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Essays in Development Economics and Economics of the Family

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ESSAYS IN DEVELOPMENT ECONOMICS AND ECONOMICS OF THE FAMILY

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ABSTRACT

Chapter 1 explores a potential solution to the continuing disequlibrium in microfinance markets. I design a mechanism to aid in securitization of microloans, using a dynamic investment pool governed by a Central Microcredit Clearinghouse (CMC), that would sell investment units back to MFIs and outside investors simultaneously. The CMC would serve as a catalyst to this other avenue of microcredit financing, securitization of microloans, which could help spawn the type of growth in investor-based funding of MFIs that is so urgently needed. Chapter 2 analyzes Official Development Assistance (ODA) commitment and disbursement activity in terms of motivation, considering that the difference between bilateral aid commitments and disbursements may be related to the business cycle of the donor country. The annual disbursement gap is calculated for each pair for each year, as well as a cumulative disbursement gap, and these are regressed against multiple cyclicality measures of income and a set of control variables. It is found in multiple specifications that the cumulative disbursement gap is generally procyclical, much as aid itself, although the cyclicality of aid depends on the cyclicality measure. This is confirmed with four extensions designed mainly as robustness checks. Chapter 3 uses both the round six and 2006-2008 National Survey of Family Growth (NSFG) data for both male and female respondents along with macroeconomic data over the same time period to test a number of theoretical questions regarding changes in relationship exit costs and their effects on behavior in cohabitation, marriage, and separation. I find that our proxy for cohabitation surplus and exit costs significantly affects subsequent decisions of cohabitation, marriage, separation, and divorce. Also, marriage hazard rates are related to these changing exit costs in ways consistent with recent advances in theory.

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Chapter 1

The Central Microcredit Clearinghouse:

Facilitating a Microloan Securitization Market

Chapter Summary

As Microfinance Organizations (MFIs) gain commercial viability, the prospect of international capital markets' participation in assisting MFIs to meet the worldwide demand for services holds much promise, especially in the area of microcredit. Prior analyses support the use of collateralized debt obligations (CDOs) for bundling diversified loans to MFIs together to be repackaged as rated investments. In this paper, I design a mechanism to aid in securitization of microloans, using a dynamic investment pool governed by a Central Microcredit Clearinghouse (CMC), that would sell investment units back to MFIs and outside investors simultaneously. The CMC would serve as a catalyst to this other avenue of microcredit financing, securitization of microloans, which could help spawn the type of growth in investor-based funding of MFIs that is so urgently needed. Finally, I present a simulation of growth of microlending in South Asia, if a South Asia CMC would have been in place for a ten year span.

1.1 Introduction

The microcredit industry, the largest component of microfinance services, is expanding in volume, and close to reaching commercial viability. What started as a charitable mission decades ago is moving from the purview of NGOs to the interested eyes of profit-seeking investors. Recent years have seen rapid growth in micro-lending, advancing from an estimated $4 billion market in 2001 to around $25 billion in 2006 (Dieckmann, 2007). Today, it is estimated that over 100 million micro-borrowers in more than 85 countries are being served by 10,000 microfinance institutions (MFIs) (Galema & Lensick, 2009). These institutions collectively self-report a gross loan portfolio of over $60 billion today (The Mix).

Despite this rapid growth of funds available to micro-borrowers, only around 4% of the total demand for microloans is being met (Wardle, 2005; CGAP, 2006; Swanson, 2007; Byström, 2008; World Bank). It has been estimated that 1 to 1.5 billion potential micro-borrowers collectively seek to borrow between $300 billion and $500 billion. The market appears to be in disequilibrium, exhibiting significant and persistent excess demand (Dieckmann, 2007). If the microfinance industry is to meet this demand, it must undergo significant adjustments, one of which is increased access for MFIs to market-based funding sources.

The benefits of microfinance have been subject to significant analysis and scrutiny. Prior research suggests that microcredit may not be a solution for impoverished individuals to lift themselves out of poverty, since not every impoverished person possesses sufficient education or entrepreneurial talent to create a successful enterprise. Another challenge to the effectiveness of microlending is the ultimate use of funds. There is evidence that even with the thus far restricted

access to microloans, some borrow for consumption smoothing, instead of income generating activities (CGAP, 2010; Amendariz, 2000).

However, it is most common for a micro-borrower to use funds in some domestic enterprise, where the project return exceeds the interest cost of the loan, providing the borrower with an income stream (Morduch, 1999). There is substantial evidence of microcredit's success in alleviating poverty. There is also substantial evidence that many MFIs are able to hold defaults to a sufficiently low portion of their loanable funds, keeping them operationally sustainable. These together suggest that it is fair to set aside the discussion of microcredit's efficacy, and continue on to the discussion of the development of microcredit markets.

One question of particular importance to the development of the industry is whether potential funding sources for microloans are going unexplored. Microcredit financing as a debt-based investment presents many challenges to be addressed before markets will adequately develop. While loans to Microfinance Institutions (MFIs) constitute a large portion of their collective working capital, another potentially lower-cost form of capital remains unavailable. Microloan securitization has been briefly and recently attempted, but with poor results. Weaknesses of a microloan securitization market are plentiful both from the point of view of the investor and of the MFI.

For the investor, the lack of corporate governance in smaller MFIs, currency risk, country risk, non-standardization of accounting practices, and lack of institutional oversight all collude to provide risk that is most often uncompensated by the return potential. For the MFI, the cost of

securitization is prohibitive (Pollinger & Outhwaite, 2007). While such a market could provide a rich, new source of lower-cost funding for expansion of microlending to poor areas, the financial expertise required would be substantial. Even more threatening is the combination of this cost with the term of the typical microloan. Loans of just a few months are paid off almost as soon as they could be securitized, so that the expensive process would need to be repeated far more often than for mortgage-backed securities, for example. The purpose of this paper is to propose a solution to some of these challenges, so that market funding can expand for those MFIs in position for survival, growth, and eventual market penetration.

The remainder of the paper is organized as follows: Part 2 provides a survey of the current literature concerning funding sources and capital market access to MFIs, including the Microcredit Collateralized Debt Obligation (MiCDO) market, and the relative strengths of the main forms of capital market funding for MFIs. Part 3 introduces a hypothetical organization called the Central Microcredit Clearinghouse (CMC), and discusses its purpose in facilitating securitization of microcredit loans, as well as its potential organization and operation. Part 4 then uses data available about South Asian MFIs to present a simple numerical example of how a South Asia Central Microcredit Clearinghouse (SACMC) might have assisted in development of regional MFIs to expand their services over a ten year span. Part 5 concludes.

