1=SNP membership and 0=not SNP membership.*
Female Representation	*Percentage of women holding seats in the House of Commons at the time of speech.*
Critical Mass_29	*Dummy variable, 1=female representation is equal to or above 29% and 0=female representation below 29%.*
Critical Mass_30	*Dummy variable, 1=female representation is equal to or above 30% and 0=female representation below 30%.*
Dictionary Terms Total	*Total number of Dictionary Terms spoken within the speech.*
Dictionary Speech	*Dummy variable, 1=speech contained one or more Dictionary Terms and 0=speech contained no Dictionary Terms.*
Domestic Violence	*Number of Dictionary Terms spoken pertaining to domestic violence within the speech.*
Childcare	*Number of Dictionary Terms spoken pertaining to childcare within the speech.*
Labour Market	*Number of Dictionary Terms spoken pertaining to equality in the labour market within the speech.*
Criminal Justice	*Number of Dictionary Terms spoken pertaining to gender and criminal justice within the speech.*
Women's Health	*Number of Dictionary Terms spoken pertaining to women's health within the speech.*
Representation	*Number of Dictionary Terms spoken pertaining to equal representation within the speech.*

A study looking into the legislative behaviours of Canadian MPs indicated that in comparison to male MPs, female MPs are more likely to give women's interests higher priority regardless of their party affiliation, however another study indicates

that party more than sex explains the impact women have in politics (Gargarella, 1998; Tremblay, 1998). As such party affiliation is a key variable in this research and dummy variables were created to indicate party affiliations and analysis conducted on major parties in UK politics. For variables regarding party affiliation only major UK parties were coded as individual dummy variables, Conservatives, Labour, Liberal Democrats, Plaid Cymru and the SNP. The SNP and Plaid Cymru are included with the three major parties for interest as past literature has covered critical mass and SRWI within the Scottish and Welsh devolved institutions and within the SNP specifically.

A dummy variable for critical mass at 29% is used in one statistical model as the UK reached 30% representation in 2017, resulting in less data points for comparison which can lead to statistical skew. Female representation reached 29% for the election cycle prior. The dataset is presented fully in the following chapter.

4. Statistical Analysis

In order to address the hypotheses, a data subset was created that contained speeches made by male MPs only. This male subset contained 1 963 182 speeches. Using STATA software, linear regression analysis was conducted on the male subset to identify associations between key characteristics and the frequency of dictionary terms spoken in male MP speech whilst measuring and controlling for other variables. Further logistical regression analysis was conducted to identify association in the likelihood of male MPs using a Dictionary Term in a single speech and key characteristics.

The complete linear regression model was created with the dependent variable of total dictionary terms and the following independent or control variables; female representation, age, time, Conservative party dummy, Labour party dummy, Liberal Democrat dummy, Plaid Cymru dunny and SNP dummy. Further linear regression models were then computed using themed Dictionary Terms as the dependent variables to identify trends in themed term usage.

Regression models for individual years were then computed. Models were made for the years 1997 and 2017 as these were the years the lower and upper bounds of critical mass were reached respectively. 1997 is seen as a representation "shock" year with female representatives doubling in numbers. The model for 1997 uses a dummy variable to indicate when female representation crossed the 15% threshold and the model for 2017 uses a dummy variable to indicate when female representation crossed the 30% threshold. As these models only contain data for one year, the variable for time is constant and other environmental factors not accounted for in the dataset should be fairly constant.

A regression model was then computed for speeches made once the lower threshold of critical mass, 15%, had been reached. This was done in order to observe any effect modification in Dictionary Term use and critical mass. Effect modification is the phenomena that happens where there is a differential outcome of one variable based on the strata of another, here looking for a differential effect of female representation on male Dictionary Term use once a critical mass threshold was met. 15% is used rather than the upper threshold 30% as there are only 1.5 years of speeches available since 30% representation was reached. The

reaching of 15% also accounts for roughly half of the data points therefore providing a representative subset of data.

Although the linear relationship is assumed in H1, previous research has indicated to the possibility of “backlash” and a nonlinear relationship (Childs and Krooks, 2006; 2009). Due to this, combined with the results of the linear regression models and graphic representations of the raw data, quadratic and cubic regression models were computed (female representation^2 and female representation^3).

Following this, binary logistic regression models were made to predict the probability of the binary variable “dictionary speech dummy” measuring male MPs making speeches containing Dictionary Terms. Binary logistic models were also computed measuring for the effect of critical mass by adding critical mass dummy variables.

Data Summary

Of the 2 286 177 speeches analysed across the 39-year time period, 1 965 696 were made by men and 320 480 were made by women. From these speeches 42 768 Dictionary Terms were present in male speeches and 26 382 in female. Of male speeches 22 574 contained at least one Dictionary Term. 1.15% of speeches made by men contained Dictionary Terms and 3.62% of speeches made by women. These aggregate numbers across the dataset reflect the findings of previous studies (Wängerud, 2000; Tremblay, 1998).

Trends Over Time

Figure 2 shows an aggregated total of all Dictionary Terms spoken by all MPs over time, here it is possible to identify a general upward trend of women's interests being spoken by MPs. Figure 3 shows the total Dictionary Terms spoken by MPs over time split by male and female MPs. This graph uses a crude total that is not proportionate to the number of speeches made by male and female MPs, as such the total number of Dictionary Terms used by female MPs is lower than men from 1979 to 2014 due to the fact that there were less women in parliament thus they spoke less. Generally, the number of times Dictionary Terms are used by male and female MPs are reflective across the years. What is interesting about this graph is that after 2014 female MPs speak Dictionary Terms more than men even though they hold less seats in parliament. Looking at the male MP trend, there is less differential across time. However, what can be seen is a strong peak in 1996, that is not reflected in the female MP plot.

