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The Effect of Monetary Policy On Divorce

Evidence From Australia Between 2007 And 2018

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Abstract. The effect of monetary policy on divorce has implications on intra-household resource allocation and inequality. This thesis utilizes the HILDA data in Australia between 2007 and 2018. It has identified three potentially unexpected monetary policy shocks that could affect marital status. Theories imply that monetary policy can affect divorce via total income and role specialization effects. The analysis uses variable and fixed-rate mortgages to differentiate between treatment and control groups. Initially, it finds little to no effect. However, the robustness test shows that a rise of 1.75% in the interest rate can reduce the divorce rate by 5%-6% compared to the subset of the control group, which has a fixed rate and a high loan-to-value ratio. Women are subject to the biggest consumption loss as the Pareto rate is low. A possible explanation is that both partners participate in the labor force among the variable rate group. It implies that the total income effect overwhelms the role specialization effect. Therefore, it means that future research related to the causal effect of monetary policy on households can take advantage of immense unexpected interest rate shocks to study behavioral changes and intra-household inequality.

Keywords: Monetary policy, Fixed-variable rate Mortgage, Divorce, Australia
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1 Introduction

Central banks use monetary policy to achieve inflation and or employment targets. As a result, interest rates can affect the lending and borrowing of money to banks and individuals, thereby changing their consumption and investment behavior. Nevertheless, monetary policy affects the population beyond the inflation target.

One unexpected effect in the monetary policy literature is household formation, namely marital status. A couple shares the wealth and complements one another with the labor supply. Monetary policy passes through as an increase in the variable mortgage interest rate, but not a fixed one (Maggio et al., 2017; Flodén et al., 2017; Cava et al., 2016). In microeconomics, it could create both mechanical (income) and behavioral (substitution) effects (Leung et al., 2014). While the mechanical impacts mean it directly lowers the household net income and is not linked to divorce decisions, the behavioral effects are most relevant. On the one hand, one could try to regain the total household income to offset the policy effects, which could reduce the divorce risk. But, on the other hand, the relative income between the two partner falls, and the benefits of role specialization go down, which raise the breakup risk. So, two opposing forces are at play, and the net outcome is of interest.

This question is of empirical importance to the macroeconomic and household finance equality literature. First, it considers a breakup via which monetary policy affects consumption and wealth. While macroeconomic literature has broad coverage of the effect of interest rate on wealth via interest compounding, the thesis provides an additional mechanism to that association - divorce. A couple pays down a mortgage that accumulates into their assets. If they decide to end the relationship, they need to claim ownership of a share of their joint assets, most notably their property (Fisher, 2012; Goussé and Leturcq, 2018). So, divorce has a considerable intra-household wealth accumulation effect that warrants the attention of policymakers.

Second, divorce could be related to intra-household inequality between partners. It reveals that households with more equal income shares between males and females are better prepared for monetary policy shocks, thus preventing divorce risk. Divorce could yield worse outcomes for females in the equitable distribution divorce rate without a 50/50 property split, as in Australia. Thus, divorce is a crucial household decision associated with wealth distribution and gender equality that are often the focus of policymakers.

The empirical econometric analysis will show the net effect of the policy on divorce. It adapts a differences-in-differences model to examine the changes in breakup rate before and after the monetary policy over 11 pairs of years. The thesis aims to test the hypothesis of whether monetary policy via mortgage rate has a noticeable impact on splitting

a relationship. While the initial empirical analysis finds no effect, the robustness test shows that a 1.75% rise in the interest rate can reduce the divorce rate by 5% compared to the subset of the control group, which has a fixed rate and a high loan-to-value ratio. Also, women are subject to a more extensive consumption loss than men as their Pareto rate is low.

The thesis goes in the following steps. Section 2 reviews the contributions to three categories of literature, including household monetary policy, marital status, and reasoning behind the divorce. Section 3 delves into the population data around Australia's interest rates, mortgage, and divorce situations. Section 4 defines the outcome, treatment, and covariates and reveals initial correlation and statistical analysis from the data. Section 5 discusses the identification strategies essential to run a causal analysis. Section 6 examines the theories that predict the marital response of couples to a rise in interest rates. Section 7 illustrates the regression model and the causal results. Section 8 shows highlights of the discovery and the connections between the previous sections. Finally, section 9 concludes the thesis and offers direction for future research.

2 Literature review

No literature discusses the direct or indirect impacts of monetary policy on divorce, to the author's best knowledge. So, it can complement literature that discusses the (2.1) overall macroeconomic monetary policy effects on households, (2.2) household formation and divorce decisions, and (2.3) the economic reasons for divorce.

2.1 Monetary policy on households

There is a host of literature on monetary policy on wealth accumulation and consumption. It will cover how marital status factor can complement their findings.

Monetary policy literature could treat agents as single individuals without the family dimension. For instance, Flodén et al. (2020) find that monetary policy affects savings and wealth accumulation for households, especially those with sizable illiquid assets but little liquid wealth (Cloyne and Ferreira, 2020). Moreover, they consider household debt as shared by its members. However, their model does not account for the interaction of the household members when they are dependent people within their households with shared wealth and consumption, particularly those married or have children. So, because the thesis focuses on divorce, it can determine a large part of unexplained household formation decisions after monetary policy.

The thesis also adds to monetary policy literature that centers on households. Cumming and Dettling (2020) compare the fertility rate after the monetary policy in the US and UK. Using the same design as this thesis, they use the mortgage rate to differentiate between treatment and control on how fertility responds to monetary policy, as fertility changes labor supply and allocation of public resources such as education. The thesis can complement the fertility literature with factors driving marital decisions. These two are highly correlated because giving birth to babies often results from marriage and cohabitation. Hence, it can result in a complete literature on family decisions.

In sum, monetary policy literature on mortgages often considers agents as individuals that spend and save their income. However, the thesis can add the family dimension to help better understand the outcomes. There has also been an interest in fertility, where the thesis can add the couple's dimension that could drive household formation.

2.2 Household formation and divorce

Forming a relationship is a prerequisite for building a household. Nevertheless, the literature on housing and breakup often concentrates on the correlation but not causality between housing and divorce. Also, the thesis will add to the meanings of the differences between cohabitation and marriage.

First, Hughes (2003) argues that having a dwelling is the apparent necessity for forming an independent household. So, housing costs should compare to the price of living independently. They find that housing costs are inverse to independent living, conditional on marital status. However, that analysis uses a broad population, which can suffer from confounding variables, and does not reveal a mechanism that drives the correlation. For example, it is crucial to differentiate between those who rent and purchase a home because younger couples often rent, while older adults tend to purchase them. Thus, these two groups could have fundamentally different characteristics that make them incomparable. Therefore, the thesis only considers agents already paying off their mortgage, minimizing selection bias and enabling a causal analysis. It has implications for households choosing one type of mortgage over the other.

Another paper on the relationship between housing costs and marriage rate is from Gholipoura and Farzaneganb (2015). They find that higher housing costs result in a lower marriage rate in Iran because the opportunity cost of moving out from parents' homes becomes higher than staying. However, this correlation could also imply reverse causality: the general falling trend in marriage results in a weaker demand for housing, leading to a fall in prices. Furthermore, there have been many cross-country and time-series studies on the economic factors of marriage and household formation, but no causal analysis (Ahn and Mira, 2001; Clark, 2012; Ermisch and Di Salvo, 1997; Ermisch, 1999; Mulder and Billari, 2010). So, the thesis can complement the correlation literature by focusing on causal relationships for those who are married first and become divorced after the monetary policy.

It is essential to distinguish between marriage and cohabitation. It is because married people are more likely to engage in relationship-specific investments, such as intra-household specialization or having joint accounts. At the same time, a cohabiting couple is more likely to separate them (Poortman and Mills, 2012). However, cohabitation is becoming a more common choice nowadays, and some countries have implemented a law to protect cohabiting couples (Goldscheider and Calvin, 1993. For example, Chigavazira et al. (2019) find that some Australian states have a property division regime (Family Law Act) to protect cohabiting couples after their breakup. Therefore, they are incentivized to save and spend similarly to married couples. Thus, the thesis will simplify the assumption by merging married and cohabiting couples into the married group and divorced and separated people into the divorced group.

All in all, literature on housing costs and marital status could imply reverse causality and give different implications. So, the causal analysis can narrow the scope of monetary policy effects. Furthermore, as cohabitation is becoming a common choice, it will be better to assume married and cohabiting couples as a single category, while divorced and separated couples as another.

2.3 Economic reasons for divorce

There is literature that maps out risk factors related to divorce. While it is admitted that divorce is an endogenous decision, it is often assumed to be an exogenous shock. So, the contribution to the literature is covered here.

Light and Ahn (2010) state risk preference is a key consideration in deciding whether to divorce. One function of marriage is to induce consumption-smoothing opportunities (Weiss, 1997. So, the risk is incorporated into the differences in payoff between marriage and being single. They found that women are more exposed to divorce risk due to their more exposed financial well-being. In contrast, the thesis argues that risk (i.e., monetary policy) does not only cause divorce but also behavioral responses to prevent that risk. So, men and women respond to divorce risk by changing their internal or external labor supply. This correlation has received mixed results (D. Lichter et al., 1991; D. T. Lichter et al., 1992; McLanahan and Casper, 1995; Raley, 1996; South and Lloyd, 1992). However, assuming that the fundamentals in their relationships stay the same, couples will try to increase the labor supply to offset the divorce risk.