1.2 Funding Microfinance Institutions

The many microfinance institutions (MFIs) operating worldwide vary widely in their capital structure[1]. The mission of microfinance as a means toward poverty alleviation appeals to a large

[1] Fehr & Hishigsuren (2004) provide a detailed listing of operational funding sources for MFIs.

group of individual and institutional donors. Donations constitute a large share of operational dollars to many MFIs, as do government grants, and subsidized lending (Fehr & Hishigsuren, 2004). Although some MFIs are moving toward independent financial sustainability, for the industry of microfinance as a whole, donations and grants have been, and continue to be, a necessary support.

Client deposits often constitute a significant percentage of total liabilities for financial firms (Hempel & Simonson, 1999), and many MFIs are choosing to go beyond microlending by allowing, and even sometimes mandating, savings accounts held by clients of microcredit. Dowla & Alamgir (2003) describe the evolution of savings instruments in Bangladesh, noting that, despite regulatory challenges, these savings instruments not only provide liquidity to the MFIs, but also grant some protection against defaults. Of the more established MFIs in South Asia, for example, two-thirds report holding savings accounts of clients, which total an average of about 25% of assets (The Mix).

A table of microfinancing evolution typical to MFIs is provided by Calvin (2001) and modified by Fehr & Hishigsuren (2004). It shows the early MFI supported mainly by donations, savings of clients, and government grants. Various forms of debt financing are sought by more mature MFIs, and in the final stages, equity financing becomes part of the balance sheet. This equity is comprised of retained earnings, social-minded equity stakes, both private and institutional, and even commercial equity in the case of the strongest and most viable MFIs.

While donations and grants can get a young MFI into operation and sustain it for some time, few have reached the point of commercial viability where traditional equity investing is possible. An intermediate funding source, and also the most widely used, is debt. MFIs who have reached a certain point of stability as an ongoing concern are finding themselves eligible to secure funding in debt markets. Debt financing is the main focus of this paper, and it can be further subdivided into classes of direct borrowing and intermediated (brokered) transactions. Direct borrowing is straightforward; if an MFI can sometimes borrow from another financial institution for operational financing. However, due to the small size of most MFIs, the high transactions costs facing lenders associated with funding at the individual level makes this impractical (Glaubitt et al., 2009).

In contrast to direct loans, some borrowed funds are acquired indirectly, via intermediation through either packages of loans made to a group of MFIs, or securitization of microloans. It is this second category of financing that is the focus of the rest of the paper. The recent history, present status, and potential future realizations in the microcredit market is summarized by several authors (see, for example, Byström 2008). In his work, Byström introduces the Microcredit Collateralized Debt Obligation (MiCDO), and argues for its use as a conduit through which MFIs and Wall Street investors can meet. Such a rapid growth in total volume of microcredit worldwide has allowed MFIs to provide attractive opportunities to investors. That is, markets for CDOs require a deep enough pool of underlying assets for diversification, for proper valuation, and for replenishment of matured securities.

As a semantic distinction, Galema & Lensink (2009) use "CDOs" to refer to pooled loans granted to MFIs, with resulting securities backed by the MFIs themselves, and "securitization" to refer to marketing of securities backed purely by specified microloans. For the purposes of this discussion, I will follow this convention. Microfinance Collateralized Debt Obligations (MiCDOs) will signify the group-MFI lending by investors via intermediaries, and "securitization" will signify either a direct microloan to investment security conversion, or a securitization of microloans performed by an intermediary.[2]

Several authors foresee a growing and strengthening microcredit collateralized debt obligation (MiCDO) market (Byström 2008, Sundaresan 2008, Swanson 2007).[3] In fact, loans of this type have already occurred in recent years.[4] The Dexia microcredit fund was launched in 1998, aimed at the provision of financing to MFIs providing services to small businesses. More recently, in 2004 the BlueOrchard Microfinance Securities I fund (BOMSI) was launched. This was a new type of funding strategy for the field, loaning over $80 million directly to 14 MFIs, and the pooled debt was sold in Senior, Subordinated, and Equity tranches to investors (Swanson 2007). This is arguably the first real MiCDO, and its degree success will be of interest. Many microcredit funds have been launched in the interim,[5] allowing investors another indirect avenue

[2] MiCDO itself is a misnomer, since nothing is collateralized in MFI lending. These loans are simply debenture loans granted to MFIs, and backed only by their own good faith.
[3] News of MiCDO developments are important additions to any published work; the reader is referred to the MIX market (www.themix.org), the World Bank website, and other microfinance and microbanking bulletins for current information on what is summarized here.
[4] ProFund was a specialized Microfinance Investment Vehicle (MIV) that started in 1995, raising $23 million in an effort to finance several Latin American MFIs. For more on this, see Dieckmann (2007). Some evolutionary details in this storyline leaves debate as to how we might define the true start of the MiCDO. BOMS1 is considered by many to be the first.
[5] As of the time of this writing, www.microcapital.org provides a listing of at least 27 funds that specialize in providing funding to microfinance institutions.

to funding micro-borrowers; providing liquidity to the organizations that loan to the impoverished.

The operational sustainability of MFIs is necessary for this trend to continue. As long as MiCDO investors are realizing a fair risk-adjusted return, MFIs may use this access to funds to continue operation and expand services. It may be true that, in time, indirect MiCDO funding of MFIs will provide the needed capital for eventual market saturation. Many look to this avenue as the predominant form of structured microfinance in the near future.

Securitization has only been attempted in reduced form. What was touted as the first and largest "microloan securitization" deal was really a "microloan purchase" (Swanson 2007). SHARE Microfin Ltd. is the third largest MFI in India by microloan volume, with over 1,000 branches, specializing in microcredit loans to poor women across India. In January 2004, $4.3 million of SHARE's microloan portfolio[6] was purchased by ICICI Bank (Basu, 2004). This was a direct transfer of receivables, and can be viewed as a securitization deal where ICICI Bank retained all shares. ICICI Bank is India's largest commercial bank, and the deal was guaranteed by the Grameen Foundation, providing technical assistance and a collateral deposit of $344,000. The securities were purchased at a net present value, allowing SHARE to pay a rate of 8.75%, which was over 3% less than the rate of commercial loans (IFMR, 2007). Also, a second securitization deal was made between ICICI Bank and BASIX in 2004 for $842,000 of its microloan portfolio.

[6] According to The Mix Market (www.mix.com), SHARE maintained about $44 million in loans in 2004, making this offering about 10% of its total portfolio, even though it was 25% of total loans, indicating that it was truly a microloan transfer. These loans were simply assumed by the bank, not securitized and resold to investors as in a traditional securitization deal. (To underscore the impressive and continued growth in this industry, SHARE's microloan portfolio grew from $44 million in 2004 to over $576 million in 2009, just five years later).