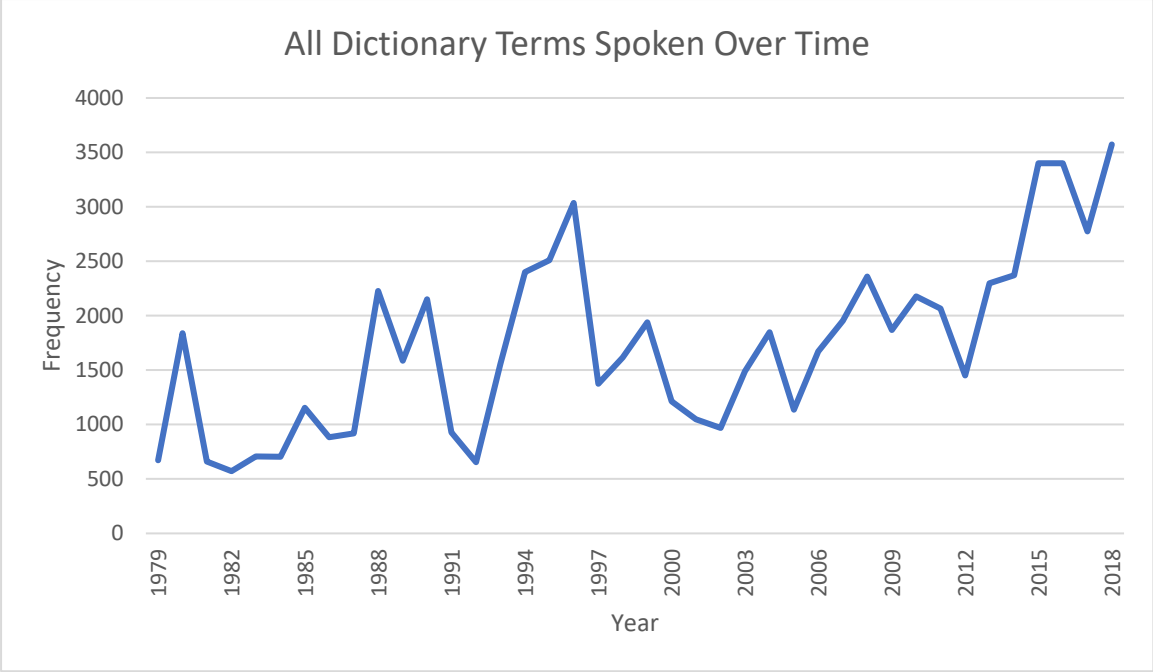

Figure 2: Dictionary Terms Over Time

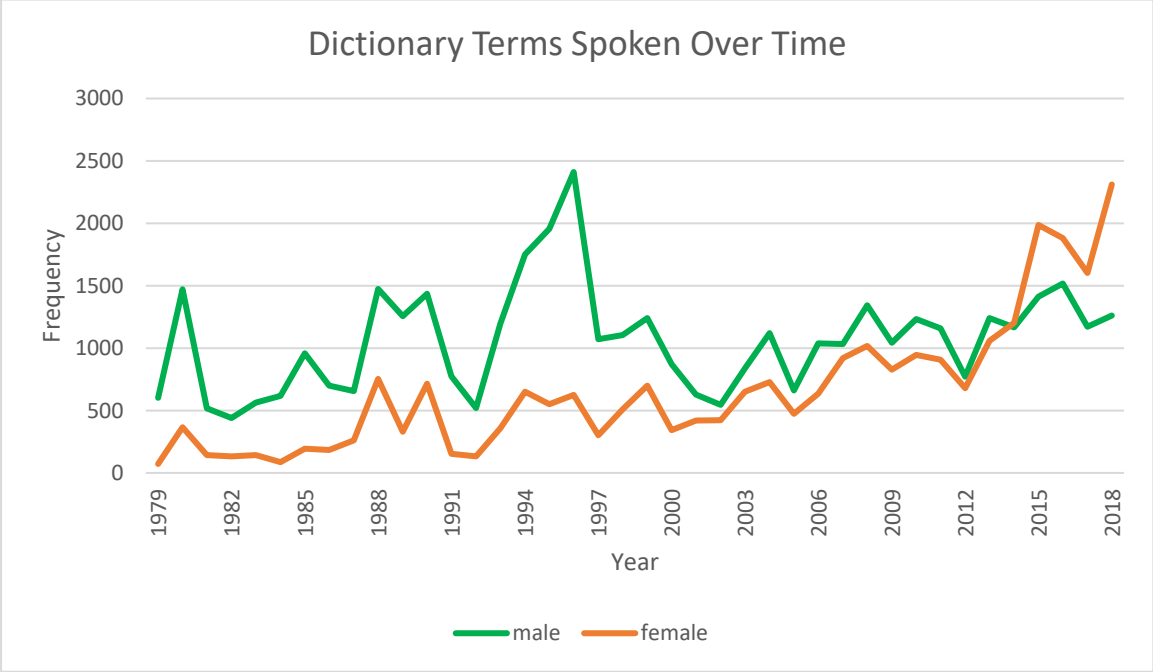

Figure 3: Male and Female MP Dictionary Terms Over Time

Trends by Female Representation

The following graphics show the trend of Dictionary Term usage against percentage of female MPs in parliament.

Figure 4 shows the relative number of speeches that contained Dictionary Terms by male and female MPs across the percentages of female representation that have occurred over the parliamentary sittings from 1979 to 2018. This graph shows that female MPs speak about women's interests proportionally more than men, with a growing gap between the genders as female representation increases. Overall, the proportionate male MP use of Dictionary Terms in speeches increases, however the increases is not as marked as the proportion for female MPs.