Some literature also treats divorce as an exogenous variable. For example, Fernandez and Wong (2014) simulate an economic model to trace the impact of marital instability on women's labor supply. They admit that marital status is an apparent endogenous variable since it evolves over the life cycle of marriage, divorce, and remarriage. However, it is treated as exogenous due to other endogenous variables. Moreover, Mazzocco et al. (2007) examine the interactions between female labor supply, savings, and marital decisions where marital status and bargaining power evolve endogenously. However, due to the demanding computation, it is hard to delve into each mechanism. Thus, the thesis treats divorce as the outcome variable, thus explaining the components of its endogeneity. Moreover, it focuses on only one mechanism that connects monetary policy and divorce - behavioral response. The emphasis on this theory allows for a better understanding of the relationship.

In sum, this thesis can help complement risk factors with behavioral responses and an understanding of factors underlying divorce.

3 Background: Australian interest rate and divorce

The Reserve Bank of Australia sets the official interest rate or so-called cash rate. Apart from the economists' assumptions, the change in interest rate prediction is based on the central bank announcements and could reflect in the yield curve. Suppose households have perfect information and free access to the financial market. In that case, they will borrow money or draw on savings to smoothen consumption, thus minimizing the response to monetary policy. In contrast, a higher interest rate will reduce their consumption if they do not. So, the expectation of interest rise and fall, and the financial markets play a role in the response. (Flodén et al., 2020)

3.1 Identification of unexpected interest rate shocks

The critical assumption in the causal analysis is identifying unexpected or surprise treatment - monetary policy in our case. Because of the selection effect present in the mortgage market, individuals can take advantage of the better option via refinancing or renegotiation with current lenders. For example, a variable rate is more favorable to absorb the low rate with an anticipated falling interest rate. Nevertheless, if people expect it to climb, a fixed rate could serve as a ceiling to prevent extra payments. In other words, the assumption that people cannot anticipate the interest rate change needs to hold.

To identify surprise monetary policy, Altavilla et al. (2019) considers three ways to forecast monetary policy: Forward Guidance, Policy Target, and Quantitative Easing (QE). The first factor, Forward Guidance, raises interesting questions about the differences in the expected policy action between the current meeting and the next or the one following. This qualitative approach compares the statements before and after the policy changes released by the central bank to analyze whether the shock is a surprise. The second method, policy Target, is about inflation targets, but interest rates could still be widely unpredictable in magnitude and duration. The last method, QE, gives a deeper understanding of surprise policy shock by determining the sign and size of the policy shocks. However, this would require a quantitative model, which is beyond the scope of the thesis. So, due to the scope of the thesis, it will only qualitatively investigate the announcements and yield curve to identify interest rate surprise shocks.

The thesis has identified three shocks between 2007 and 2018 based on the press release from the Reserve Bank of Australia (RBA), as indicated in figure 1. The first one happened in July 2008 during the global financial crisis (Stevens, 2008). The RBA stated that inflation is high, but the national income is rising due to trade. So on balance, no change in the expected interest rate is stated. However, one month later, they concluded that the negative factors outweighed the positive ones, which depressed

the demand and gave rise to an unexpected fall in interest rates.

The second unanticipated interest rate alteration happened after the financial crisis (Stevens, 2009). In June and July 2009, despite the recovery in the financial markets, the RBA suggested a decline in inflation over the medium term, leading to anticipation of further easing monetary policy. Nonetheless, the stance changed in October that private investment is more substantial than expected, and moderate inflation defied the expected inflation. So, this period also revealed a surprise in interest rate rise.

The third surprise shock in interest rate occurred between 2014 and 2015 (Stevens, 2014). In December 2014, it stated that inflation was between 2 and 3% as expected and stability in interest rates should be maintained. However, an unexpected fall in energy prices lowered the CPI inflation rates in February 2015, which was the lowest in years. As a result, these factors created the unanticipated expansionary monetary policy.

To find surprise shocks, figure 2 presents the yield curves of the three periods. The left graph shows that agents anticipate a smaller decrease in July 2008 than what happened two months later, as the yield curve entirely shifts down. Then, the middle graph illustrates that agents anticipate a rise in interest rate, which occurs two months later. So, the degree of surprise of this second shock could be small. Lastly, the right graph depicts that interest rise is expected stable in December 2014, as the yield curve is only slightly upward sloping. However, it shifts down two months later. In sum, while three shocks occurred between 2007 and 2018, only falls in interest rates seem to be unexpected. Nevertheless, for a complete analysis, all three shocks will be covered.

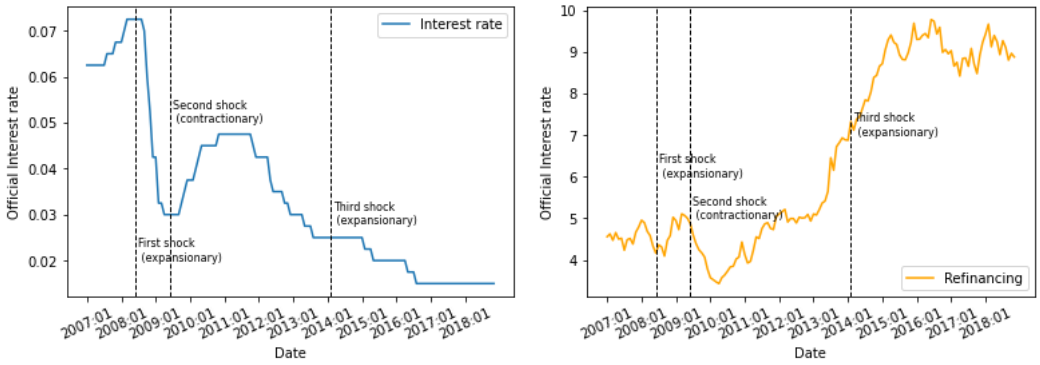

Figure 1: Cash rate (interest rate) and refinancing amount. Source: Australian Bureau of Statistics.

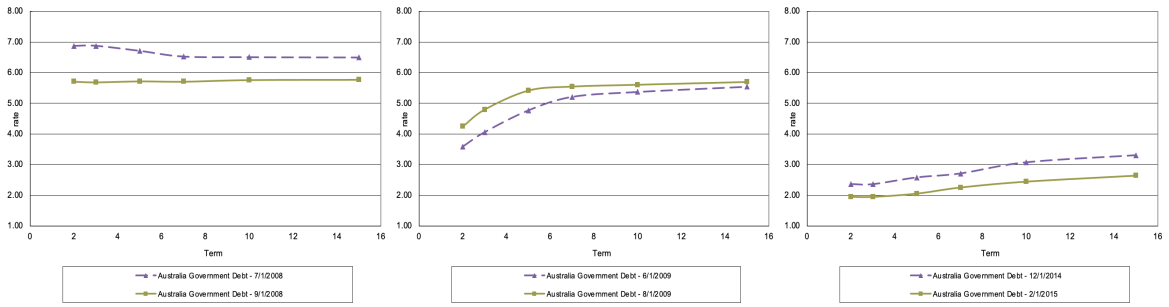

Figure 2: Australian yield curves in the three periods. Source: Capital IQ

3.2 Identification of refinancing

Refinancing mortgages influences the selection bias assumption for causal analysis. Despite the individual refinancing data's inaccessibility, aggregate refinancing can be obtained from the official data, illustrated in figure 1. The interest rate fell to 3% during the financial crisis in 2008 but bounced back to 4.75% in 2011. In the meantime, due to the surprises, the amount of refinancing a mortgage is unresponsive. However, later on, when the interest rate sank gradually to zero, the amount of refinancing followed. The reason is that those with fixed interest rates could renegotiate with a better term to reduce their mortgage payments, and they anticipate that the interest will continue to change. Eventually, the interest rate is cut further to nearly zero percent, and the refinancing soars to an all-time high. Understanding the expectation of interest rate can help consolidate the experimental design of the causal analysis.

While it is easy to refinance a variable rate mortgage, refinancing a fixed one involves a high break cost ("Switching home loans", 2022). The more the interest rate has come down since the mortgage began, the higher the cost would be. It implies the asymmetry of response to rise and fall in interest rate. Another barrier to switching between loans is the lender mortgage insurance. The rule applies when the amount borrowed exceeds 80% of the real estate value. It demands a one-off payment from the borrowers to the lenders. Other minor fees include discharge, application, switching, and stamp fees.

Refinancing response also depends on whether the interest rate rises or falls. Valadkhani and Anwar (2012) propose the 'rocket and feather' hypothesis to describe the interest rate in Australia. It means that when the interest rate rises, the mortgage rate rises correspondingly or even more considerably to gain from the borrowers. For example, three of Australia's four largest banks raised their mortgage rates more than the Reserve Bank of Australia rate's rise in 2009. On the other hand, when the interest rate decreases, lenders hesitate to reduce the interest rate and benefit from the lower cost. It happens due to the market power of the lenders in an oligopolistic market.

Thus, for the causal analysis, it should be noted that the effect of a one percentage point fall is not simply the opposite sign of it.

Moreover, in the historical data, the interest rate rose between 2009 and 2011 and only fell after that. So, it allows for analysis in both scenarios. Apart from asymmetry in rate magnitude, the response also differs in terms of the period. For example, Enders and Siklos (2012) proves that the federal funds rate and US mortgage rates are co-integrated in the long run, although the short-run pass-through is incomplete. So, the adjustment processes toward the long-term equilibrium differ depending on the sign of the initial shock.

3.3 Divorce risk in Australia

There are various indicators of divorce risk. The common one is the crude divorce rate (CDR), the ratio of the number of divorces to the total population (Chen and Yip, 2018). Figure 3 shows Australia experienced a decline in CDR between 2000 and 2001 but no change in CDR onwards until 2014. Afterward, the CDR continues to drop to an all-time low at 3%. The falling marriage population and divorce risk could explain the decline. Chen and Yip (2018) explains that the general trend nowadays is to choose cohabitation over marriage or marriage at an older age.