While these transactions appear to hint at a developing securities market for securitized microloans, positive reports of the ultimate profitability of these microloan purchases are hard to come by. An acceleration in microloan purchases is not evident, and many reasons for this are enumerated in the following section.

1.2.1 Strengths and Weaknesses of MiCDOs

The recent surge of support of MiCDOs from stakeholders in microfinance arguably stems from its current and potential volume. Until recently, there simply wasn't a great enough volume of microcredit origination to warrant its consideration as a viable asset class. Now that this aggregate has crossed $25 billion (Dieckmann, 2007), the possibilities have changed. The potential profitability of top tier microlenders has caught the interest of the investment community. While attainment of this new market volume level is the main catalyst for this progression, there are several other reasons why MiCDOs can be mutually beneficial for MFIs and their investors.

As an asset class, packages of microloans (or packaged loans to regional groups of microlenders, to stay within the MiCDO framework for now) would provide an investment that is fairly homogenous, subject to little prepayment risk, and resilient to economic shocks (Dieckmann 2008, Galema & Lensink 2009). MiCDOs could certainly present investors with an attractive risk-adjusted return, if default rates remain as stable as are widely reported for the more successful MFIs. Loans to a handful of MFIs would also provide some diversification to the

investor. However, the security would retain significant firm risk, since these loans are repaid by and backed only by a small group MFIs.

For many investors, part of a "return" on their investment includes personal benefits, such as knowing that they hold a Socially Responsible Investment (SRI) (Morduch 1999, Copestake, 2007, Dieckmann 2008). Since some poverty has been alleviated by coupling entrepreneurial ability and drive with initial financing, investors in MFIs or their constituent clients are indirectly providing that opportunity to some of the billions of impoverished citizens of our globe. Marketing MiCDOs as an SRI may enhance investor interest in the asset class.

While financialization techniques and market sophistication have evolved significantly in past decades to easily assimilate a new asset class, Wall Street investors are used to a well-regulated market. Once we consider the debtors in a MiCDO as a small organization in south Asia, Africa, South America, etc. it is easily imagined how these standard rules of the developed world may not apply. To provide investors with better assurances and become eligible for MiCDO funding, many MFIs will have to improve their corporate governance (Arun & Hulme 2008, Glaubitt et al. 2009, Swanson 2007).

In some countries, currency and inflation risk is significant. In places that suffer economic instability as a direct result of macro policy, the total risk presented to the foreign investor may simply be too great (Byström, 2008). Currency risk is often viewed as a source of diversification to investors, but the risk of currency devaluation amid hyperinflation is universally unwelcome. This potential currency risk could significantly slow the development of international capital

markets tailored toward microfinance (Byström, 2008, Swanson 2007). For many investors, the ability to effectively hedge this risk is essential. Donated funds also represent a threat to the growth of commercial MFI financing. Many microlenders are just beginning the transition from NGO to a profit-seeking, financially sustainable organization. Donor funds will need to be put to use in ways other than direct MFI funding, or else some activity will be crowded out by this free financing (Byström 2008, Glaubitt et al. 2009).

In summary, MiCDOs present investors with a possibility of fair risk-adjusted returns, diversification, and the added benefit of being a reasonable social investment. Also, developed financial markets have the tools to effectively financialize these investments. Challenges that remain include a weak legal and regulatory environment with idiosyncrasies across each border, macro policy challenges, country-specific, currency risk within each MiCDO that is not regional in nature, currency risk for the foreign investor even if only one currency is used for loan denomination, and the threat of donated funds "crowding out" profit-seeking efforts necessary to grow the industry to meet demand.

1.2.2 Strengths and Weaknesses of Securitization

The direct securitization of microloans is another way that investors can connect with impoverished borrowers. It is this conduit to liquidity that now takes center stage in the discussion. Early attempts at securitization, as noted earlier, have not been successful. It is vital, then, that the strengths and weaknesses of securitization are analyzed, in search of a better method of securitization, if it is to be used at all in MFI financing.

Attractive investments with an infrastructure to create them

As with MiCDOs, securitizations can offer investors a fair risk-adjusted return (even greater, when enhanced diversification is realized). They are also classified as a Socially Responsible Investment (SRI), and the investor of a securitized portfolio is able to take on the good faith of an individual or small group of impoverished borrowers instead of vouching for the general operations and activities of an MFI. Also, the same developed markets that can create MiCDOs stand ready to establish securitization contracts. In addition, there are reasons to prefer this form of risk transfer to MiCDOs. First, investors are offered a "pure play" on the underlying asset, instead of relying on the viability of the MFI (Swanson, 2007). The microloans as a pooled and securitized asset are vastly diversified, much more so than loans to a handful of organizations (Glaubitt et al, 2009). Since securitized investments have their underlying value in the microloans themselves instead of the MFI, there is little firm risk.

Reduced liquidity strain for the MFI

Also, one marked benefit of securitization over MiCDO funding is the removal of liabilities from the balance sheet of the MFI. Cash via a MiCDO provides extra liquidity, a portion of which can be loaned out. This in turn expands leverage ratios, making the MFI more risky as a going concern. When required rates of returns on loans to that MFI increase, the benefit is mitigated. Securitization allows for the sale of the receivables for cash without exacerbating the firm's leverage ratios. This allows for further originations and subsequent sales, never forcing the MFI to approach an operational limit due to excess leverage.

However, these improvements come with a price. It is straightforward to review the list of MiCDO challenges in section 2.1 and recognize that they also apply to securitizations. The same legal risk, macro instability, and other challenges face direct securitizations of microloans in the traditional framework. In addition, securitization presents an addendum list of obstacles to overcome.

Extremely Short-term Loans

A common securitization in developed markets is based on mortgage loans, with terms of 15-40 years. These loans can be packaged relatively infrequently, and allowed to perform over this time frame. In contrast, many microloans are as short in term as just a few months. Packaging these short-term loans for securitization would present the financial intermediary with significantly higher (i.e. more frequent) administrative costs than other securitizations, much as the MFIs wrestle with similar costs at origination. This is a significant threat to the growth of any microloan securitization market (Byström, 2008, Swanson 2007).

Lack of Financial Sophistication in Small MFIs

There is significant technical, relational, and legal expertise required of an MFI to securitize its loans. While it is true that many of these skills could be acquired in the market by using financial intermediaries, still there remains a need for knowledge and advocacy at the MFI level if a series of successful securitizations is to take place. Most of the 10,000 MFIs in existence would find themselves inadequately supplied with these resources (Glaubitt et al., 2009).