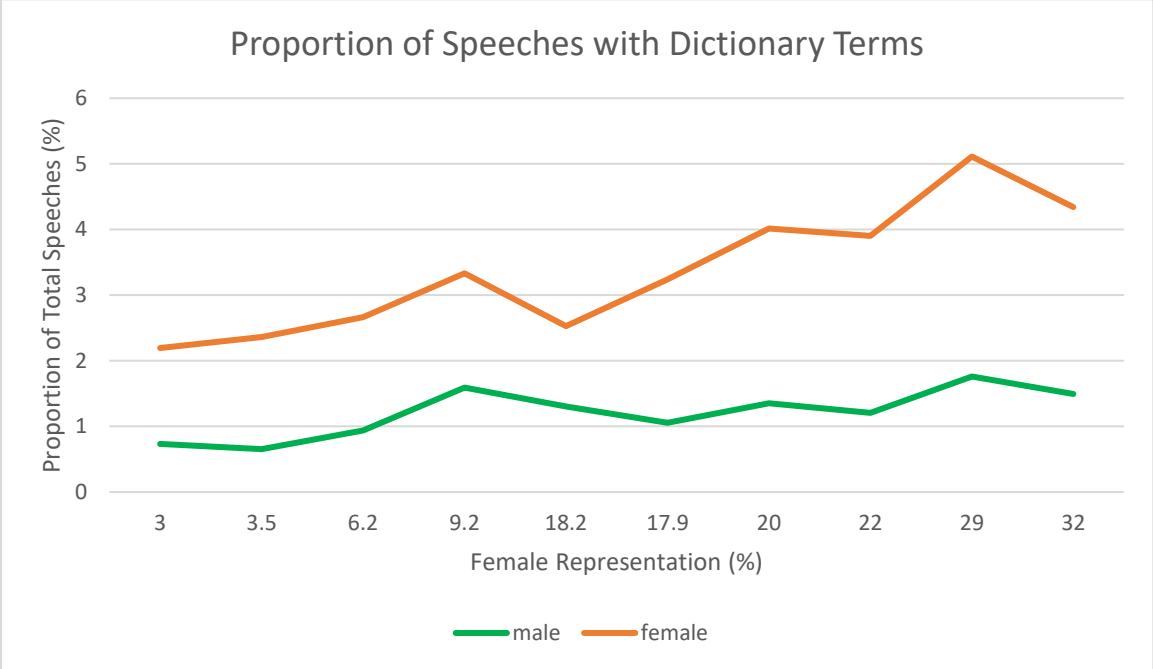

Figure 4: Male and Female Percentage of Speeches with Dictionary Terms

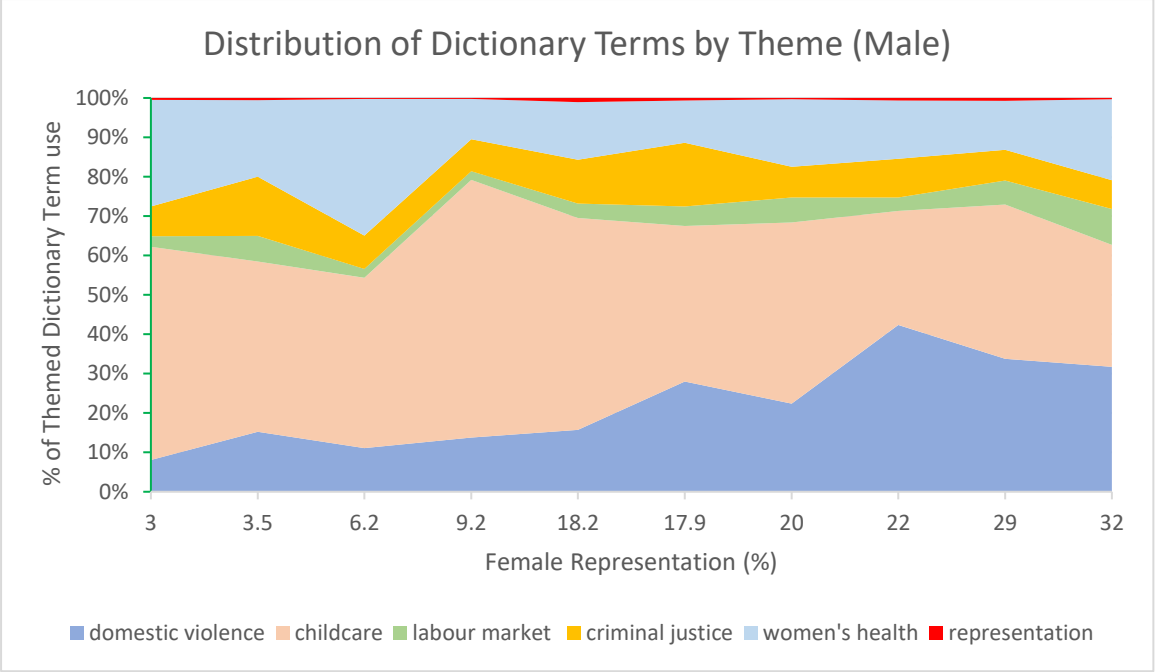

Figure 5: Distribution by Theme for Male MPs

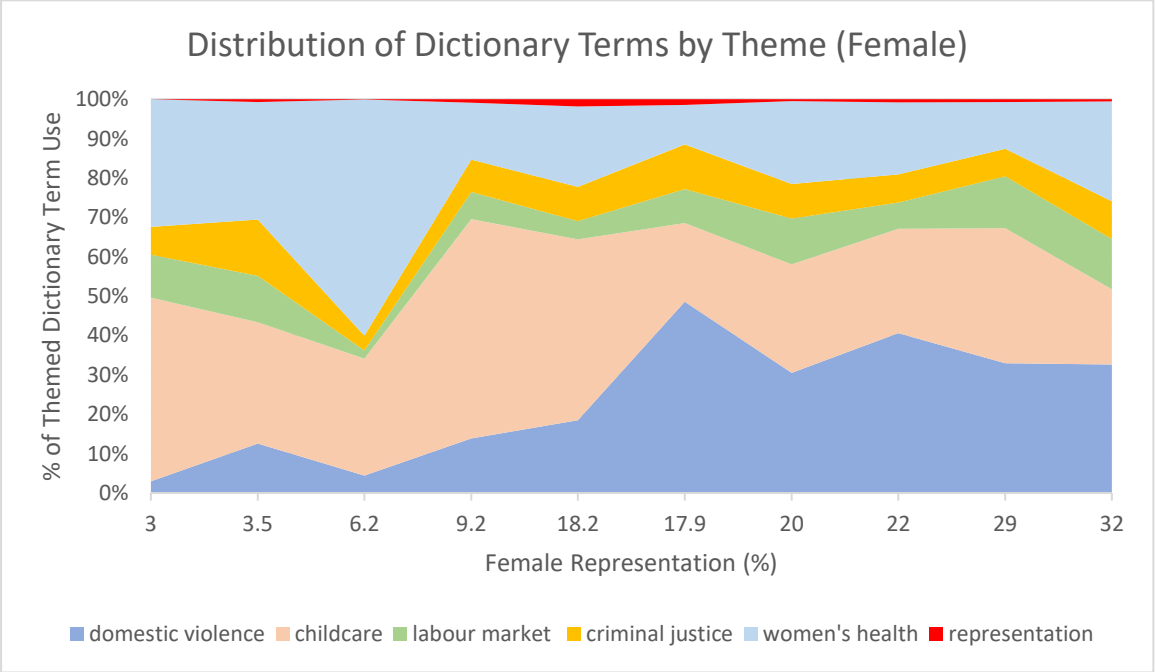

Figure 6: Distribution by Theme for Female MPs

Figures 5 and 6 show the distribution of Dictionary Term use, for male and female MPs respectively, disaggregated by the six themes. The two graphs are fairly reflective of each other; however, it is clear that male MPs are less inclined to speak about women's health and domestic violence as compared to female. When female representation is low, the largest proportion of Dictionary Terms were in regard to

childcare by a significant margin. As female representation increased, the proportion of Dictionary Terms for domestic violence increased to the point where it is fairly equal to Dictionary Terms on childcare today.

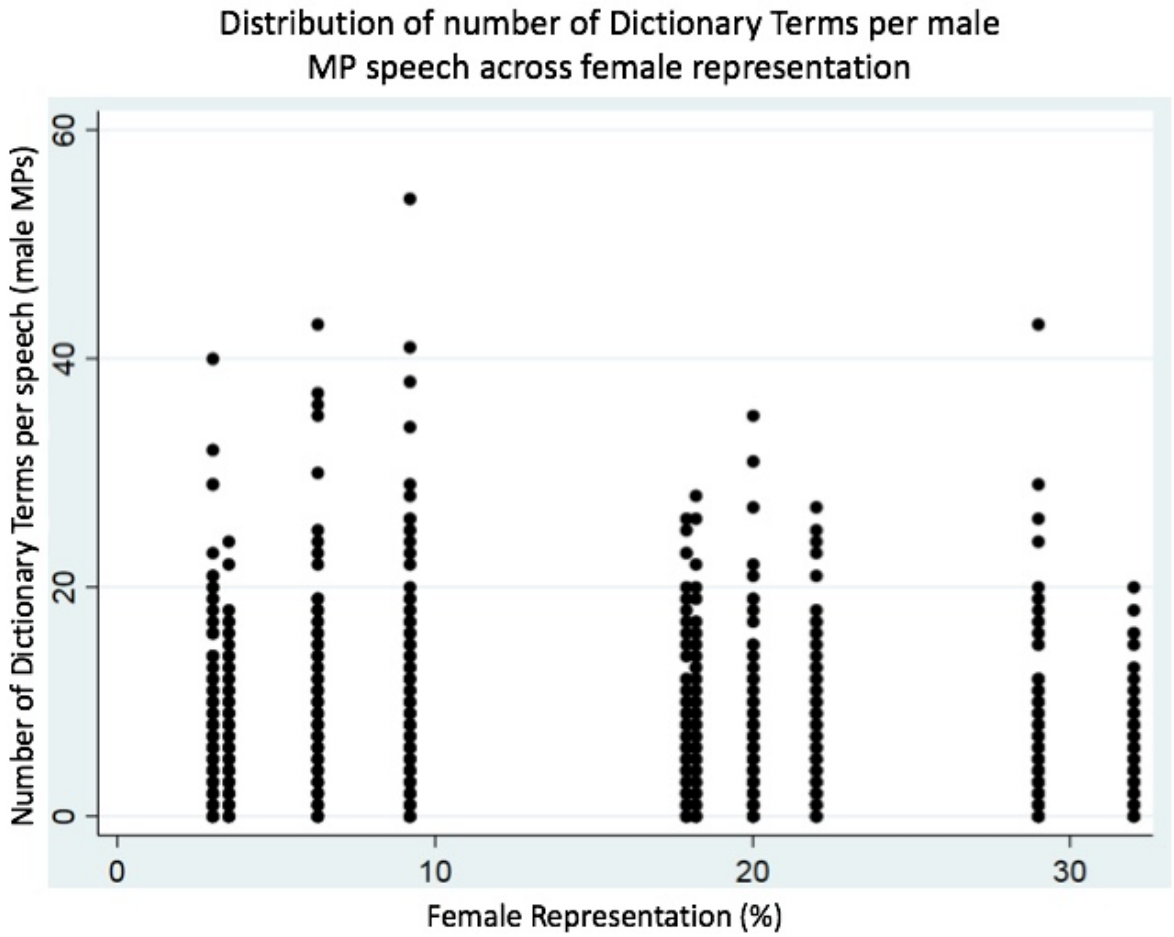

Figure 7: Distribution of Dictionary Terms per Speech for male MPs

Figure 7 shows the scatter graph plot for number of Dictionary Terms used in each male MP speech across the percentage of female MPs in parliament. This plot indicates that as female representation increases there is not a clear linear relationship as the points do not increase diagonally across the graph but seems to increase as female representation increases to a certain point, then start to decrease. Due to the size of the dataset a graph like this will not be indicative, additionally this only shows

a crude relationship not accounting for confounding and effects of other variables. As such statistical models were computed to understand the relationship between Dictionary Term use by male MPs and female representation, the results of which are shown in the following section of this paper.

Statistical Analysis Results

Linear regression models and logistic (logit) regression models were computed to investigate the association between the use of Dictionary Terms by male MPs and various explanatory variables. All values are rounded to 3 significant figures. Sample original outputs for table 1 and logit model 1 (table 8) can be found in Appendix 3. STATA coding for all models can be found in Appendix 4.

The original model computed uses Dictionary Term per speech made by male MPs as the dependent variable, with female representation (%) as the independent variable and age of MP, time, Conservative, Labour, Liberal Democrat, Plaid Cymru and SNP membership dummies as control variables. All of the further linear regression models are based on this original model.

Table 2: Linear regression output for the original model

	Coefficient	Standard error	t-value	p-value	95% confidence interval	
Female representation	-0.000566	0.000106	-5.34	0	-0.000774	-0.000358
Age	-0.000491	0.0000256	-19.26	0	-0.000541	-0.000441
Time	0.000687	0.0000796	8.63	0	0.000531	0.000843
Conservative	-0.00329	0.00105	-3.12	0.002	-0.00535	-0.00122
Labour	0.00376	0.00108	3.50	0	0.00165	0.00587
Lib Dem	0.00419	0.00139	3.02	0.002	0.00147	0.00691
Plaid Cymru	0.00960	0.00327	2.94	0.003	0.00319	0.0160
SNP	0.00115	0.00226	0.51	0.611	-0.00328	0.00558
Constant	0.0416	0.00168	24.82	0	0.0383	0.0449
					Total Observations:	1 963 182
					Adjusted R-Squared:	0.0003

Table 2 shows the linear regression results of the original model indicating the relationship between female representation and Dictionary Term usage when holding constant for MP age, time and affiliation to major parties.