Another statistic is the refined divorce rate. It is the number of divorces divided by the number of married people (Shryock, 2013). For example, figure 3 (to the right) shows the number of divorces per 1,000 married population in each age group in 2016. It demonstrates that the young age group between 25 and 29 has the highest divorce risk at 16. Then, it gradually increases until the age group between 45 and 49. Afterward, the risk exponentially drops as couples settle down. It is also worth noting that young females have a higher divorce risk than their male counterparts at a younger age. It means that the male partner could have higher experiences and competencies than the female partner because of age, increasing the male share of income relative to the female and the risk of intra-household inequality, despite the potential benefits of the role specialization effect.

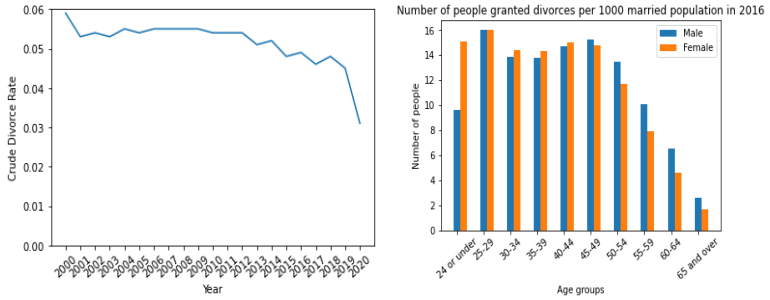

Figure 3: Crude divorce rate (left) and divorce rate by age and gender groups (right). Source: Australian Bureau of Statistics

3.4 Cohabitation law in various states

There is an increasing number of de facto relationships. In Australia, a de facto relationship refers to couples that have cohabited for at least two years or have at least one common child without marriage. Some states implement the Family Law Act 2008 (hereafter FLA), which protects the division of property and retirement savings for cohabiting couples after divorce. Allocation criteria include retirement savings, parties' financial and non-financial contributions to the relationship, and their present and future economic needs. So, a cohabiting couple can enjoy certain rights by married couples (Kaspiew and Qu, 2016).

Chigavazira et al. (2019) identifies three categories of property division based on how close the state law is to the FLA. Firstly, Queensland, Tasmania, Western Australia, and Victoria are strictly states that follow FLA, where the courts need to guide the decisions based on the partners' contributions and their financial needs. Secondly, Australian Capital Territories (ACT) and South Australia partially follow FLA. They direct the courts to "other relevant matters" without specifying earnings capacity or future needs. Thirdly, New South Wales and the Northern Territory have laws to limit FLA, considering relationship contributions but not the partners' future needs. This grouping allows for estimating state law's combined effects and monetary policy.

4 Data Description

The analysis is based on the Household, Income, and Labour Dynamics in Australia (HILDA). There are two levels in the data: The household-level data describe general information about the households, including the mortgage payment, which both partners share. The individual-level data give specific information about the identity or status of the individuals, including their marital status. Therefore, the two datasets need to merge to see the implications of the monetary policy on individuals. This section will define the outcome variable, treatment, and control variables. Finally, the summary statistics will be reported and analyzed.

4.1 Outcome variable

There needs to be a definition of marital status. There are six types of marital status in the sample. [1] Legally married, [2] De facto, [3] Separated, [4] Divorced, [5] Widowed, [6] Never married, and not de facto. If a person is separated, divorced, or widowed but is in a relationship, that person will count de facto. Thus, de facto includes those who could be separated, divorced, and widowed but are currently in any relationship in the sample period. This observation is important because the analysis in the thesis is to confirm the breakup of any romantic relationship.

Figure 4 shows the development of marital status over 12 years. While the marriage rate is slightly declining, de facto is on the rise and is absorbing observations from the other categories. Since the share is relative to the whole sample, the crude divorce rate of about 5% is also aligned with the population divorce rate from 3 before. This rate does not seem to vary over time, but as noted, the variable of interest is the divorce rate relative to the married population, not the whole population. So, the more precise rate will be covered later.

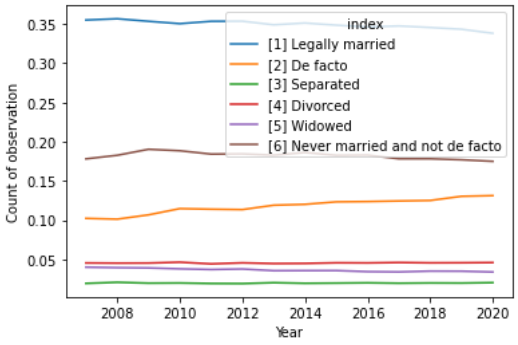

Figure 4: Marital status of the sample population.

4.2 Treatment variable

The treatment variable is whether an observation belongs to the fixed or variable rate mortgage group. Since the dataset only shows information in 2010, 2014, and 2018, imputation is required to investigate the two rates in the other years (see table 1). The vital assumption here is that the loan terms should have been the same since people last refinanced their mortgages. For example, assume refinancing occurred in 2008, and the mortgage rate was fixed in 2010, then the mortgage rate was fixed in 2009-2008. Thus, this is valuable information to expand the sample size.

This imputation is a means to increase the sample sizes across the years of interest. However, this could have led to misrepresentation in the imputed years. For example, if an agent had a fixed-rate loan in 2011 but paid off the mortgage in 2013, then the data in 2014 and 2010 will have no information about the agent. So, three validation tests are conducted to increase credibility.

The first validation test is to backward forecast the available years. There are two waves to be used for checking: 2014 and 2010. The procedure uses the 2018 data to forecast backward the 2014 data, and 2014 to 2010. Then, compare this forecast with the actual data. The validation test results show that the accuracy of the backward forecasting power in 2014 and 2010 is 80% and 78%, respectively. Considering that about 80% of the observations belong to the variable rate group, the accuracy is acceptable. A potential reason for the imprecision is that the interest rate term could have changed without refinancing by resorting to and negotiating with the same lender. For example, it is hard to argue that a person that refinanced her mortgage in 1998 had the same interest rate until 2010. Typically, Australians refinance their mortgage from 6 months to 10 years, while fixed interest rates can last for a minimum of a year. Besides, from the survey perspective, loan holders that recently refinance their mortgage have a better memory of the refinancing year than those who did many years ago.

With these in mind, a potential solution is to use refinancing year data to backward forecast only the past three years but not beyond. However, the issue with this solution is that it shrinks the sample size significantly. The fixed group's sample sizes would lie between 53 and 249. Assuming that 5% of the couples face a divorce, it would mean that the results will be dependent on 2 to 12 people, which are vulnerable to the outlier effect. Therefore, the trade-off between the accuracy of the backward forecast and the sample size needs to balance. Considering that no inferences can be little from small samples, which limits the scope of the thesis, the best solution is to keep the original imputation, including those from more than three years before the data is available, only with 80% accuracy.

Year	2007	2008	2009	2010*	2011	2012	2013	2014*	2015	2016	2017	2018*
Fixed	222	278	318	966	262	313	385	1445	253	327	441	1568
Variable	1144	1424	1772	5237	1449	1795	2144	6218	1348	1667	2053	5992

Table 1: The number of observations in fixed-variable interest rate groups between 2007 and 2018. * indicates the non-imputed actual years. All other years are imputed.

The second validation test checks whether people have the same mortgage rate conditions in the data available years. Since the choice of refinancing the mortgage and thus turning a fixed rate into a variable rate is present, table 2 shows the percentage of individuals who hold the same fixed or variable rate mortgage in two pairs of years. It is apparent from the graph that while 70% to 73% of the individuals hold variable rate mortgages for four years, about 20 to 23% of the individuals switched to a different interest rate. It is also noteworthy that it is almost equally possible to switch from variable to fixed rate, as the other way around. It proves that individuals do not have a particular preference for either choice and strengthens the assumption of random selection for identification.

The last test compares the general ratio of people taking fixed-vs-variable rate mortgages. Australian Bureau of Statistics states that no trend data is available for the number of owner occupiers or investors for total housing as the data collection began in July 2019. Thus, the most recent data is used, which shows that the ratio of variable to fixed rate total mortgage value is $25.8 billion to $4.6 billion. So, fixed and variable rate mortgage shares stand for 15% and 85% of total mortgage values, respectively. It is fair to assume the ratio is $\frac{1}{6}$ and constant between 2009 and 2018 (except 2007 and 2008) because the available data shows that the shares of a fixed-rate mortgage in the available years relative to the total are between 18% and 26%. Table 1 shows the number of individuals with fixed and variable mortgage rates over the period. It is noticeable that the imputed share maintains around 16% to 26%, similar to the actual data. So, the finding is consistent with the official data regarding the ratio.

	Fixed (2014)	Variable (2014)
Fixed (2010)	6.8%	9.1%
Variable (2010)	10.5%	73.6%
	Fixed (2018)	**Variable (2018)**
Fixed (2014)	7.0%	12.1%
Variable (2014)	11.8%	69.1%

Table 2: Shares of people holding same or different mortgage rate.

4.3 Control variables

This subsection sheds light on the inclusion and exclusion of covariates. Whereas a predictive analysis requires the inclusion of all covariates correlated with the outcome, causal analysis has restrictions to meet the identification assumptions.