Moral Hazard

The originating MFI plays a substantial role in the local success of the microcredit market. The relationships built and social pressures utilized in exacting repayment are vital to the success of microlending (Swanson 2007). These ongoing efforts are very costly for the MFI. Also, securitization passes the risk of the loan from the MFI to the investor. Therefore, there is a great incentive to, after origination, let securitized loans perform without these efforts. Potentially, moral hazard exists at the borrower level as well. The close relationship necessary between an MFI and its client indicate significant communication between the borrower and the MFI representative. The market's solution to the problem of these higher default rates would be to sever the relationship between foreign investors and MFIs once risk-adjusted returns fell sufficiently, making future securitizations (even if improvements were undertaken) much more difficult. In this way, moving too quickly into securitizations could quite possibly even harm the evolution of the market into longer term practices.

Summary

The additional costs presented by traditional loan securitization over that of MFI-level CDOs in microloans clearly outweigh the benefits of occasional investor preference and added diversification. It is this direct comparison that have led many to abandon microloan securitization as a promising possibility. Still, the benefits of a promising avenue of funding, the creation of an attractive investment-grade asset, and the reduction of leverage from the balance sheets of MFIs are worth pursuing. Success might rely on the existence of a custom designed intermediary available to address the challenges that currently stifle any microloan securitization market.

1.3 The Central Microcredit Clearinghouse

In this section, I propose the formation of an entity that can address most, if not all, of the challenges identified here to direct securitization of microloans, and in fact provide multiple enhancements to the market as well. Where traditional securitization techniques fall short in terms of cost-effectiveness, risk management, and practicality, a specific type of structured finance closely approaches the level of innovation that may succeed in developing this market.

Multiple types of Asset-Backed Commercial Paper (ABCP) structures exist in developed markets. One is the multi-seller structure, allowing multiple originators to combine assets in a securitization through program sponsor that then sells homogenized securities to investors in the market. The proposed entity, the Central Microcredit Clearinghouse (CMC), is a regional clearinghouse for microloans set up to serve several potential functions, some of which are similar to the role played by the sponsor in an ABCP securitization. In the following sections, the multiple purposes, the organization, the operation, and the solutions offered by a CMC will be explored.

1.3.1 Functions of the Central Microcredit Clearinghouse

The main function of the CMC is to stand ready to purchase microloans from member MFIs. While securitizations are most often large brokered deals (and often guaranteed by a third party), a microlender would be able to sell small to medium-sized batches of loans directly to its regional CMC for an actuarially discounted value, based on several criteria. In this way, the CMC would serve the purpose of both the Special Purpose Vehicle (SPV) and sponsor in traditional securitizations, but without the need for exclusivity to one particular originator, and

not for securitization of just one set of microloans. The regional CMC would offer purchase agreements to any area MFI that met certain membership criteria, with each purchase made at the option of the participating MFI, facing independent and automated valuation.

This valuation might be a function of the MFI's star rating on the Mix Market, the performance of past loans sold to the CMC, and the percentage of CMC securities held by the MFI of total assets under management[7]. Inclusion of the Mix market rating is simple.[8] If the MFI has a five diamond rating, then they are afforded a nonzero value for some binary variable in the valuation equation. This will serve as an encouragement for the MFI to pursue the extra rating or due diligence report required for this fifth diamond, as well as the incentive to maintain that rating.

Performance of past loans sold to the CMC would be vital in assessing the MFIs' ability to service current loans and the clients who receive them. A ratio of currency received to currency loaned could easily be calculated for each interest rate level, loan size, and demographic variables relating to the borrower. This would provide the CMC with a good estimate of a mean repayment rate for each future loan purchased from an MFI. Using this information as a large portion of the purchase value of the loan would be one very important step in addressing the enormous moral hazard problem that plagues traditional securitizations, where the originator could pass along poor loans for excess profit. Such a scheme would not be beneficial for an MFI

[7] As indicated in some areas below, a successful valuation will ultimately be more complex, including some variables for country risk, currency risk, inflation expectation and firm financial ratios at minimum.

[8] The CMC would likely accept only four- and five-diamond rated MFI loans. The Mix Market assigns a 1-5 diamond rating to an MFI based on disclosure levels, and four diamonds are given once the MFI has at least two consecutive years of audited financial statements with an auditor's opinion and notes.

in the long run, and they would likely be competed away by more stable MFIs. In addition, initial sales of loans to the CMC by a newly participating MFI could be restricted to small amounts, until some accredited payment history is established.

Third, using a purchase ratio of CMC securities and cash to the total of receivables purchased is a way to mitigate moral hazard. Since the sale of microloans to a regional CMC allows an MFI to free up more cash for origination of additional loans, a constant pass-through of loans with no minimum holding percentage would essentially allow the MFI to quickly multiply its cash into a massive expansion of loans.[9] Instead of assuming this risk, the CMC would purchase loans for a combination of cash and CMC-securitized assets, to be held at the CMC in the name of the MFI.

Purchasing microloans from MFIs would bridge a large portion of the current funding gap; but the CMC is not a central bank, and cannot create money from nothing. This organization will act more like a broker between profit-seeking investors, and MFIs with a comparative advantage in local lending. Securitization of these microloans, in a style similar to that of investment banks, will allow the CMC to repackage and sell this debt both back to the MFIs it serves, and to domestic and foreign investors.

By assessing the repayment risk, any country risk, inflationary pressure, etc. at the point of purchase, the CMC could then actuarially reduce each loan to an expected CMC currency unit (CMCU). This currency unit would be denominated in the most internationally traded currency

[9] This would incite a one-time moral hazard for a small MFI. Without limits, loans could be originated, immediately sold for cash to the CMC, and re-originated any number of times in a single day. The MFI could then cease CMC membership, while hundreds or thousands of "clients" default.

of the region. Then, currency futures could be obtained by the CMC for net currency exposure. This way, the CMCUs track closely to a single, stable currency, and investors from any corner of the globe will have the option of accepting this single currency risk, or hedging as one would against the currency risk associated with any foreign bond.