The null hypothesis for the original model is that there is no linear association between the dependant variable and female representation when holding all else constant. The adjusted R-squared value is low; however, this is expected in social science and behaviour research. These results indicate there is a negative association between female representation and Dictionary Term use, significant at the 99% confidence level. For every 1% increase in female representation there is a predicted 0.000566 decrease in the dependant variable, when holding all else constant. As such the null hypothesis can be rejected.

At all levels of conventional significance testing, on average,

- for every year in age increase of a male MP there is a predicted 0.000491 decrease in the dependent variable;
- for every year increase there is a predicted 0.000491 increase in the dependent variable;
- male MPs belonging to the Conservative Party will use 0.00329 less Dictionary Terms in a speech as compared to all other parties;
- male MPs belonging to the Labour Party will use 0.00376 more Dictionary Terms in a speech as compared to all other parties;
- male MPs belonging to the Liberal Democrats will use 0.00419 more Dictionary Terms in a speech as compared to all other parties;
- male MPs belonging to Plaid Cymru will use 0.00115 more Dictionary Terms in a speech as compared to all other parties;
- there is no significant relationship between SNP membership and Dictionary Terms in speech,

when holding all else constant.

Table 3: Beta-coefficients of linear regression models for each Dictionary Term theme

	Female Representation	Age	Time	Conservative	Labour	Lib Dem	Plaid Cymru	SNP
Domestic Violence	-0.000219	-0.0000808	0.000395	N/S	N/S	N/S	0.00537	N/S
Childcare	-0.000445	-0.000297	0.000337	-0.00219	0.00381	0.00287	N/S	N/S
Labour Market	0.0000671	-0.0000282	N/S	-0.000360	N/S	N/S	N/S	0.000827
Criminal Justice	-0.000059	-0.0000293	0.0000648	N/S	0.000454	0.000765	0.00251	N/S
Women's Health	N/S	-0.0000525	-0.0000836	N/S	N/S	0.00215	N/S	-0.00286
Representation	0.0000113	-0.00000028	N/S	-0.000173	-0.000175	-0.000157	N/S	N/S
All Dictionary Terms	-0.000566	-0.000491	0.000687	-0.00329	0.00376	0.00419	0.00960	N/S

N/S= not significant based on all conventional levels of significance testing and 95% confidence interval testing

= positive association

= negative association

Table 3 shows the beta-coefficients for 7 models, modelling the association with the use of Dictionary Terms in male MP speeches by theme (and in total) and the variables from the original model. The null hypotheses of these models are that there is no association between the number of Dictionary Terms for each respective theme in a male MPs speech and female representation, when holding all else constant. There is no significant association between percentage of female representation and the use of women's health themed Dictionary Terms in a male MP speech and thus must accept the null hypothesis. For all other themes the null hypothesis can be rejected.

Here it is possible to infer that there is a negative association between the number of Dictionary Terms used per speech by male MPs and female representation for the themes of domestic violence, childcare and criminal justice; and a positive association between female representation and the use of labour market and representation themed Dictionary Terms in a male MP speech. Across all of these models there is a negative association with age and the number of Dictionary Terms spoken in a speech by a male MP. The rest of the models generally reflect the results of the complete model.

Table 4: Beta-coefficients of linear regression models for individual years where lower and upper bounds of critical mass were met

	Critical mass threshold	Age	Conservative	Labour	Lib Dem	Plaid Cymru	SNP
1997 model	N/S	-0.000681	N/S	N/S	N/S	N/S	N/S
2017 model	N/S	-0.000740	N/S	N/S	N/S	N/S	N/S

N/S= not significant based on all conventional levels of significance testing and 95% confidence interval testing

Table 4 shows the beta-coefficients of computed models for individual years that are significant in the progression of female representation and critical mass. The null hypothesis for the 1997 model is that there is no association between Dictionary Term use in male MP speeches and reaching 15% critical mass in the year 1997, when holding all else constant. The null hypothesis for the 2017 model is that there is no association between Dictionary Term use in male MP speeches and reaching 30% critical mass in the year 2017, when holding all else constant. These models show that within each given year there is no statistically significant change in the number of Dictionary Terms used in male MP speech once critical mass thresholds are met and thus the null hypothesis is accepted.

Table 5: Beta-coefficients of linear regression models for Dictionary Theme after 15% female representation is reached

	Female Representation	Age	Time	Conservative	Labour	Lib Dem	Plaid Cymru	SNP
Domestic Violence	-0.000122	-0.0000824	0.000464	N/S	N/S	N/S	0.00969	N/S
Childcare	0.000575	-0.000266	-0.000353	-0.00343	N/S	N/S	N/S	N/S
Labour Market	0.000129	-0.000042	N/S	N/S	N/S	N/S	N/S	0.000892
Criminal Justice	N/S	-0.0000295	N/S	0.000629	0.000628	0.000956	0.00256	N/S
Women's Health	0.000235	-0.0000416	N/S	-0.00130	N/S	N/S	-0.00463	-0.00372
Representation	0.0000146	N/S	N/S	N/S	N/S	N/S	N/S	N/S
All Dictionary Terms	0.00845	-0.00467	N/S	-0.00372	N/S	N/S	N/S	N/S

N/S= not significant based on all conventional levels of significance testing and 95% confidence interval testing

= positive association

= negative association

Table 5 shows the beta-coefficients for models modelling the association between the use of Dictionary Terms in male MP speeches by theme and the variables from the original model only in data where female representation is equal to or above 15% (the lower threshold of critical mass) to observe the presence of effect modification.

The null hypotheses being tested in table 5 are that there is no association between Dictionary Term, and Dictionary Term themed use respectively, and female representation over 15%. Overall it can be predicted that on average, once female representation is above 15%, for every 1% increase in female representation there is a 0.00845 increase in number of all Dictionary Terms used in speeches made by male MPs when holding all else constant, therefore reject the null hypothesis for total Dictionary Term use. It is possible to infer that there is a negative association between the number of Dictionary Terms used per speech by male MPs and percentage of female representation for the themes of domestic violence, no significant association for the use of criminal justice themed Dictionary Terms and a positive association for all other themes. The null hypothesis can be rejected for all themes bar criminal justice.

When comparing with the original model, the model computing associations for speeches after 15% female representation was reached and the model computing associations for speeches before 15% female representation was reached, shown in in table 6, it is possible to see that there are a differential associations between overall Dictionary Term use in speeches by male MPs at different levels of female representation. The comparison of these models using f-tests and comparing R-squared statistics is not conclusive; however, does indicate that there may be a more complex relationship between female representation and number of dictionary terms used by male MPs in speeches than a simple linear model. As such quadratic and cubic models were computed, as shown in in table 7.

Table 6: Comparison of linear regression models for critical mass threshold

	Original Model	Female Representation <= 15%	Female Representation >= 15%
Female Representation	-0.000566 (0.00)	0.00351 (0.00)	0.00845 (0.00)
Age	-0.000491 (0.00)	-0.000476 (0.00)	-0.00467 (0.00)
Time	0.000687 (0.00)	-0.000771 (0.707)	0.000 (0.999)
Conservative	-0.00329 (0.002)	-0.00433 (0.009)	-0.00372 (0.005)
Labour	0.00376 (0.00)	0.00593 (0.001)	0.00170 (0.213)
Lib Dem	0.00419 (0.002)	0.020 (0.00)	-0.000382 (0.814)
Plaid Cymru	0.00960 (0.003)	0.012 (0.024)	0.00622 (0.115)
SNP	0.00115 (0.611)	0.000395 (0.942)	-0.00166 (0.498)
Constant	0.0416 (0.00)	0.258 (0.00)	0.0295 (0.00)
		KEY=	Beta-coefficient (p-value)
Total Observations	1 963 182	949 883	1 013 299
Adjusted R^2	0.0004	0.0010	0.0003

= not significant based on all conventional levels of significance testing and 95% confidence interval testing.

The original scatter graph of all data points (figure 7) and the comparison of the above models have given reason to compute quadratic and cubic models which can measure

fit for non-linear associations between female representation and number of Dictionary Terms used in male MP speech. These models fit the dataset with non-linear associations (sample positive curves drawn in figure 8), for example a positive quadratic association where Dictionary Term use increased until a certain point then start to decrease.