The included variables should be background variables that are independent of the treatment. It is necessary to include observable confounders that jointly influence outcome and treatment variables to meet the conditional independence assumption (CIA). They include residence in Family Law Act states (binary), sex (binary), high education (binary), and origin from Australia (binary) (Bumpass et al., 1991; Lehrer and Chiswick, 1993). However, the number of children and income are out for exogeneity reasons. Other relevant variables, such as whether respondents' parents were divorced, are helpful but lack observations, so they are also out.

4.4 Statistical summary

There are various variables for the econometric model, including divorce rate, sex, education, and countries of origin (from Australia or not). We need to see if there is any selection into fixed and variable rate mortgages for the sample. Table 3 shows the model's balance checks of the numeric control variables. Both groups have balance in most areas, except for education. Nevertheless, given the differences-in-differences research design, this should not be a huge concern for identification.

Furthermore, table 7 to 10 in the appendix display the descriptive statistics in the selected years, where most variables are binary. Year has a mean of 0.5 because every individual is recorded in the before and after treatment states. The divorce rate is less than 0.01 because everyone is married before intervention and can only divorce after it.

Variable names	[1] Fixed rate	[2] Variable rate
Divorce rate	10.49%	7.02%
Share female	54%	51%
Share with high education	25.0%	33.7%
Share with good health	79.1%	80.0%
Share with employment	84.1%	87.2%
Share originally from Australia	77.7%	79.0%

Table 3: Means of variables in fixed and variable rate mortgage groups.

4.5 Correlation analysis

Moreover, it is helpful to investigate correlations for preliminary results. First, figure 5 (left) shows the scatter of interest rates and the corresponding divorce rates in the two groups, where each point represents a data point in a year. To the left, it is clear that there is only a slight but unclear correlation between divorce and interest rate, thus giving a Pearson correlation of only 0.186. On the other hand, the graph to the right illustrates a prominent upward-sloping relationship between the two variables, giving a high estimate of 0.859. It aligns with the assumption that monetary policy only affects mortgage holders with a variable interest rate rather than a fixed one. Moreover, the treatment effects of the policy are passed through the mortgage to divorce.

Another striking correlation is between the divorce rate and the employment rate. As mentioned, labor supply could be a channel via which monetary policy influences divorce, as it can be an insurance against monetary policy shocks and has an economic relationship with a divorce. Figure 5 (right) shows a negative correlation between divorce and employment in the fixed rate group but not in variable one. Employment changes divorce via two channels. On the one hand, household income increases and can reduce conflicts among couples, which decreases divorce.

On the other hand, if both partners are employed, they spend less time together, which could lead to a breakup. Since there is a negative correlation between labor supply and divorce, it assumes that the net effect of the two channels is negative. Moreover, there is almost no correlation between labor supply and the divorce rate for the variable rate group since they almost always have high employment levels. Therefore, it could imply that their behavioral response to monetary policy could come from other variables, such as getting a second job or working extra hours.

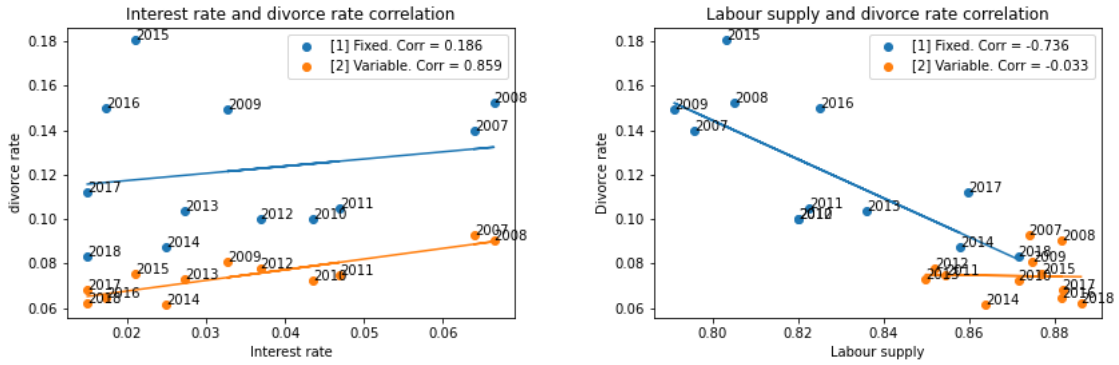

Figure 5: correlation of divorce on the interest rate and labor supply.

4.6 Pareto weights

Voena (2015) highlight the importance of Pareto weights in initiating divorce. Pareto weights measure the bargaining power of female partners relative to the male partners. A weight of 0.5 means that females and males have the same bargaining power. One measure is current weekly wages since it captures individual expenditure and data is readily accessible. When cleaning the data, observations with zero wages are out since it would give an absolute 0 or 1 weight to the other partner, which is often not the case.

Figure 6 shows the Pareto weights measured as the female share of total couples' wages between fixed and variable-rate mortgage holders over the sample period. There are two features. First, fixed-rate mortgage holders constantly have lower Pareto weights than their variable-rate counterparts. So, couples with fixed rates tend to have unequal market productivity and bargaining power. Second, a shock occurred in 2010, when the weight of fixed-rate women slipped to only 0.28, while the variable one was 0.40. This gap seems to coincide with the interest rate rises during the aftermath of the financial crisis.

In contrast, when the interest rates fall in other periods, such as 2008 and 2014, the weight does not seem to respond accordingly. Therefore, this gender difference seems to arise from a rise in interest rates, not a fall. This insight could support the econometric robustness analysis later.

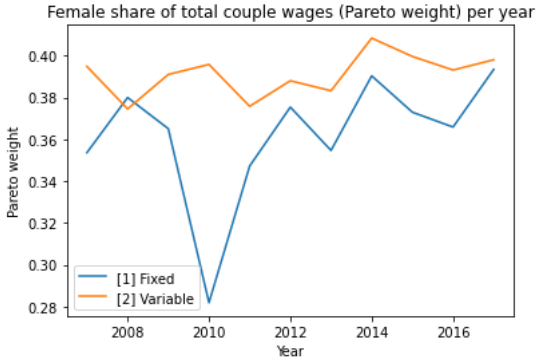

Figure 6: Pareto weights: Female share of total couples' wages.

5 Identification strategies

The empirical analysis adapts causal inference for the effect of monetary policy on divorce. The thesis will discuss the identification assumptions, then cover how they are satisfied under the setting. Only limited inferences from the results could come if they fail.

The research design in this experiment is differences-in-differences. It requires the common trend assumption, meaning that potential outcomes of groups with or without treatment are subject to the same time trends. It is crucial to explore shocks in time trends to see whether the assumption holds.

Figure 7 shows trends of the divorce rates of the fixed and variable rate mortgage groups. The data comes from agents who are married the year before. For example, the 2013 divorce rates come from individuals who were married in 2012. This can ensure to remove respondents who are always divorced or separated. When it comes to the interpretation, there is a clear difference between the two rates during 2009-2011, which could result from the monetary intervention. But on the other hand, the two trends seem to intersect and the gap is small between them in 2008 and in years after 2011. This implies that divorce rates are likely to be almost equally probable no matter what types of mortgage a person chooses. However, the unexpected changes in the interest rate could be driving the divorce rate down for the variable rate group, leaving the fixed rate group vulnerable.

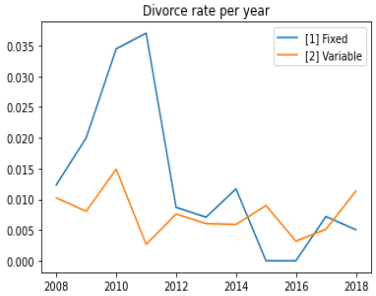

Figure 7: Parallel trend assumption.

Apart from the DiD assumption, four other identification assumptions must hold. The first assumption is that confounders with endogeneity should be excluded from the experiment. For example, if treatment influences both confounders and outcomes, some causal effects of the treatment could be shifting away from the outcome to the confounders, such as the number of children. It will thereby underestimate the coefficient. The second assumption is no confounding on observables (CIA), implying that all the time-varying confounding variables that jointly influence both treatment and outcome

variables need to be observable. It is because, conditional on those confounding variables, the outcomes could be independent of the treatments. Thirdly, the stable unit treatment value assumption (SUTVA) states that an agent's response depends on the treatment that the person is assigned, not the treatment assigned to other agents. Lastly, there needs to be common support for any given values of confounders. It applies to both discrete and continuous variables. Make sure that the probability of both treatment and control is positive for a given value of a discrete variable and a distribution of a continuous variable.

The first assumption of exogeneity is a criterion for excluding certain variables. As explained, the treatment cannot simultaneously affect the confounders and outcome. Variables, such as disposable income and the number of children, are endogenous. The crucial analysis of the thesis is that the central bank changes the interest rate, thus altering the mortgage expenses and leaving lower disposable income. However, disposable income is a prominent cause of divorce. Voena (2015) states that couples allocate their income based on the Pareto rate. If the less dominating spouse, typically the female, has less household income, she is more likely to threaten to divorce to gain an equal share. Similar arguments go for the number of children (Cumming and Dettling, 2020). Therefore, the causal effect estimate of the mortgage rate variable can be shifted to the disposable income instead, thus yielding an underestimation. To prevent such bias, variables with endogeneity should not be in the model.

Second, for the CIA assumption, there are certainly confounders that can affect both the treatment and outcome variables. Fortunately, DiD could subtract out unobserved time-invariant variables, including personality traits. In addition, other time-varying variables, including education, and health status, could be found in the data set and incorporated into the regression model. The test is to estimate the propensity scores via Logit regression using a matrix of covariates and a vector of treatments. The scores represent the probability of observation with specific characteristics to receive the treatment.