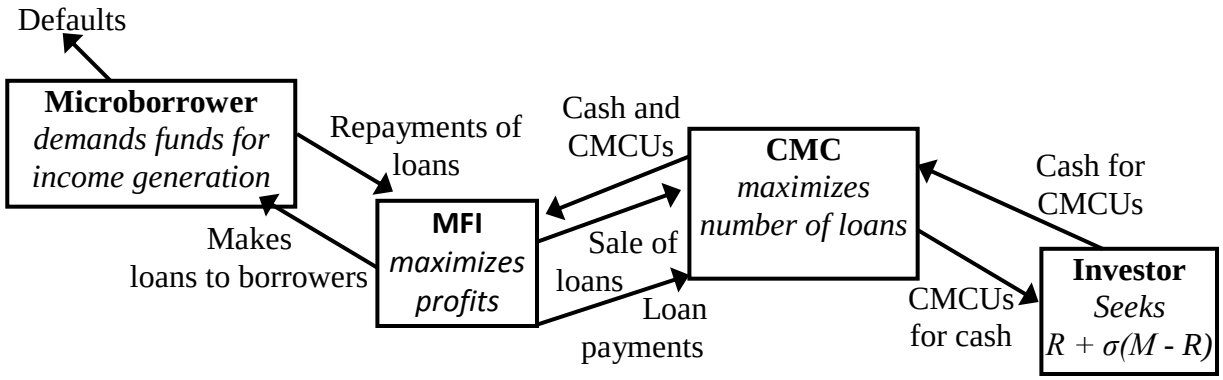

Figure 3.1.1

The CMC would continue to create CMCUs every time it made a purchase of microloans. This means that a CMC would maintain a constantly evolving pool of loans, with each CMCU representing a proportional claim on this dynamic pool of assets. The relatively short duration of the microloans purchased would be immaterial to the CMC and its investors. As various terms are continuously bundled together, the quality of CMCUs on the market would vary with the current average quality of microloans in the pool. The return on a CMCU would be estimated by the deepness of the discount rate offered in purchase of the loans, and the variance of returns would depend on the ability of the CMC to accurately manage the valuation of the underlying pool at acquisition.

The CMCU has several attractive qualities as an investment. It would be well diversified across borrowers, representing the collective repayments of all micro-borrowers of a region. It would be valued and created independently by a nonprofit institution, with the mission of developing the investor-MFI connection through this indirect securitization channel, making it relatively easy and transparent for investors to value. The social nature of the investment would remain, as the investor not only receives a nearly direct connection with the micro-borrower, but also indirectly supports the CMC with social objectives other than just investment brokering, to be described below. Finally, a CMCU would be denominated in a single, stable, and hedgeable currency.

Another useful function of the CMC is the provision of various standards of membership, governance, accounting & reporting practices, emergency financial assistance, and arbitration. The number and variety of microlenders in existence leaves potential investors with a dizzying array of information to assimilate. Accounting practices vary widely, language barriers hinder communication, cultural norms require lenders to practice in different ways, with different rules; this leaves significant heterogeneity in microloan receivables. It also leaves potential direct investors (large banks willing to accept loan packages, much like the ICICI purchase of 2004) wary of the counterparty risk.

Finally, the CMC, through its incentivized loan purchase and securitization program, could actually serve to provide a little creative destruction to the field. That is, the influence of the CMC could serve to grow the most successful microlenders, and at the same time, be a catalyst for some healthy crowding out of other microlenders who are already losing money, are

inefficient, or practice lending with methods that are ineffective or harmful to the client. The acceleration of funding to MFIs in the field may also accelerate the market's ultimate response.

1.3.2 Model, Structure, and Organization of the CMC

In this section, I intend to briefly introduce some of the possibilities in organizing a regional CMC. In section 4, I assume a South Asia CMC, and create a dataset to simulate ten years of activity. This will show some of the potential direct benefits of the existence of a South Asia CMC (SACMC). This section is written with this area in mind, although the structure here is flexible enough to export to every region of the world.

1.3.2.1 Modeling the representative Microfinance Institution

Assume there is a representative microfinance institution (MFI) in a geographical region. There is demand for loaned funds from *n* identical potential micro-borrowers in that region. Transportation costs for borrowers to get to another MFI are prohibitive. All *n* borrowers have potential entrepreneurial projects with chances of success of known probability, and other potential sources of income or lending sources for repayment of MFI loans.[10] The combination of these factors (as well as the performance of the MFI in project development and collection activities) creates a probability of default, *d*, where with probability *1 - d*, the MFI's loan will be paid in full, including interest charges. For simplicity, I assume that if a borrower defaults, they will do so immediately after origination. It is also reasonable to assume that the default rate is an increasing function of the interest rate chosen by the MFI. Therefore, the probability of default is *d(I)*, where *I* is the monthly interest rate, and $d_I > 0$.

[10] The borrower is often more richly modeled in other settings, where adverse selection, strategic default, etc. are of interest. Here, the focus is on the lender; the borrower will remain simplified.

Each identical representative borrower seeks a loan of size g. The loan demand function is $g(I)$, $g(I) = 0$ for some finite level of I, and $g_I < 0$. Total demand of loanable funds facing the representative MFI is then $L_D = ng(I)$.

Each loan has an identical term of m months. The payment expected from each borrower at time t is given by $E(P_t) = g(I)\frac{(1+I)^m}{m}(1-d(I))$. That is, interest for the term is entirely expensed by the borrower at origination. This is known as a "flat rate" calculation, and is common practice among MFIs in developing nations. It removes the prepayment incentive, and also creates an APY much larger than the stated interest rate.

Each MFI is endowed with initial cash on hand of C_0, and inelastically supplies this cash to the market in lending each period. The MFI is able to borrow from capital markets at some rate r_{MFI}, which is an exogenously determined rate greater than a net risk-free periodic rate R. From this, the MFI chooses a debt level in each period of D_t.[11] The supply curve of the representative MFI is then the perfectly inelastic curve of originations $O_t = C_t + D_t$.

Each MFI has a fixed cost w of originating a new loan that is recognized at the time of loan origination. This can be assumed to capture necessary search costs, screening, documentation, and all administrative expenses, including subsequent collection and processing of payments. Since the MFI originates a total loan portfolio addition of O_t in each period, lending to $Ot/(g(I) +$

[11] Perhaps $r_{MFI} = (R + \sigma_{ROA}(M-R)/\sigma_M)*(1+\text{Debt/Equity ratio of the MFI})$, for example. The specific rate is beyond the scope of this paper, and does not impact the subsequent analysis of interest, which surrounds the CMC.

w) borrowers, with origination expenses of $wO_t/(g(I) + w)$ in each period. Each MFI is able to costlessly invest any cash on hand to earn the periodic risk-free net return *R*.

If we allow the MFI to choose an interest rate in the face of their cash constraint and origination cost, the MFI will have cash in each period C_t of

$$\textbf{(3.2.1.1)} \quad C_t = C_{t-1}(1+R) + \sum_{k=t-m}^{t-1} O_k \frac{(1+I)^m}{m}(1-d(I)) - O_t\left(\frac{g(I)}{g(I)+w} + \frac{w}{g(I)+w}\right) + D_t - r_{MFI} D_{t-1}$$

That is, the ending cash balance in each period after zero is the ending cash balance from the prior period plus its investment income, plus the sum of payments net of defaults from the current period and the *m-1* prior periods on past loans, less new originations and related costs, plus any debt held, minus any debt service payments.[12] Also, assume that the MFI does not offer deposit accounts. This removes a money multiplier effect from loaning its initial cash.