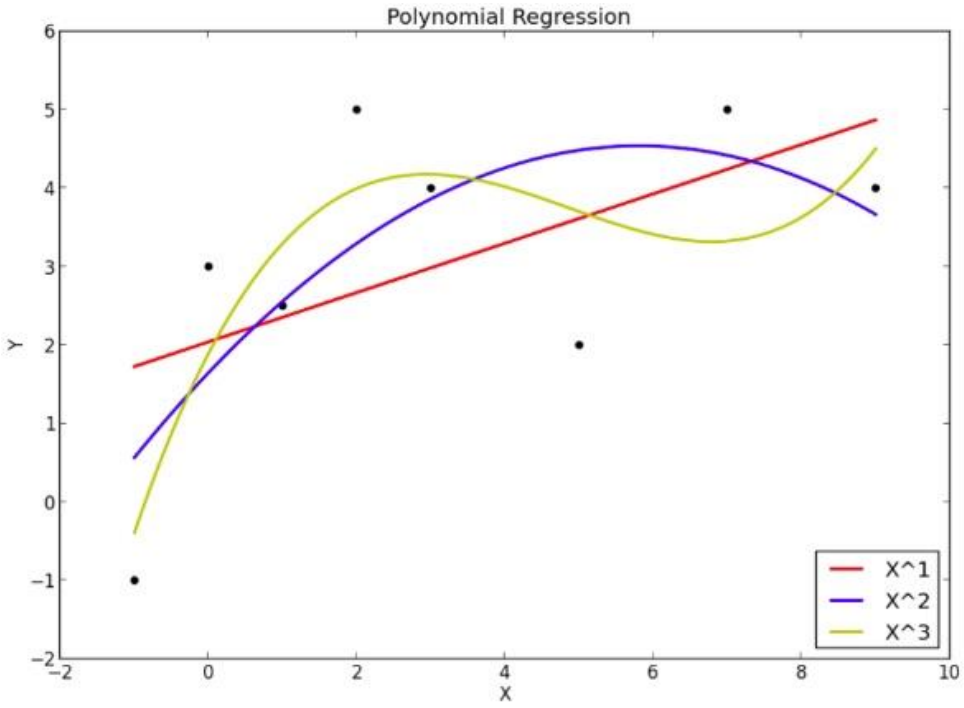

Figure 8: Models of Polynomial Regression

Beta-coefficients and p-values for the quadratic and cubic model are shown in table 7. The p-values associated with the variables in the quadratic model are comparatively high; however, the cubic curve most resembles that of the crude relationship between number of Dictionary Terms used in male MP speech and female representation, thus this is the model focused on. To test the relative fit of the cubic model compared to the linear a f-test is conducted to compare the linear model and the cubic model. The f-test statistic comparing the linear and cubic model is 98.2, lying above the critical value

for all conventional levels of significance testing implying it is possible to reject the null hypothesis for this test that the cubic model is not a better fit.

Table 7: Comparison of linear, quadratic and cubic models.

	Linear Model	Quadratic Model	Cubic Model
Age	-0.000491 (0.00)	-0.000492 (0.00)	-0.000493 (0.00)
Time	0.000687 (0.00)	0.000717 (0.00)	0.000651 (0.00)
Conservative	-0.00329 (0.002)	-0.00331 (0.002)	-0.00394 (0.00)
Labour	0.00376 (0.00)	0.00384 (0.00)	0.00352 (0.001)
Lib Dem	0.00419 (0.002)	0.00431 (0.002)	0.00472 (0.001)
Plaid Cymru	0.00960 (0.003)	0.00967 (0.003)	0.00886 (0.007)
SNP	0.00115 (0.611)	0.000957 (0.673)	-0.00297 (0.896)
Constant	0.0416 (0.00)	0.422 (0.00)	0.0238 (0.00)
Female Representation	-0.000566 (0.00)	-0.00725 (0.00)	0.00531 (0.00)
Female Representation^2		0.000000401 (0.268)	-0.000412 (0.00)
Female Representation^3			0.000000008 (0.00)
Adjusted R^2	0.0004	0.0004	0.0005
		KEY=	Beta-coefficient (p-value)

= not significant based on all conventional levels of significance testing and 95% confidence interval testing.

It is not conclusive that the linear model has the best explanatory power, therefore logistic models were computed (table 8). Binary logistic (logit) models are used, these model for a binary dependent variable/outcome and produce models indicating the odds of the outcome changing based on the independent variables. As the dependent/outcome variable is binary the model is not fitted to a linear line. Here the dependent variable is no longer the number of Dictionary Terms spoken in a speech by male MPs but whether a male MP used at least one Dictionary Term in their speech.

Table 8: Comparison of logistic models, showing odds ratio and log odds

	Logit model 1	Logit model 2	Logit model 3
Female representation	0.993 (-0.00676)	0,974 (-0.262)	1.02 (0.027)
Age	0.982 (-0.0178)	0.982 (-0.018)	0.982 (-0.018)
Time	1.02 (0.0237)	1.03 (0.339)	1.02 (0.0219)
Conservative	0.869 (-0.140)	0.859 (-0.152)	0.846 (-0.167)
Labour	1.18 (0.168)	1.20 (0.185)	1.22 (0.198)
Lib Dem	1.15 (0.143)	1.19 (0.175)	1.22 (0.202)
Plaid Cymru	1.33 (0.281)	1.34 (0.290)	1.34 (0.291)
SNP	N/S	N/S	0.885 (-0.122)
Constant	0.0194* (0.0267)	1.34* (-3.88)	0.0173* (-4.05)
Critical Mass Dummy (29%)		1.34 (0.295)	
Critical Mass Dummy (30%)			0.533 (-0.630)
Pseudo R-squared	0.0079	0.0083	0.0095
		KEY=	Odds Ratio (Log odds/beta coefficient)

*Constant for odds ratio estimates baseline odds.
N/S= not significant based on all conventional levels of significance testing and 95% confidence interval testing
= increased odds
= decreased odds

The dependent variable for these logistic models refers to a male MP using a Dictionary Term in a speech. The null hypothesis for logit model 1 is that there is no association between female representation and the odds of a male MP using a Dictionary Term in a speech when holding all else constant. At all conventional levels of significance testing the null hypothesis can be rejected. Model 1 indicates that as female representation increased, the odds of the dependent variable decreased. Using model 1, the odds of the dependent variable decreased 6.76% for every 10% increase in female representation.

Models 2 and 3 adjust model 1 for the reaching of critical mass. Model 2 does not predict significant change from model 1 but does show that reaching 29% female representation increases the odds of the dependent variable as compared to not reaching 29%. Model 3 shows a negative association between the dependent variable and female representation once 30% critical mass is reached. The results of a log likelihood test and the pseudo R-squared values indicate that logit model 3 had a better explanatory power than logit model 1, however due to large sample size, small subset of data above 30%, and behavioural nature of the dependent, variable these are not indicative. What could be discussed are the possible reasons for such a significant change in associations for the most recent election cycle.

Discussion

Hypothesis 1: The increase of female representation in Parliament will have a positive linear association with Dictionary Term use (SRWI) by male MPs.

The linear statistical models (tables 2 and 3) indicate a negative association between Dictionary Term use by male MPs and female representation. In this section the dependent variable refers to the number of Dictionary Terms used by male MPs per speech, which is a proxy for SRWI by male MPs.

On the whole, time had a significant positive association with the SRWI by male MPs, which indicates to the changing social environment. The addition of this variable accounts for its confounding effects on the relationship between female representation and dependent variable. Age of MP also has a strong negative association across all models on the dependent variable.

Across all models it can be seen that male MP engagement in female interests is strongly swayed by their party affiliation, supporting previous literature (Lovenduski and Norris, 2001). Results routinely showed a negative association with the dependent variable for Conservative party members; whereas Labour, Lib Dem and Plaid Cymru affiliation consistently showed a positive association. Therefore, it is possible to assert that party affiliations can alter the effects that female representation has on male MPs. However, it is important to note that this variation may well be due to party manifesto positioning. When looking at the disaggregated themes, the support for topics not commonly seen in party manifestos, generally all those other than childcare, the clear association is not present.