The third assumption of SUTVA is relatively easy to identify by intuition. There is no belief that one person taking a fixed or variable mortgage could affect the relationship of other couples. In the individual dimension, although each partner plays as a single person, the mortgage rate and marital status are the same in the household. So, this assumption is likely to hold. The last assumption of common support can be verified in data testing. Based on the control variables, agents are free to choose between different mortgage terms and there should be no discrimination. It is to ensure there is overlap in all levels of the continuous variables. Those outside the overlapping areas will not be in the sample due to their misrepresentation.

Figure 8 depicts the histogram of propensity scores for treatments and controls. It shows that most observations lie in the middle of the score of 82, forming an almost

symmetric bell shape. Thus, both are consistent with the random distribution. Also, both distributions overlap entirely, meaning no observations are off-support. It is also noticeable that the treatment has broader coverage than the controls due to their sample ratio. It implies that given the individual characteristics of covariates, such as states and education, both groups have an almost equal chance of 82% to receive the treatment. Thus, the common support assumption is valid under this test.

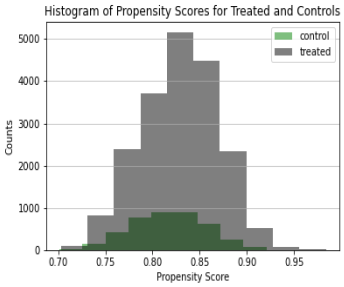

Figure 8: Common support analysis.

A threat to identification is a possibility of reverse causality, wherein unhappy couples choose the mortgage rate in anticipation of monetary policy. Couples in the process of divorce need to negotiate the mortgage terms, for example, by removing one's spouse's name or switching the mortgage to a new home. It will involve refinancing to resolve the issues, which alter the fixed and variable rates and undermine the research's causal implication. In light of this possibility, the thesis will restrict the sample to individuals that hold the same mortgage after divorce. It will count on the precision of imputation using the refinancing year variable, explained later in detail. For example, suppose a person is married in 2014 but divorced and decides to refinance the mortgage in 2015. This observation is out because the person has different interest rate terms in two years. The research design of the thesis only focuses on those that hold either fixed or variable rate mortgages in both before- and after-intervention years. Thus, while an agent's treatment variable is constant, only the outcome variable will change in the sample years. It ensures that there is one-way causality from monetary policy to divorce. Also, all people are married in the first period and can only divorce in the second period in the DiD. It also reduces the reversal causality risk.

6 Theoretical model

The model here is based on both couple's total income effect and role specialization effect theory. There are two assumptions. First, when both partners work and are engaged in market production, they can increase their ability to withstand an interest shock, even though their incomes may not be complementary. Second, opposite to the combined effect, the divorce risk is reduced if the couple engages in specialized household roles or only one partner works. For example, the husband can provide market production, such as earning a market salary, while the wife can focus on home production, such as raising kids. This distinction has been labeled as 'income' and 'independence' effects and proven in literature (Ross and Sawhill, 1975; Cherlin, 1979). Third, if both partners do not do more work, there is no effect.

The matrix in figure 9 summarizes the assumptions in response to monetary policy. First, if both partners are in a work state, they will have a positive couple's total income effect that reduces divorce. However, if one works and the other does not, they will enjoy the role specialization effect that mitigates breakup. Lastly, if both partners do not work, there is no effect on divorce, and their marital outcome is unpredictable.

		Partner 2	
		Work	Not work
Partner 1	Work	Couple's total income effect	Role Specialization
	Not work	Role specialization	No effect

Figure 9: The matrix shows two partners in two states in response to interest shocks. The combination of their actions corresponds to an effect on divorce.

In the context of monetary policy, it is possible to predict the divorce outcome using the two effects described earlier. Figure 10 shows that monetary policy influences divorce in two channels. On the one hand, an increase in the official interest rate increases the cost of investments and economic activities. However, to offset this effect, both partners can be engaged in work to withstand a rise such as shock, hence at least partially enjoying the pre-shock level of household income. South (2001) show that the impact of wives' employment on marital issues has switched from negative to positive over the past decades. It is because female-paid employment has been a solution to marital problems (Johnson and Skinner, 1986; Rogers, 1999). This economic opportunity gained wide acceptance by sociological researchers (Cherlin, 1992). So, the contractionary monetary policy could induce the total income effect, lowering the risk of divorce.

On the other hand, the two partners could involve in the same or similar economic

activities. They lose the role specialization effect since they duplicate each other's functions (Parsons, 1955; Parsons, 1959). For example, if men and women have the same working schedule and share similar income levels, they rely less on each other due to their duplicated functions. It will increase the divorce rate as the couple could spend less time together (Becker, 1981).

Therefore, assume that monetary policy prompts both partners to start working to meet mortgage payments and other necessary expenses. The net outcome will depend on the strengths of the two distinct effects. In other words, choosing one cell (i.e., couple total income effect) in the matrix in figure 9 will have the opportunity cost of not having the other effect (i.e., role specialization). The sum is then the benefit of one effect minus the opportunity cost. The assumptions are:

- Assuming the couple's income effect overweighs the role specialization, an unexpected rise in interest rate results in lower divorce.
- So, the hypothesis is that the net effect of monetary policy on divorce is negative.

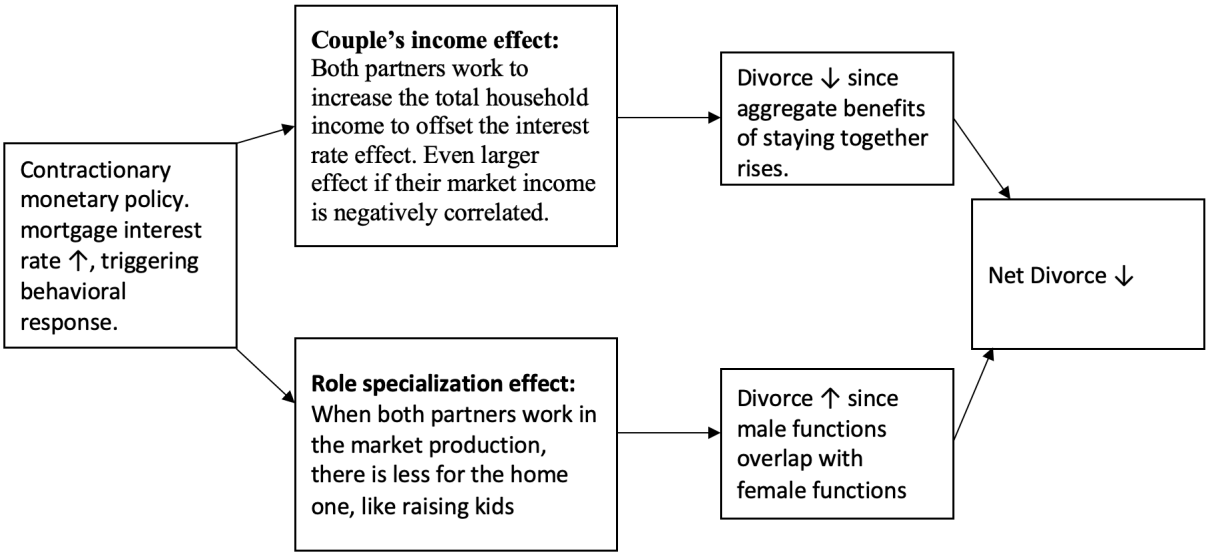

Figure 10: The figure shows the total income and role specialization channels after monetary policy.

The utility maximization equation with varying degrees of substitution supports this assumption. This equation is based on the household specialization equation from

Boerma and Karabarbounis (2021):

$$U = \log(c_t) - \frac{(BH_h + DH_f)^{1+\frac{1}{\eta}}}{1+\frac{1}{\eta}}$$

$$c_t = (c_h^{\frac{\phi-1}{\phi}} + c_w^{\frac{\phi-1}{\phi}})^{\frac{\phi}{\phi-1}}$$

In the first equation, subscripts h and f stand for husband and wife, respectively. c_t is the combined consumption, H is working hours, B and D are disutility from working, $\eta(>1)$ is the degree that amplifies the disutility. Then, the second equation includes the consumption of both husband and wife. η governs the degree of substitution between husband and wife's consumption.

The ϕ determines whether a couple's relationship is complementary. If it is low $\phi = 2$, the degree of substitution is low, and the couple is highly complementary. However, if it is high $\phi = 10$, their labor supply becomes a substitute. The marginal utility of an additional unit of a partner labor supply is low. Assume that the disutility of work is the same for the two partners, $B = D$. So, it is always better for both partners to work, even if their production is highly complementary. Notice the crucial assumption that the disutility of work is equal for both because a high disutility for one person will cause the other to work more. In modern society, such as Australia, it should be assumed that the disutility of work between the two partners is at least similar.

To summarize, monetary policy could change mortgage expenses and prompt both partners to respond. They both try to offset the income loss by raising their market production. On the one hand, they could regain their pre-shock aggregate level of income and consumption and withstand the shock, thereby reducing the divorce rate. On the other hand, this will alleviate the effect of role specialization as both partners could work in similar functions, which renders a breakup. Nevertheless, the hypothesis is that the net effect is negative and that the divorce rate will decline, given that the disutility of work is similar for the two partners. This will be tested later in the econometric analysis.