Further assume that $O_t < ng(I)$ for all "reasonable" levels of *I*; that is, there is excess demand for loans.[13] Recall the origination fee *w*. It is this variable that disallows an equation of $O_t = ng(I)$. Indeed, if $w = 0$, then the MFI could simply loan tiny amounts of cash to each potential micro-borrower with demand for a loan, charging a high enough interest rate such that the market was in equilibrium. To maintain excess demand for loanable funds, it is sufficient to assume that $O_t < wn$.

Equation (3.2.1.1) creates a trade-off for the MFI: higher interest rates bring in higher payments

[12] See Appendix A for more on this decision. In subsequent discussion here, incoming cash each period of $\sum_{k=t-m}^{t-1} O_k \frac{(1+I)^m}{m}(1-d_k)$ will be occasionally substituted for C_t for notational ease.

[13] The inclusion of *w* will be shown at the end of this section to limit the range of interest rates chosen by the MFI.

in a given loan, but it also incentivizes smaller loan sizes given that $g_I < 0$, increasing the cost of origination as a percentage of assets under management. Also, to simplify calculations, we will allow for "fractional loans" instead of rounding to the nearest whole optimal loan value.[14]

The MFI has no incentive to hold on to cash in each period, if demand is sufficient to make lending worthwhile. There are no liquidity reserve requirements, and no assumption of liquidity risk for the MFI. So, the MFI has only capitalized interest and as total income, and origination fees and potential debt service as total expenses. Idle cash is suboptimal; the MFI would prefer to use any cash for operational returns in excess of R. Using (3.2.1.1), we can then allow prior period cash and debt to be zero, and $O_t = C_t$. Then, solving for current period originations:

$$\textbf{(3.2.1.2)} \qquad O_t = \sum_{k=t-m}^{t-1} O_k \frac{(1+I)^m}{m}(1-d(I))$$

Equation (3.2.1.2) tells us that the outflows in each period will equal the inflows. The payments received on prior loans, which are the sum of outstanding loans and capitalized interest net of defaults, are pooled and re-loaned, less the portion of the "loan plus fee" sum that is required for origination expenses.

It is also important to specify that the MFI is assumed to be sustainable. At this point, only a necessary condition is given. Any loan made by the MFI must be assumed to return in expectation at least the undiscounted nominal cash equivalent over the term of the loan. If this

[14] This is a fairly reasonable concession, given that the demand for loanable funds is downward sloping. We assume that the MFI can find a borrower who then will take a loan at less than their reservation interest rate for the smaller loan amount. This also allows the MFI to reduce origination costs on this last fractional loan, which is also implicitly assumed in the calculations.

condition is not met, the MFI is simply granting, rather than microlending. This requirement, then, is that expected repayments from period *t+1* to period *t+m* sum to at least the sum of originations and related costs in time *t*.

$$\textbf{(3.2.1.3)} \qquad E\sum_{k=t+1}^{t+m} P_k = \sum_{k=t+1}^{t+m} O_t \frac{g(I)}{g(I)+w}\frac{(1+I)^m}{m}(1-d(I)) \geq O_t\left(\frac{g(I)}{g(I)+w}+\frac{w}{g(I)+w}\right)$$

Since (3.2.1.3) sums across m periods of identical payments, the expression can then be simplified:

$$\textbf{(3.2.1.4)} \qquad \frac{g(I)}{g(I)+w}(1+I)^m(1-d(I)) \geq 1$$

Equation (3.2.1.4) is simply a statement that the net return on loans must be greater than or equal to zero. This provides both a lower bound and an upper bound for the interest rate choice by the MFI[15]. If the interest rate is too low, then interest income will not exceed the fixed origination expenses, even though originations will be relatively few, and of relatively large size. If the interest rate is too high, then the many small loans originated will generate too large a number of origination expenses. Since the interest rate has both an upper and lower bound, the borrowers' demand for funds *g(I)* is also constrained with an upper and lower bound. All that is necessary to lead to a persistent disequilibrium is a sufficiently high number of borrowers *n* given the parameters chosen.

[15] This assumption is predicated on the existence of real roots for (3.2.1.4) with respect to the interest rate. Since the expression is to the power of *m*, there are many potential roots. For subsequent analysis, it is necessary that at least two real roots may exist, which is shown in Appendix B.

Growth of the MFI

The gross growth rate of originations is simply $(C_t + D_t)/(C_{t-1} + D_{t-1})$, And this gross growth rate is provided by the left hand side of equation (3.2.1.4). Therefore, an MFI is expected to grow at the gross rate of a growth factor (GF) given by:

$$\textbf{(3.2.1.5)} \qquad GF = \frac{g(I)}{g(I)+w}(1+I)^m(1-d)$$

which is a non-negative rate for the sustainable MFI (and at this point must be larger than *R* to induce lending).

The MFI's profit is revenue, or $\frac{C_t + D_t}{g(I)+w} g(I)(1+I)^m(1-d(I)) - \frac{C_t + D_t}{g(I)+w} g(I)$ minus expenses, or $\frac{w(C_t + D_t)}{g(I)+w}$. Profit is then:

$$\textbf{(3.2.1.6)} \qquad \Pi = \frac{C_t + D_t}{g(I)+w} g(I)(1+I)^m(1-d(I)) - \frac{C_t + D_t}{g(I)+w} g(I) - \frac{w(C_t + D_t)}{g(I)+w}.$$

We can simplify this expression, recognizing from the right side of the profit function that:

$$-\frac{C_t + D_t}{g(I)+w} g(I) - \frac{w(C_t + D_t)}{g(I)+w} = -(C_t + D_t)$$

Profit is then, more simply,

$$\textbf{(3.2.1.7)} \qquad \frac{C_t + D_t}{g(I)+w} g(I)(1+I)^m(1-d(I)) - (C_t + D_t)$$

To solve explicitly for the profit-maximizing interest rate, we assume linear demand[16] $g(I) = \alpha - \beta I$, and a linear default rate function $d(I) = \delta + \phi I$.

Then, profit maximization for the MFI is the solution of:

$$\mathbf{max}_{\mathrm{I}}\ \Pi = \frac{C_t + D_t}{\alpha - \beta I + w}(\alpha - \beta I)(1+I)^m(1-\delta-\phi I) - (C_t + D_t)$$

A first order condition provides:

$$\frac{\partial \Pi}{\partial I} = (C_t + D_t)\frac{(\alpha - \beta I + w)\left[-\beta(1-\delta-\phi I)(1+I)^m - \phi(\alpha-\beta I)(1+I)^m + m(\alpha-\beta I)(1-\delta-\phi I)(1+I)^{m-1}\right] + \beta(\alpha-\beta I)(1+I)^m(1-\delta-\phi I)}{(\alpha-\beta I+w)^2} = 0$$

At this point, the denominator, cash, and debt all drop out. Also, $(1+I)^{m-1}$ can be cancelled throughout. This leaves a simplified expression:

(3.2.1.8) $$(\alpha - \beta I + w)\left[-\beta(1-\delta-\phi I)(1+I) - \phi(\alpha-\beta I)(1+I) + m(\alpha-\beta I)(1-\delta-\phi I)\right]$$
$$+\beta(\alpha-\beta I)(1+I)(1-\delta-\phi I) = 0$$

The I^* that equates this expression is the optimal interest rate that the MFI will choose for profit maximization. This rate also maximizes the MFI's growth factor:

(3.2.1.9) $$GF = \frac{g(I^*)}{g(I^*)+w}(1+I^*)^m(1-d(I^*))$$

The choice of debt level follows immediately from this. If $I^* > r_{MFI}$, then the MFI will borrow until $I^* = r_{MFI}$.