On the converse to previous literature which showed the power of female representation and critical actors in the SNP, the results of this research indicate that there is no association between the dependent variable and SNP membership. This inconsistency draws attention to the literature discussing the role of parties in descriptive representation. Many scholars have noted the discrepancies in descriptive representation between UK political parties and the varying degrees of commitment between them, for example Labour's use of all women shortlists (Campbell et al., 2006; Childs, 2001). Other literature has assessed the effectiveness of critical actors within devolved Parliaments and political parties (Chaney, 2005; Childs and Krook, 2009). The conclusions of these studies do not deny the importance of internal party resolutions for descriptive representation. These conclusions, coupled with the results of this research leads to the question: how can internal party resolutions translate to SRWI at the national level by male representatives?

The results of this research can conclusively say that within UK parliament there is not a positive linear association with SRWI by male MPs and female representation. The linear regression models show a negative association across the whole dataset; however, models with data-subsets for before and after the lower threshold for critical mass show positive linear associations each side of critical mass. The relatively suitable fit of the cubic regression model leads to the assumption that there is not a linear association but a more complex interaction between female representation and SRWI by male MPs.

The cubic association indicates an initial rise in SRWI by male MPs, followed by a dip then a continued rise. This may indicate that a form of critical mass threshold is an important factor to account for when investigating the SRWI by male MPs.

Hypothesis 2: The reaching of a critical mass of female representation in Parliament will result in a significant change in Dictionary Term use (SRWI) by male MPs.

In order to assess the magnitude of such hypothesised change of SRWI by male MPs without the influence of any external factors, singular years were modelled. The years 1997 and 2017 were selected to measure the effects of the "shock" of reaching the lower threshold of 15% (which coincides with the doubling of female representation in one election) and upper threshold, 30% of critical mass theory. These models show no immediate effect of reaching critical mass on the dependent variable. This speaks to the literature assessing the use of quota's as a "fast-track" to SRWI which argues for a more incremental approach that is, however, reliant on electoral and institutional shifts with strict implementation for more than a "symbolic" change (Dahlerup and Freidenvall, 2005). Although the UK did not implement a national quota, the results of the 1997 election effectively mimicked a quota, mainly due to Labour using all women shortlists (Norris and Lovenduski, 2001). The absence of a reflective "fast-track" of SRWI post an electoral shift rationalises the conclusion that critical mass theory requires a certain amount of time to take effect. This research only examines the effects on male MPs, it is possible that critical mass will first need time to take effect on female representatives before affecting male.

The models looking for effect modification allow for the hypothesised time required for critical mass to take effect. What is interesting about these models is that although across the whole dataset there is a negative association with the dependent variable and female representation, when split by critical mass threshold, the association becomes positive for both before and after. What is important to note is that the beta-coefficients for variables within the model for post 15% critical mass are generally

insignificant. These inferences, alongside comparisons to the line and scatter plots of the crude data, lead to the questioning of the fit of a linear model. The modelling outcomes of the cubic model show more promise.

Drawing from previous studies and the result of this paper's statistical analysis, a cubic relation between descriptive and SRWI could be theorised, of three main stages, illustrated in figure 9.

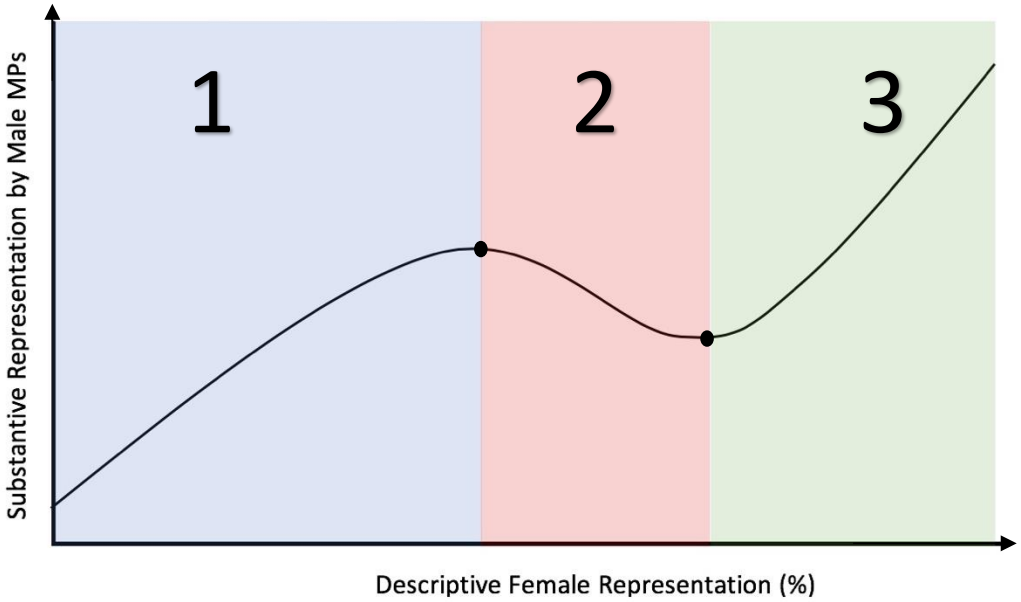

Figure 9: A cubic "critical point" model for Female Representation and SRWI by male MPs

1. As descriptive representation increases there is an initial increase in the SRWI by male MPs affected by the lower proportion of women who do not undermine male domination (Bratton, 2005).
2. Once a "pre-critical mass" threshold is met, the increased presence of women increases SRWI by female MPs causing a backlash amongst male representatives and thus the SRWI by male MPs decreases (Krook, 2015).

3. After time and a reaching of “traditional critical mass” the presence of female representatives is normalised and SRWI by male MPs starts to rise again (Bratton, 2005).

As the UK is still in comparatively early stages of a growing descriptive representation, this model is by no means conclusive. This model peaks and troughs at certain “critical points” (demarked by the black points in figure 9) almost akin to the theory of “inflection points” in economic theory. This model anticipates a highly reactionary relationship between SRWI by male MPs in light of changes to descriptive representation, that is not clearly set at a “critical mass”.

From the previous qualitative research conducted on the mechanisms for SRWI it may be possible to deduce “critical points” in relation to staple features such as backlash, critical actors, diversity of women and political climate (Childs and Krook, 2009). In the future, as female representation grows, this cubic model may no longer be accurate. Even over this dataset’s short time period of four decades, it is clear that this is a an ever changing, reactive and dynamic relationship. This theorisation may not be exhaustive in all contexts but can be an indication as to which cross sections of data are of interest.

It is clear to see that there is some type of relationship and mechanisms where by the presence of women is influencing the behaviour of men, however, not always towards a “women-friendly” environment. This can prompt investigations to the reasons for the decrease in SRWI by male MPs and the possible way in which to sustain the positive change in behaviour for increased SRWI.

Other Findings

A Country in Crisis

The logistic models assert that as descriptive representation increases the odds of SRWI by male MPs decrease; however, the models also show that once 29% descriptive representation is reached the odds of SRWI by male MPs is higher than when 29% had not been reached, supporting the previous discussion of this paper. What is interesting about the logistic models is that for the 30% threshold, which occurred in the most recent electoral cycle, the relationship between descriptive and SRWI inversed. As alluded to previously, the contextual nature under which critical mass is met is crucial. When looking at the contextual environment under which the UK met 30% representation it is reasonable to suggest that these factors smothered the potential positive impact.

Critical mass was met in 2017 after a snap election as a result of the EU referendum, in the wake of a new female Prime Minister, Thereasa May. In the following years UK politics has been largely focused on the policy disputes and polarisation of party values regarding UK's withdrawal from the EU (Brexit) which has been characterised as a "crisis" by not only the media but scholars alike (Cox, 2017). From this research, it is not possible to draw a causal conclusion between the Brexit crisis and the reduction of SRWI by male MPs, but a correlation is clear. There is a large body of research discussing the "back seat" status of women's interests in times of crisis, which has inspired literature investigating the lack of gender in the Brexit debate, which the results of this paper could support (Borland and Sutton, 2007; Hozić and True, 2017; Guerrina and Murphy, 2016).

The appointment of May could induce a backlash towards women's priorities in conjunction with the "glass cliff" phenomena. The glass cliff theory posits that women are more likely to ascend to positions of leadership in times of crisis, thus the symbolism of their position, along with their "women's priorities", is overshadowed (Ryan and Haslam, 2007; Bruchmüller and Branscombe, 2010). As a result, it is not a stretch to assume that not only has the Brexit crisis eclipsed the impact of critical mass on SRWI, but that the appointment of May has compounded this negative effect increasing the backlash. Furthermore, the stereotypical perception of female leaders often leads to over masculinisation of their policy priorities (Wilkinson, 2019; Beveridge, 2000). The influence of "crisis" and "glass cliff" on the mechanisms between descriptive and substantive representation is not fully explored in this research, but a correlation can be inferred.