7 Econometric analysis

The analysis will use a differences-in-differences (DiD) model to estimate the causal effect of monetary policy on divorce. The reason is that observable confounders in the dataset have missing values, such as partner satisfaction. However, as each period covers only two years before and after the treatment, it can be assumed that these confounders are constant over time. Also, monetary policy is implemented only within the time dimension - the treatment group only receives the treatment if they hold a variable mortgage in both years. Thus, it makes a case for a DiD estimator, which is suitable for a causal analysis with a time dimension. The idea of DiD is to remove confounding by differencing outcomes over time. It thus requires repeated cross-sectional data, which the HILDA dataset can meet. One group will respond to the treatment, the variable rate group, while the other group will stay put, the fixed rate group.

7.1 Baseline model

The econometric equation (1) is stated below:

$$E[Y_t|D = d, T = t, X = x] = \alpha + t\delta + d\gamma + dt\lambda + x\beta^0 \tag{1}$$

On the right-hand side, t refers to the binary variable of time, d the binary variable of treatment, and x numeric covariates. The coefficient of δ is the common trend that affects both groups equally, while γ is the existing difference between both groups. These parameters are present in time even without the monetary policy. However, when the policy takes place, the group variable interacts with the time one since only one group receives the treatment. So, the coefficient of λ captures this causal effect. Also, it is helpful to assume that the treatment and time are not associated with the covariates, which are only for control. Lastly, there is no error term since its expected values are zero as the sample size approaches the population one.

On the left-hand side is the expected value of the outcome variable, divorce, conditional on the group, time, and covariates. A linear regression model estimated using ordinary least squares (OLS) will give the causal effect estimate in probability. Also, since the focus is on causal rather than predictive analysis, an OLS analysis is suitable for this probability coefficient. It is also essential that the datasets only contain individuals who are either married or de facto in the first periods and exclude those who are already divorced or separated. It is because the analysis is interested only in those who become divorced after monetary policy.

Table 4 shows the selected results of the regression (full results of the regression models in the appendix). Overall, contractionary monetary policy or a rise in interest rate has

resulted in less divorce among the variable rate couples. In contrast, the expansionary monetary policy does not have a causal impact. After the 2008 financial crisis, the central bank tightened the monetary policy to resume the interest rate and fight inflation between 2009 and 2011, raising the interest rate. It has caused more divorce in the economy overall since the year parameter is significantly positive. However, if the couples have a variable interest rate, they are 2% less likely to get divorced, with a nearly significant p-value of 0.12 in 2009 and 2010. Keep in mind that 2% is still a tiny percentage, whether significant or not. One year later, it became highly significant in 2010, as the lenders passed on interest expenses to consumers and mortgage costs started to compound. It implies that when the central bank raised the interest rate by around 1%, the divorce rate among couples with variable interest rate mortgages was reduced by 3.5%.

- Contractionary monetary policy: An rise of 1.75% in the interest rate significantly reduces divorce rates by a small percentage of 3.5% between 2010 and 2011.
- Expansionary monetary policy: it does not have significant impacts on divorce rates.

However, it is vital to investigate the sample in that year for potential spurious correlations. By examining the data closely, the sample in 2010 and 2011 had only two divorces. This sample period has limited observations because the 2011 year data comes from the 2014 imputation and is then connected to 2010. In contrast, data from other pairs of years, such as 2011 and 2012, come from the same imputation year of 2014, raising the likelihood of having the sample mortgage type. Since there is only an 80% chance of finding a match with the interest rate, this sample becomes small. Thus, the significance of the estimate could be in doubt and should come with caution.

Second, the low interest rate in 2008 and 2014 does not seem to influence divorce. The anticipation is that a lower interest rate results in a lower divorce rate among the variable rate mortgage holders, thus giving a positive sign on the estimates. However, both estimates are inconsistent; therefore, no conclusions should come. Moreover, it is tough to infer meanings from 2008 during the financial crisis, where the ripple effects of the housing markets influence many economic aspects of life.

It could argue that conditioning data could find causal effects on specific characteristics, such as gender. Nonetheless, this will limit the sample size and remove the few observations that turn divorced in the next period, causing it impossible to run the regression. So, there will be more credible results than this approach.

Variable/ Year	2008-2009	2009-2010	2010-2011	2014-2015
treatment*year	-0.012	-0.019	-0.035**	0.008
	(0.008)	(0.013)	(0.014)	(0.016)
year	0.020	0.034**	0.037**	0.001
	(0.010)	(0.012)	(0.013)	(0.016)
treatment	-0.000	0.000	0.000	-0.000
	(0.007)	(0.009)	(0.010)	(0.012)

Table 4: Differences-in-differences regression output with the divorce rate as the outcome variable. Treatment = 1 if the mortgage is variable, 0 else. Year = 1 if it is in the second period of the pair, =0 if first. Note: Robust standard errors in parentheses, *p<0.10, **p<0.05, ***p<0.01.

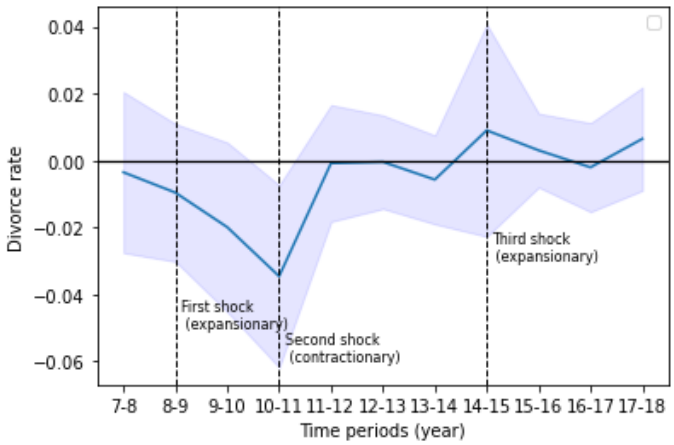

Figure 11: Differences-in-Differences causal effect estimates on the divorce rate.

7.2 Robustness test

7.2.1 Interaction with leverage ratio

It could argue that mortgage holders at the beginning of the loan period are more exposed to interest shocks than those at the end. So, the loan-to-value ratio could be used to measure the vulnerability of households in the face of monetary policy. The analysis based on these subsamples can indicate that the effects are significant for highly leveraged couples who must change their behavior. It could suggest that liquidity constraints play a role in explaining the marital status response to monetary policy.

The loan-to-value, bound between 0 and 1, the ratio is measured as the amount of

mortgage outstanding divided by the home's approximate value today. For the numerator, if a person has a high amount of payable liability, the interest payments are likely to be high too. Then, for the denominator, if the home value is higher than the mortgage outstanding, the person is nearly at the end of the mortgage period, so an interest rate change will not cause an enormous shock. Furthermore, the median loan-to-value ratio in the 11 samples is between 0.37 and 0.42 since most mortgage holders have made their down payments or that housing prices have risen since their home purchase. So, the ratio could reflect the middle of their mortgage payment period. The median is used to differentiate between high and low loan-to-value ratios.

By building this new variable, the new treatment variable is defined as below:

Treatment: D[var=1, H-LTV=1] + D[var=1, H-LTV=0] + D[var=0, H-LTV=0]
Control: D[var=0, H-LTV=1]

where var is 1 if a person has a variable rate mortgage instead of a fixed one, and H-LTV is 1 if she or he has a higher loan-to-value ratio than the median. In this setting, the control group becomes those with (I) a fixed mortgage rate and (II) a high loan-to-value ratio. These groups are likely to be locked into an unfavorable interest rate and are more vulnerable to monetary policy shocks than the other types. The same econometric equation (1) with the new treatment variable d is rerun. The results are shown below in table 5 and figure 12.

The results show a similar pattern to the baseline model. Nonetheless, the estimates' sizes and significance have seen marked increases. For example, the monetary policy caused the divorce rate to decrease by 5.2% in 2009-2010 and 6.4% in the following period. Oppositely, those with a fixed-rate mortgage and high loan-to-value ratio have seen an increase in the divorce rate. On the contrary, the other periods did not show any changes in their significance. In sum, the control group in the regression becomes people with a fixed mortgage and high loan-to-value ratio. Then, it is feasible to determine the monetary policy effect.

- Contractionary monetary policy: a rise of 1.75% in the interest rate significantly reduces divorce rates by percentage of 5.2% between 2009 and 2010 or 6.5% between 2010 and 2011, conditioning on loan-to-value ratio.
- Expansionary monetary policy: it does not have significant impacts on divorce rates again.

Variable/ Year	2008-2009	2009-2010	2010-2011	2014-2015
treatment*year	-0.027	-0.052***	-0.064***	0.009
	(0.015)	(0.018)	(0.017)	(0.021)
year	0.035**	0.067***	0.067***	-0.001**
	(0.014)	(0.017)	(0.017)	(0.021)
treatment	0.000	0.000	-0.000	-0.000
	(0.011)	(0.012)	(0.011)	(0.015)

Table 5: Differences-in-differences regression output with the divorce rate as the outcome variable. Treatment = 1 if the mortgage is variable, 0 else. Year = 1 if it is in the second period of the pair, =0 if first. Note: Robust standard errors in parentheses, *p<0.10, **p<0.05, ***p<0.01.

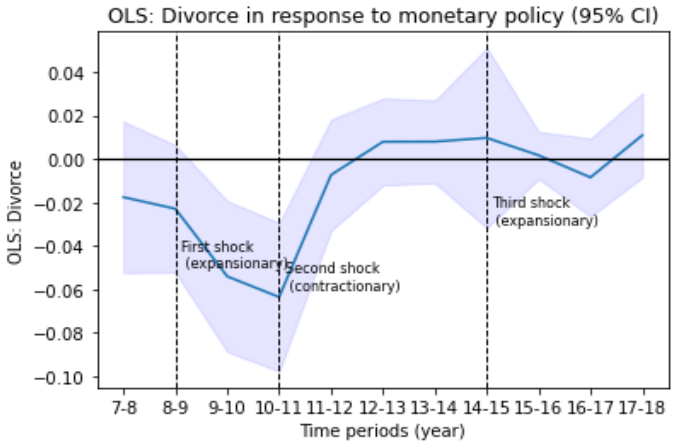

Figure 12: Differences-in-differences regression with adjusted treatment variable.