1.3.2.2 Modeling the Central Microcredit Clearinghouse

Assume now the existence of a nonprofit organization, with the goal of maximizing the number

[16] Note that this assumption need not describe the entire demand curve. For purposes here, we only need to assume linearity of demand within the limits of interest rate feasibility given by the sustainability requirement of (3.2.1.4).

of loans in its service region. The main function of this organization, the Central Microcredit Clearinghouse (CMC) is to allow the sustainable MFI to achieve the optimum growth rate shown in (3.2.1.8) *within* periods, by augmenting its loan portfolio via a money multiplier maintained by the CMC. Another main function of the CMC is then to securitize its resulting portfolio of microloans, allowing investors a "pure play" on a standardized investment unit.

To see the leverage effect, consider the representative MFI that has just finished loaning its cash balance of C_t in time t. With many other potential borrowers waiting, the MFI is forced also to wait until payments arrive in period $t + 1$ to sum to C_{t+1}, so that another period of lending can ensue. However, now assume that the regional CMC is in operation, and the representative MFI is approved as a member agency. The CMC now stands ready to purchase the portfolio of microloans from the MFI at an actuarially determined rate of p times the expected value of the portfolio, where $0 < p < 1$. A fraction $1-f$ is purchased for cash, and the remaining fraction f is purchased for investment units in the pool of underlying loans at the CMC, maintained at the CMC in the name of the MFI. It is the CMC's choice of the values of p and f that allow it, indirectly, to influence the number of loans granted.

The discounted purchase rate p ensures that some expected value is passed on to investors of the resulting CMC securities, and this total expected gross return is $1/p$. Therefore, the MFI is left with the choice in each period to invest cash in an outside risk-free investment with gross periodic return R, a risky market asset M, invest in borrowers with gross periodic expected return $\frac{g(I^*)}{g(I^*)+w}(1+I^*)^m(1-d(I^*))$, or to connect microborrowers to the CMC by originating microloans, selling the receivables to the regional CMC for an *immediate* gross return

$\frac{pg(I*)}{g(I*)+w}(1+I*)^m(1-d(I*))$ on portion *1-f* of the sale, receiving CMC securities for *f* portion of the sale, and reinvesting the cash in more microloans, effectively leveraging the portfolio by a calculable multiplier.

The summation of these repeated loan balances, reduced in each round by the fraction *1 - f* and augmented by the growth factor net of purchase $\frac{pg(I)}{g(I)+w}(1+I)^m(1-d(I))$ are a geometric series, leading to a Maximum Leveraged Growth Factor (MLGF) of

$$\textbf{(3.2.2.1)} \qquad MLGF = \frac{\frac{fpg(I)}{g(I)+w}(1+I)^m(1-d(I))}{1-(1-f)\frac{pg(I)}{g(I)+w}(1+I)^m(1-d(I))}$$

From (3.2.2.1), it is unclear whether *MLGF* > *GF*. This depends on, among other things, the value of *p*. If the CMC pays a purchase price that is "too low", it is reasonable that the MFI would be better off originating microloans for itself without partnering with the CMC. Given the securities ratio *f*, there exists some price p_{min} for the CMC that makes *MLGF* = *GF*. This can be found from (3.2.2.1) as

$$\textbf{(3.2.2.2)} \qquad p_{\min} \frac{1}{f+(1-f)\frac{g(I)}{g(I)+w}(1+I)^m(1-d(I))}$$

The CMC must offer a purchase rate greater than p_{min} to induce sales by the MFI. This allows a maximum return to the investor of CMC securities of the inverse of (3.2.2.2). It is quite possible to have a sustainable MFI where (3.2.1.4) holds (i.e., *FG* > *1*), and yet the MFI does not engage in lending because *FG* < *R*. However, for purchase levels $p > p_{min}$, we know that *MLGF* > *GF* (where *GF* > *1*). This allows for the condition *MLGF* > *R* > *GF*. In this case, the presence of

the CMC allows the MFI to sustainably lend, where it would not on its own. However, this would require concessionary investing, as the return $1/p_{min}$ would necessarily be less than $1+R$. Regardless, this possibility exists with the leveraging effect offered by a CMC.[17] The sustainable and active lender, where $FG > R$, is able to grow at the faster rate of MLGF when $p > p_{min}$.

The discount factor p is also bounded from above. The CMC is assumed to get its funding from investors, who demand an expected gross return $1/p$ that is at least the rate compensated for the amount of risk (measured in standard deviation of returns) that the CMCU presents. Assume that investors demand a return provided by the standard Capital Market Line (CML) as:[18]

$$\textbf{(3.2.2.3)} \qquad \frac{1-p}{p} \geq R + \sigma_{CMCU}(M - R)/\sigma_M$$

A higher f reduces the expected variance of the investment return, also working to satisfy the constraint, but lowers the MLGF. The assumed relationship that links the leveraging factor f to the risk factor σ_{CMCU} is simply $\sigma_{CMCU} = (k/f)\sigma_M$, where k is some scalar to account for the assumed relative variance of the CMC security and the market portfolio, given the default multiple of $1/f$.

The CMC then maximizes the MFI's growth rate of MLGF, via selection of p and f, given the constraint that $1/p \geq R + \sigma_{CMCU}(M - R)/\sigma_M$. Given that $0 < f < 1$, and assuming that the MFI is sustainable (e.g. equation 3.2.1.4 is satisfied), both the leveraging variable f and the growth

[17] Perhaps this may be appropriate in an initial operation phase, or else a special program for directed funds.