Gender Typing of Women's Interests

Female MPs have recently over taken male MPs in the number of times they discuss women's interests even though their relative representation is half that of male MPs. Although this could be a promising sign for increased influence on male MPs, it could be a sign that male MPs have decided to take a backseat on women's interests now that women are present to "speak for themselves" (Beveridge et al., 2000).

From the graphic plots (figures 5 and 6), illustrating the crude relationships between MPs speaking about women's interests by theme and female representation it is clear that there has been a diversification of topics. However, this coupled with the overall drop in male MP attention to women's interests allows for the postulation that whilst some sectors grew, others were neglected. When looking more closely at the disaggregated themed data it is possible to see that some sectors are seeing a

withdrawal of male MP attention as female representation grows. For example, figures 10 and 11 show that as female representation approached the 30% critical mass, male MP use of Childcare and Women's Health Dictionary Terms has declined to below that of female MP use even whilst male representation was double that of females.

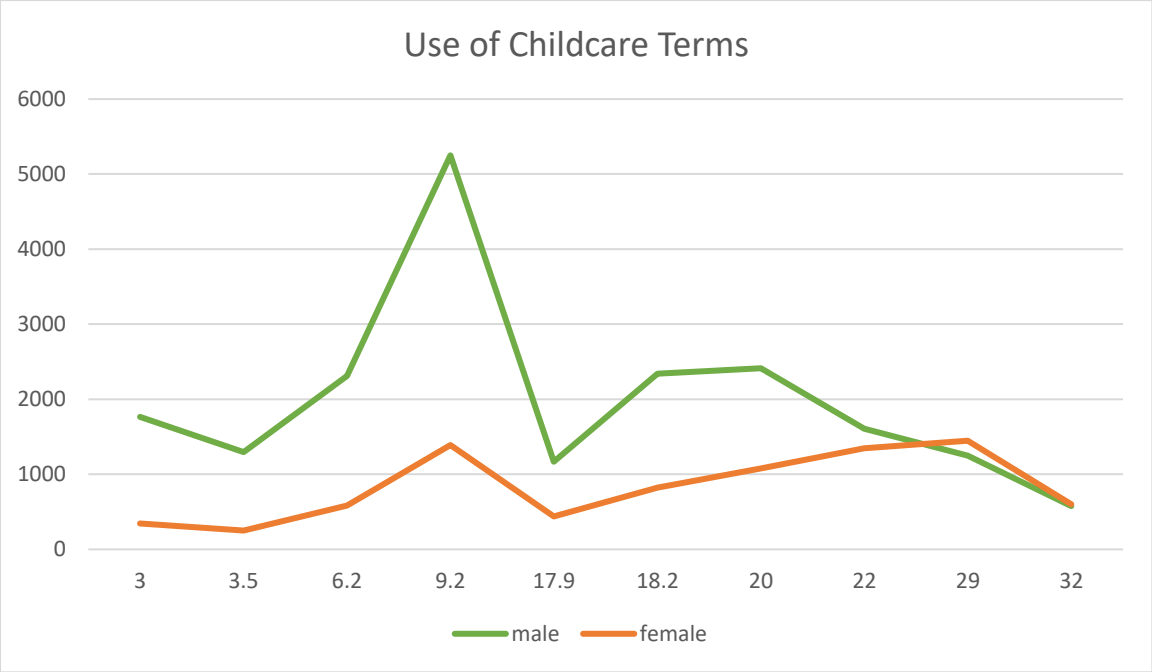

Figure 10: Use of Childcare Dictionary Terms by male and female MPs

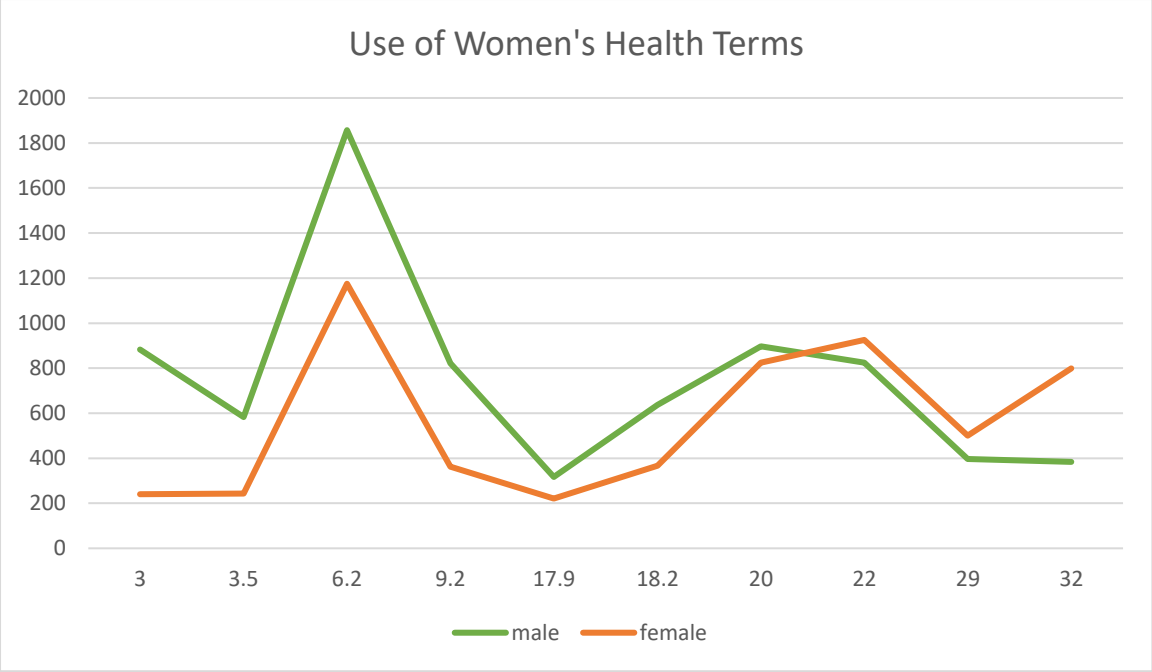

Figure 11: Use of Women's Health Dictionary Terms by male and female MPs

These findings lead to the assertion that with the increase of female MPs, there has also been an allocation of responsibility of "women's interests" to female MPs, supported by the literature on gendered responsibility allocation (Barnes and O'Brien, 2018). In essence what is being said here is that when women were not present in parliament male MPs were forced to take on the responsibility of speaking on interests such as childcare, however once women began to make up a significant enough proportion of MPs it became the female MP responsibility to discuss childcare interests. The bulk of growth comes from interests that male MPs would not normally put forward themselves due to pre-existing gender frames that shield them from issues such as domestic violence. This highlights the complexities of gaining SRWI across the board and the multi-layered obstacles that need to be overcome.

Conclusions and Further Research

The results of the statistical models are not conclusive and demonstrate the complexities of research in this field. This research only scratched the surface of the relationship between female representation and SRWI by male MPs. Particularly its dynamic nature and how it would be unwise to assume a simple positive relationship. From these results, it would be pertinent to take the investigation further by accounting for the discrete effects of descriptive and substantive by female MPs on male MPs' SRWI. As suggested in the discussion of critical points and the cubic model it is conceivable that the levels of women's SRWI would impact male MPs' SRWI. Furthermore, as time passes, reassessments of the effects of female representation on SRWI by male MPs would add significant insight.

This research fully acknowledges the arguments against quantitative analysis in the study of political representation as outlined in the literature review and methodology sections. If taken further, more in depth sentimental and qualitative coding could be completed, as well as the use of a more extensive dictionary search, on the same dataset. In addition, policy outcomes could be followed similarly to that done in the US, to further assess intent and power relations between male and female representatives (Volden et al., 2012). However, due to the dearth of research completed on male involvement in SRWI, this paper positions itself as an initial mapping of the possible untapped resources, for both research and practical interventions, of the importance of male involvement in SRWI.

If taken further, research can give attention to: 1) differing legislative contexts; 2) the impact of social movements and public opinion; 3) socio-economic backgrounds of male representatives; 4) party impact and 5) policy outcomes, to gain a more

comprehensive picture of how male representatives can contribute or do (not) contribute to the SRWI.