7.2.2 Panel data regression

An alternative approach to this analysis is to run a differences-in-differences regression model using the entire panel dataset to estimate the overall effect. It can ensure that the sample size is large enough to represent the population. In addition, the interest rate variable can be instrumented with unexpected shocks defined by a discrete variable. Figure 13 shows the development of the instrument and the treatment. The treatment is adjusted with the Loan-to-Value (LTV) ratio defined earlier.

Table 6 shows the results of the 2-stage least square with differences-in-differences regression results. The first-stage results show that the instrument is significant, as expected. The interaction term has a coefficient of negative 0.005. Overall, it means that if an agent belongs to the variable rate group and/or has a low loan-to-value ratio,

she or he will have a 0.5% lower chance of divorce. Mainly, having a fixed-rate mortgage and a high loan-to-value ratio raises the probability of divorce relative to other groups. This result shows that the significance of the estimate is robust in the entire dataset, although it is a small percentage.

Note that there are three caveats to this approach: The interest rate could have lagged effects on the outcome, meaning that the interest rate could take 1 to 2 years to affect a breakup, which could change the signs of the estimates and the interpretation. However, it is still being determined how long that lag is, so no time gap between the interest rate and divorce is assumed in the model. It is not a typical differences-in-differences model, as the time variable is assumed to be a continuous variable, which is the interest rate. It is unknown whether people turn from marriage to divorce stage or vice versa since marital status can change more than one time over the years.

Briefly summarize, monetary policy has a small but significant impact on divorce. On the one hand, couples could both be involved in the same market production to offset the monetary policy shocks, resulting in the couple's total income effect and a lower divorce rate. On the other hand, they could be employed in the same activities and reduce the role specialization effect, which raises divorce. However, divorce seems to decrease after the monetary policy changes the mortgage expenses for the variable rate group.

- Monetary policy: A rise in the interest rate is associated with a 0.5% lower divorce rate overall.

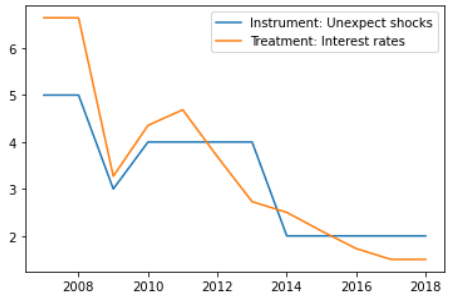

Figure 13: Instrumented unexpected shocks and interest rates.

Stage	Variable	Coefficient	Standard error
First stage	Intercept	5.855***	(1.377)
	Shocks	1.377***	(0.190)
Second stage	Intercept	0.017	(0.006)
	Treatment*interest rate	-0.005***	(0.002)
	Interest rate	0.005***	(0.002)
	Treatment	-0.013**	(0.006)
	Health condition	-0.001	(0.002)
	Born in Australia	0.002	(0.002)
	State (from NSW, NT)	-0.002	(0.002)

Table 6: 2 stage least square with differences-in-differences model. Note: Robust standard errors in parentheses, *p<0.10, **p<0.05, ***p<0.01.

8 Discussion

8.1 Implications

The main finding of the analysis is that monetary policy has a negligible effect on divorce using the whole control group but a more prominent effect using only a subset of the control group. The overall effect of a 1.75% rise in the interest rate is 2 to 3%, while the effect using the subgroup is 5 to 6%. It could imply that the loan-to-value ratio is a crucial adjustment to the mortgage rate variable to reveal the causal effect.

Moreover, the significant coefficient coincides with the Pareto weight drop in 2010, illustrated in figure 6. It means that

- A higher divorce rate and a lower female wage relative to males co-occur among people with a fixed-rate mortgage and a high loan-to-value ratio during the aftermath of the financial crisis.

The surprising finding is that the variable rate group people are better at preventing divorce risk than the fixed rate people. One possible explanation is that women's earnings can have a positive effect on marriage, as opposed to the independence hypothesis (Goldscheider and Waite, 1986; Mare and Winship, 1991; D. T. Lichter et al., 1992; Oppenheimer and Lew, 1995).

The underlying reasoning lies with the theory discussed earlier: the couple's total income effect outweighs the role specialization effect. On the one hand, when the monetary policy takes place, both partners will shift their activities towards market production, increasing the total household income to offset the monetary policy shock. On the other hand, they will also lose their specialized roles in the household and forgo some home production, reducing marriage's benefits. However, in aggregate, partners should prefer the outcomes of their joint production to the standalone one. It is consistent with the assumption that women are not using their economic independence to avoid marriage (Qian and Preston, 1993). Instead, men and women combine their economic contributions to save the marriage. It confirms the hypothesis on the net effect discussed earlier. In our case in 2010, the Pareto weight of the variable rate group could also drop to nearly 0.28 as in the control group, where males concentrate on market production while females focus on home production, which should reduce divorce. Nonetheless, since males and females share their market production more equally in the variable rate group, it is associated with a lower breakup rate.

The causal analysis relies on the identification assumptions. Section 4 reports the aggregate national statistics about the official interest rate in Australia. Apart from

the central bank announcements, the yield curves of the three waves are crucial. The thesis mentions that since the yield curve was upward-sloping in 2009, an increase in the interest rate could have been expected. So, there is suspicion of selection bias, which restricts the inferences from the results.

Nevertheless, there still needs to be solid proof that all agents in the sample could have anticipated the rise or the magnitude of the rise in interest rate. It could only be valid if everyone had free access to the financial market and had perfect information. Moreover, a standard yield curve is upward-sloping already, which may not predict a climb or a fall in interest rate. Because bonds incorporate future risk, the long-term yield is higher than the short-term one. Overall, while open for further investigation, this thesis concludes that the identification assumptions are likely to hold and the rise in interest rate in 2009 is unexpected.

Another discovery of the econometric analysis aligned with the early assumption is that a drop in interest does not have the same effect as a rise. Figure 1 shows that there are two waves with falls in interest rates. Assuming they are unexpected, this should have raised the divorce rate among the variable rate mortgage group relative to the fixed rate with a high loan-to-value ratio. However, no such effects are there. It is consistent with the "rocket and feather" hypothesis by Valadkhani and Anwar (2012) discussed in the previous section. Banks could typically pass a rise in interest as an expense to mortgage holders while shifting little to nothing to benefit from lower costs when the interest rate falls.

The monetary policy could expose intra-household inequality. Women are robust to consumption loss when interest rate increases among those with a variable interest rate. The analysis does not reveal who initiates the divorce, but divorce could be associated with gender inequality since women could lose their shared assets. "Division of matrimonial property in Australia" (2001) states that the way women and men divide their property on divorce primarily reflects financial contributions to the marriage in Australia, meaning it is an equitable regime rather than a community property regime with a 50/50 split. Thus, since women earn less than men before the divorce, they will suffer bigger losses.

It is noteworthy that while the outcome variable represents both marriage and de facto relationships, the term divorce stands for a breakup of these relationships in this thesis. While a traditional divorce will lead to a procedure with property settlement, a breakup of a de facto relationship will depend on whether Family Law Act 2008 is implemented in the corresponding states (Kaspiew and Qu, 2016). As de facto relationships become increasingly common, the property settlement law will become more critical to ensure an equal distribution between partners.

This thesis focuses on the behavioral response of couples to monetary policy shocks.

An increased female labor supply could drive this response. For example, Attanasio et al. (2005) explains that the increased female labor supply can hedge against income shocks, which include permanent and temporary components. However, the behavioral response could be in other forms. For example, one could get a second job or work extra hours. Due to the scope, only the employment rate statistics are in the data section.

Moreover, other non-behavioral responses include withdrawing savings and reallocating the budget. Nevertheless, these could have limited impacts as the monetary policy is unexpected. Thus, the behavioral response could be the influential factor driving divorce.

8.2 Limitation

This thesis adapts a causal analysis research design using the HILDA from Australia. Nevertheless, it faces limitations in the country selection, empirical methods, data cleaning, identification, and regression methods.

First, data availability is the main reason for choosing Australia for the analysis. It is the only country with a good and acceptable balance in the number of individuals between the treatment and control groups. It experienced ups and downs in interest rates over the sample period between 2007 and 2018. In contrast, the Panel Study of Income Dynamics (PSID) from the US has too few waves with fixed-variable rate data and an uneven distribution between treatment and control groups. Then, the British Household Panel Survey (BHPS) does not have information about the type of mortgage a household takes. Lastly, Longitudinal Individual Data Base (LINDA) from Sweden is not accessible to master thesis writers. Therefore, even though the Australian data might not be enough to conclude that a rise in interest rate reduces divorce, it has at least one rise and two falls. It would be interesting to consider a rise in interest rates in the aftermath of Covid 19 crisis, assuming that it comes as unexpected.

Apart from a causal analysis, a simulation of the life-cycle model could also predict the outcomes of divorce after a change in interest rate. It could be the adjusted version of the Zeldes (1989) and Attanasio et al. (2005) models. However, the thesis does not implement it due to the complexity of rewriting the code. The life-cycle model also sheds light on changes in consumption and wealth, which are beyond the scope of the thesis. Practitioners must also match the moments of income and interest rate shocks with the actual data, which is another barrier to implementing it.

After obtaining the data, the imputation method is used to expand the sample size because the mortgage fixed-or-variable rate data is only available in 2010, 2014, and 2018. While the imputation has an accuracy of 80%, it could imply that outliers could

heavily influence the results due to the small number of individuals (i.e., less than 50) every year that decide to divorce every year in the data. The accuracy will improve with a larger sample size, which could be feasible in the future.

Then, the fulfillment of identification assumptions also warrants attention. The causal analysis assumes the absence of selection bias, meaning that the allocation of people into fixed and variable-rate mortgages should be random. This design is better than other designs, such as comparing people renting vs. purchasing a home, where people share different characteristics. Table 3 shows that most attributes of the mortgage holders are similar except for education. Most statistics show that variable-rate mortgage people tend to have better living quality than fixed-rate people, such as a lower divorce rate and higher labor supply, though the parallel trend assumption holds. Notice that the differences-in-differences research design will filter out the time-invariant variables, but time-variant variables could be a concern. So, it could be argued that the two groups have some minor fundamental differences. Another identification challenge is whether the interest rate comes as unexpected. More research should be done to validate the anticipation of interest rate changes.

Another unclear factor is whether an increase or decrease in the interest rate results in the changes in divorce. The rise in the interest rate follows its decline. As the divorce or separation arrangement could take some time, it is possible that the decline in the interest rate gradually takes effect in the following years. However, it is not feasible to verify this fact based on this research design. Moreover, it is also probable that there are other effects from the financial crisis that are not captured by the official interest rate. This could also limit the interpretation.

Lastly, the regression analysis relies on Ordinary Least Squares (OLS) regression. It is because of the limitation of other types of regression. For example, logit regression belongs to the class of Maximum Likelihood (MaxLik). It is suitable for estimating the outcome variable as a probability ranging between 0 and 1, which is the case of divorce in this analysis. However, there are two limitations to it. First, the implication of the marginal effects complicates the design of differences-in-differences. To run logit regression, it is necessary to estimate the mean marginal effects (or at the mean) by setting the treatment variable to 1 and 0 and comparing their differences. Nevertheless, in the context of differences-in-differences, the interaction term will be either 1 or 0, contradicting the time and group variables. It adds complexity to the analysis. Second, it is impossible to run bootstrap to obtain the logit regression variances for the first analysis using pairs of years. It is because there are few outcome values equal to divorce there. When bootstrapping the sample with replacements, some samples will not contain any divorces, leading to regression errors.

All in all, the limitations warrant attention from the readers, and more could be accomplished to mitigate them.

9 Conclusion

This thesis concludes that monetary policy has a small but significant effect on divorce. The main reason, as the author argues, is the behavioral response of couples to interest rate shocks, as both partners could work in the same functions to hedge against the risk of mortgage default. On the one hand, the total household income and benefits could increase to provide enough resources and reduce the divorce risk. On the other hand, as both males and females participate in market production, the relative income between the two partner falls, and the advantages of role specialization of being a couple diminish, which raise the breakup risk. However, since the total income effect outweighs the role specialization effect, the net effect will be negative and imply a lower divorce risk.

The econometric and correlation analysis treat variable rate mortgage holders as treatment and the fixed rate one as control. The loan-to-value ratio is used as an adjustment factor. It finds that the rise in the interest rate of about 1.75% causes divorce risk to fall by 5-6%, compared to the control group with fixed interest rates adjusted with a high loan-to-value ratio. This control group suffers higher divorce risk and a more unfavorable female wage share of the total couple's wage. These results are essential for macroeconomic policy literature on intra-household inequality and family economics.

In light of the limitations discussed in the previous section, the direction of future research is highlighted here. First, this research design could be applied in countries with more equal distribution of shares between variable rate and fixed rate mortgage holders, such as Sweden (Economist, 2022). It will further minimize the chance of selection bias between the two groups since selection into either group will become more random. Second, the official interest rate has been flat since the financial crisis, but it has gone up again during the aftermath of the Covid 19 crisis. Its effect could not be investigated at the time of writing this thesis. As the availability of data rises, more research could be done to validate the impact of an interest rate rise, given that it is unexpected. Third, the research can go beyond the context of causal analysis. One can also run a life-cycle model to examine its impacts on consumption and wealth accumulation, which are directly linked to welfare.

To summarize, divorce is a vital household decision often overlooked in macroeconomic literature, but its connections with economic variables could be an exciting field for research.

10 References

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11 Appendix

	mean	var	std	max	min	na	unique	obs
treatment*year	0.43	0.25	0.50	1.0	0.0	0	2	1442
Year	0.50	0.25	0.50	1.0	0.0	0	2	1442
treatment (share with var mortgage)	0.86	0.12	0.35	1.0	0.0	0	2	1442
Share with good health	0.80	0.16	0.40	1.0	0.0	0	2	1442
Share originally from Australia	0.76	0.18	0.43	1.0	0.0	0	2	1442
divorce_rate	0.00	0.00	0.07	1.0	0.0	0	2	1442

Table 7: Summary statistics: 2008-2009.

	mean	var	std	max	min	na	unique	obs
treatment*year	0.44	0.25	0.50	1.0	0.0	0	2	1842
Year	0.50	0.25	0.50	1.0	0.0	0	2	1842
treatment (share with var mortgage)	0.87	0.11	0.33	1.0	0.0	0	2	1842
Share with good health	0.78	0.17	0.42	1.0	0.0	0	2	1842
Share originally from Australia	0.78	0.17	0.42	1.0	0.0	0	2	1842
divorce_rate	0.01	0.01	0.09	1.0	0.0	0	2	1842

Table 8: Summary statistics: 2009-2010.

	mean	var	std	max	min	na	unique	obs
treatment*year	0.47	0.25	0.50	1.0	0.0	0	2	806
Year	0.50	0.25	0.50	1.0	0.0	0	2	806
treatment (share with var mortgage)	0.93	0.06	0.25	1.0	0.0	0	2	806
Share with good health	0.80	0.16	0.40	1.0	0.0	0	2	806
Share originally from Australia	0.76	0.18	0.43	1.0	0.0	0	2	806
divorce_rate	0.00	0.00	0.05	1.0	0.0	0	2	806

Table 9: Summary statistics: 2010-2011.

	mean	var	std	max	min	na	unique	obs
treatment*year	0.46	0.25	0.50	1.0	0.0	0	2	958
Year	0.50	0.25	0.50	1.0	0.0	0	2	958
treatment (share with var mortgage)	0.93	0.07	0.26	1.0	0.0	0	2	958
Share with good health	0.76	0.18	0.43	1.0	0.0	0	2	958
Share originally from Australia	0.81	0.15	0.39	1.0	0.0	0	2	958
divorce_rate	0.00	0.00	0.06	1.0	0.0	0	2	958

Table 10: Summary statistics: 2014-2015.

	coef	se	t-value	p-value
intercept	0.003146	0.008492	0.370425	0.711120
treatment*year	-0.011922	0.010579	-1.126956	0.259949
Year	0.019924	0.009819	2.029054	0.042637
treatment	0.000340	0.007491	0.045371	0.963818
Good health	-0.001897	0.004536	-0.418172	0.675884
Originally from Australia	-0.001375	0.004310	-0.319137	0.749669
From states with limited FLA	-0.003063	0.004094	-0.748197	0.454464

Table 11: Full regression: 2008-2009.

	coef	se	t-value	p-value
intercept	-0.000670	0.010204	-0.065702	0.947622
treatment*year	-0.019381	0.012976	-1.493592	0.135454
Year	0.034282	0.012132	2.825812	0.004767
treatment	0.000205	0.009183	0.022315	0.982199
Good health	0.004661	0.005169	0.901604	0.367386
Originally from Australia	-0.001542	0.005169	-0.298255	0.765542
From states with limited FLA	-0.006636	0.004763	-1.393398	0.163668

Table 12: Full regression: 2009-2010.

	coef	se	t-value	p-value
intercept	0.007386	0.010589	0.697513	0.485685
treatment*year	-0.034544	0.013933	-2.479257	0.013371
Year	0.037203	0.013458	2.764332	0.005835
treatment	0.000183	0.009856	0.018554	0.985202
Good health	-0.004493	0.004344	-1.034281	0.301318
Originally from Australia	-0.003784	0.004099	-0.923084	0.356242
From states with limited FLA	-0.004235	0.003996	-1.059903	0.289509

Table 13: Full regression: 2010-2011.

	coef	se	t-value	p-value
intercept	-0.001801	0.011983	-0.150254	0.880596
treatment*year	0.008229	0.016192	0.508217	0.611419
Year	0.000781	0.015609	0.050057	0.960088
treatment	-0.000136	0.011524	-0.011811	0.990579
Good health	-0.006641	0.004892	-1.357474	0.174953
Originally from Australia	0.005172	0.005305	0.974862	0.329877
From states with limited FLA	0.010293	0.004715	2.182917	0.029286

Table 14: Full regression: 2014-2015.

	mean	var	std	max	min	na	unique	obs
divorce rate	0.005	0.005	0.070	1	0	0	2	9876
Year	3.194	2.313	1.521	5.855	1.725	0	4	9876
treatment	0.853	0.125	0.354	1	0	0	2	9876
Share with good health	0.771	0.177	0.420	1	0	0	2	9876
Share originally from Australia	0.783	0.170	0.412	1	0	0	2	9876
From states with limited FLA	0.541	0.248	0.498	1	0	0	2	9876
treatment * year	2.730	3.250	1.803	5.855	0	0	5	9876

Table 15: Summary statistics: Panel data without leverage ratio.