This research shows the non-linear relationship between female representation and SRWI by male MPs, putting forward a reactionary model with multiple “critical points”, where female representation creates inflection points for the SRWI by male MPs. These critical points are much more akin to the tangible effects of female representation than critical mass theory. Furthermore, the discussion shows other than descriptive representation, there are a whole host of environmental factors that impact female MP’s SRWI and consequently male MP’s SRWI.

In much of the representation literature, it is taken for granted that women will effect change on their male counterparts over time. This research has highlighted the non-effect female representatives have in truly altering the involvement of male representatives in women’s interests. Most crucially, it has added to the literature by laying the ground work for future research on the participation of male representatives in women’s interests, an area of study which requires desperate attention if the policy interests of the female population are to be acted upon. Particularly as these results warn that although female representation is increasing, support from their male counterparts is not matched, weighing down the burden on female representatives to represent women’s interests.

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Appendix 1: Dictionary of Women's Interests Terms

Domestic Violence: domestic abuse, domestic violence, intimate partner violence, rape, sexual violence, sexual assault, gender base violence, violence against women.

Childcare: childcare, child poverty, day care, nursery, child abuse, primary education, children, child benefits, child support, children's social services, pre-school education, special needs education, family benefits.

Labour Market: equal pay, equality of pay, pay equality, equal wages, gender pay gap, wage equality, pay discrimination, maternity leave, shared parental leave, glass ceiling, paid paternity leave.

Criminal Justice: sex discrimination, gender discrimination, gender equality, sex equality, equality of the sexes, gender recognition, sexual offence, sexual offences, family law, women's rights, female rights, discrimination against women, suffrage, suffragette, suffragettes.

Women's Health: reproductive rights, abortion, pregnancy, cervical cancer, breast cancer, HPV vaccine, tampon, sanitary towel, post-natal, pre-natal, reproductive health

Representation: female representation, women's representation, equal representation, gender representation, women in science, women in business

Appendix 2: Coding

Example of text data mining code for the year 1981.

```
library(readtext)
library(quanteda)

path <- file.path("~", "Desktop", "MPspeeches_1981.csv")
readtext(path, text_field = "speech")
path_data <- system.file(path, package = "readtext")
MPspeech <- read.csv(paste0(path_data, "~/Desktop/MPspeeches_1981.csv"))

speech <- readtext(paste0(path_data, "~/Desktop/MPspeeches_1981.csv"),
 text_field = "speech")
names(speech)
corp_speech <- corpus(speech)
summary(corp_speech, 5)

myDict <- dictionary(list(domesticviolence = c("domestic abuse", "domestic violence",
 "intimate partner violence", "rape", "sexual violence", "sexual assult", "gender based
 violence", "violence against women"), childcare = c("childcare", "child poverty", "day
 care", "nursery", "child abuse", "child benefits", "child support", "children's social
 services", "pre-school", "special needs education", "family benefits"), labourmarket =
 c("equal pay", "equality of pay", "pay equality", "equal wages", "gender pay gap",
 "wage equality", "pay discrimination", "maternity leave", "shared parental leave",
```

```
"glass ceiling", "paid paternity leave"), crimjustice = c("sex discrimination", "gender
discrimination", "gender equality", "sex equality", "equality of the sexes", "gender
recognition", "sexual offence", "sexual offences", "family law", "women's rights",
"female rights", "discrimination against women", "suffrage", "suffragette",
"suffragettes"), whealth = c("reproductive rights", "abortion", "pregnancy", "cervical
cancer", "breast cancer", "HPV vaccine", "tampon", "sanitary towel", "post-natal",
"pre-natal", "reproductive health", "female health", "women's health"), representation
= c("female representation", "women's representation", "equal representation",
"gender representation", "women in science", "women in business")))

toks_speech <- tokens(corp_speech)
kw_multiword <- kwic(toks_speech, pattern = phrase(c(myDict)))
head(kw_multiword, 10)
toks_comp <- tokens_compound(toks_speech, pattern = phrase(c(myDict)))
kw_comp <- kwic(toks_comp, pattern = c(myDict))
head(kw_comp, 10)
toks_dict <- tokens_lookup(toks_speech, dictionary = myDict, levels = 1)
head(toks_dict, 10)

dfm_speech <- dfm(toks_speech)
dfm(toks_dict)
dfm_toks_dict <- dfm(toks_dict)
convert(dfm_toks_dict, to = "data.frame")

new_data <- convert(dfm_toks_dict, to = "data.frame")
nrow(new_data)
nrow(speech)
bound <- cbind(speech, new_data)
names(bound)

write.csv(bound, file = "1981_data.csv")
```

Appendix 3: Sample Outputs

The following are screenshots of STATA outputs for the original linear regression model and for the first logistic regression model.

Original model output (shown in table 2):

Source	SS	df	MS		
Model	80.3059175	8	10.0382397	Number of obs	= 1,963,182
Residual	204548.167	1,963,173	.104192635	F(8, 1963173)	= 96.34
				Prob > F	= 0.0000
				R-squared	= 0.0004
				Adj R-squared	= 0.0004
Total	204628.473	1,963,181	.104233116	Root MSE	= .32279

dict_terms_total	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
female_rep	-.0005662	.000106	-5.34	0.000	-.0007739	-.0003584
age_numeric	-.0004907	.0000255	-19.26	0.000	-.0005406	-.0004407
time	.0006868	.0000796	8.63	0.000	.0005308	.0008429
partyconservative	-.0032866	.0010531	-3.12	0.002	-.0053507	-.0012226
partylabour	.0037634	.0010763	3.50	0.000	.0016539	.0058729
partyliberaldemocrat	.0041912	.0013859	3.02	0.002	.0014748	.0069076
partyplaidcymru	.0095978	.0032688	2.94	0.003	.0031911	.0160045
partyscottishnationalparty	.0011494	.002259	0.51	0.611	-.0032782	.005577
_cons	.0415929	.0016758	24.82	0.000	.0383085	.0448773

Logit model 1 output (show in table 8):

```
Iteration 0:   log likelihood = -123168.25
Iteration 1:   log likelihood = -122214.77
Iteration 2:   log likelihood = -122193.89
Iteration 3:   log likelihood = -122193.88

Logistic regression                             Number of obs     =  1,963,182
                                                LR chi2(8)        =    1948.75
                                                Prob > chi2       =     0.0000
Log likelihood = -122193.88                     Pseudo R2         =     0.0079
```

dict_dummy1	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
female_rep	-.0067646	.0030069	-2.25	0.024	-.012658	-.0008712
age_numeric	-.0178364	.0007504	-23.77	0.000	-.0193073	-.0163656
time	.0237496	.0022758	10.44	0.000	.0192891	.02821
partyconservative	-.1404098	.0307374	-4.57	0.000	-.200654	-.0801657
partylabour	.1682097	.0310132	5.42	0.000	.1074249	.2289945
partyliberaldemocrat	.1425193	.0379506	3.76	0.000	.0681376	.216901
partyplaidcymru	.281542	.0806835	3.49	0.000	.1234051	.4396788
partyscottishnationalparty	-.0267035	.0601183	-0.44	0.657	-.1445331	.0911262
_cons	-3.943742	.0482399	-81.75	0.000	-4.03829	-3.849193

Appendix 4: STATA Coding

The following are codes for all of the statistical models shown in the results section of this paper, referring to the corresponding table in which their results are shown in the main body of the paper.

Table 2:
Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Table 3:
Regress domestic_violence female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Regress childcare female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Regress labour_market female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Regress crim_justice female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Regress whealth female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Regress representation female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Table 4:
Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if time==18

Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if time==38

Table 5:
Regress domestic_violence female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Regress childcare female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Regress labour_market female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Regress crim_justice female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Regress whealth female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Regress representation female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation >=15

Table 6:
Regress domestic_violence female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Regress childcare female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Regress labour_market female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Regress crim_justice female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Regress whealth female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Regress representation female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy if female representation <=15

Table 7:
Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy female representation^2

Regress total_dict_terms female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy female representation^3

Table 8:
Logit dict_term_dummy female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy

Logit dict_term_dummy female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy CM_29_dummy

Logit dict_term_dummy female representation age time conservative_dummy labour_dummy libdem_dummy plaidcymru_dummy snp_dummy CM_30_dummy