[18] Note that 1/p is a gross rate of return; investors demand a rate 1/p-1, which is equivalent to $\frac{1-p}{p}$.

factor GF are positive. If we substitute (3.2.1.8) into (3.2.2.1), a first derivative of the MLGF with respect to the discount rate *p* provides

$$\textbf{(3.2.2.4)} \qquad \frac{\partial MLGF}{\partial p} = \frac{fpGF}{1-(1-f)GF} = \frac{fGF}{[1-(1-f)pGF]^2}$$

This clearly shows that the CMC achieves its goal of greater loan takeup with a higher value of the discount rate *p*. This is intuitive; a higher discount rate *p* leaves more profit with the MFI, allowing the inelastic supply of funds to the market to be larger. Since we already know that the choice of variable *p* is bounded from above, and that the CMC will choose the highest possible level of *p*, we can now use this constraint with equality:

$$\textbf{(3.2.2.5)} \qquad \frac{1-p}{p} = R + \sigma_{CMCU}(M-R)/\sigma_M$$

Given the assumption that $\sigma_{CMCU} = (k/f)\sigma_M$, we can combine this with (3.2.2.5) to find

$$\textbf{(3.2.2.6)} \qquad \frac{1-p}{p} = R + \frac{k}{f}(M-R)$$

This allows us to substitute the choice variable *p* with its highest value, that which satisfies (3.2.2.6). This substitution into the original objective function, the MLGF, provides us with

$$\textbf{(3.2.2.7)} \qquad MLGF = \frac{\left(\dfrac{1}{R+\dfrac{k}{f}(M-R)+1}\right)\dfrac{fg(I)}{g(I)+w}(1+I)^m(1-d(I))}{1-(1-f)\left(\dfrac{1}{R+\dfrac{k}{f}(M-R)+1}\right)\dfrac{g(I)}{g(I)+w}(1+I)^m(1-d(I))}$$

The substitution of the constraint now allows us to treat this as an unconstrained optimization, and we simply derivate the MLGF with respect to the remaining choice variable, *f*. Again, with substitution (purely for notational ease) of *GF* for the growth factor expression $\frac{fg(I)}{g(I)+w}(1+I)^m(1-d(I))$, we have

$$\frac{\partial MLGF}{\partial f}=\frac{\left(\frac{GF\left(R+\frac{2k(M-R)}{f}+1\right)}{\left(R+\frac{k(M-R)}{f}+1\right)^2}\right)\left[1-\frac{(1-f)GF}{R+\frac{k(M-R)}{f}+1}\right]-\left(\frac{fGF}{R+\frac{k(M-R)}{f}+1}\right)\left[\frac{GF\left(\frac{(1-f)k(M-R)}{f^2}-R-\frac{k(M-R)}{f}-1\right)}{\left(R+\frac{k(M-R)}{f}+1\right)^2}\right]}{\left[1-(1-f)\left(\frac{1}{R+\frac{k}{f}(M-R)+1}\right)GF\right]^2}=0$$

We can immediately eliminate the denominator and a few like numerator terms. Continuing to simplify, and reintroducing the growth factor form, the entire equation simplifies to an explicit solution for the securities purchase ratio:

$$\textbf{(3.2.2.8)} \qquad f^*=2k\frac{(M-R)}{\frac{g(I)}{g(I)+w}(1+I)^m(1-d(I))-R-1}$$

Equation (3.2.2.8) provides an expression for f^* that can be seen as a simple ratio: net market return over and above the risk free rate divided by the MFI's net operational return over and above the risk-free rate, all multiplied by twice the scalar *k*. Recall that *f* is the proportion of the CMC's purchase offer that is paid in securities; therefore, a higher value of *f* reduces leverage (and consummate risk) for the MFI. Equation (3.2.2.8) is then very intuitive. A higher market premium will, ceteris paribus, increase the return demanded by investors of CMC securities, lowering the discount rate *p* and increasing the optimal securities ratio *f*, as the MLGF benefits more at this point from a reduction in variance than a gain in expected return. Conversely, if the

MFIs growth factor increases, the optimum securities ratio f is lower, since there is more benefit from the expected return brought on by additional leverage than the loss associated with the increased variance of expected return.

To ensure that this solution for f^* is indeed a maximum, we can explore the second derivative of the modified objective function. With a little algebra, an equivalent MLGF can be stated as

(3.2.2.9) $$MLGF = \frac{f}{\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f)}$$

Derivating this expression also leads to (3.2.2.8), but the algebraic result lends itself a little better to a second derivative.

$$\frac{\partial MLGF}{\partial f} = \frac{\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f) - f\left[\frac{-k(M-R)}{f^2 GF}+1\right]}{\left[\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f)\right]^2}$$

$$\frac{\partial^2 MLGF}{\partial f^2} = \frac{\left[\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f)\right]^2 \left(\frac{-2k(M-R)}{f^2 GF}\right) - 2\left[\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f) - f\left(\frac{-k(M-R)}{f^2 GF}+1\right)\right]\left[\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f)\right]\left[\frac{-k(M-R)}{f^2 GF}+1\right]}{\left[\frac{R + \frac{k}{f}(M-R)+1}{GF} - (1-f)\right]^4}$$

Diving out one of the denominator terms and factoring a term, we have

$$\frac{\partial^2 MLGF}{\partial f^2} = \left(\frac{-2k(M-R)}{f^2 GF}\right) \frac{\left[\frac{R+\frac{k}{f}(M-R)+1}{GF} - (1-f)\right] + \left[\frac{R+\frac{k}{f}(M-R)+1}{GF} - (1-f) - \left(\frac{-\frac{k}{f}(M-R)}{GF} + f\right)\right]}{\left[\frac{R+\frac{k}{f}(M-R)+1}{GF} - (1-f)\right]^3}$$

If we can assume that $\frac{R+\frac{k}{f}(M-R)+1}{GF} > (1-f)$, then both the numerator and the denominator are clearly positive, and with the term in front clearly negative, the entire expression is negative. We can show this to be true by remembering that the discount rate $1/p = R+\frac{k}{f}(M-R)+1$. From this, the condition becomes $\frac{1}{pGF} > (1-f)$. Next, substitute the expression for f^* as given by (3.2.2.8): $\frac{1}{pGF} > 1-2k\frac{(M-R)}{GF-R-1}$. Finally, multiply both sides of this inequality by *pGF*, and remove one from each side. This provides the condition $0 > -2k\frac{pGF(M-R)}{GF-R-1}$. In the numerator, we know that the discount rate, the MFI's growth factor, and the market premium are all positive. In the denominator, it is already assumed for participation that the growth factor of the MFI must be greater than *R*, otherwise the MFI will not lend. With a positive scalar *k*, we may confirm that this inequality holds, affirming that the optimal f^* found in (3.2.2.8) is indeed a maximizing factor.

A Note on Infinite Leverage

The modeling of the CMC thus far has been constructed under the assumption that the leverage provided by the CMC is finite. However, this is not strictly the case. Note from (3.2.2.1) that the denominator may be zero when $GF = \frac{1}{p(1-f)}$. A growth factor greater than this value will cause the MLGF to be negative. To see this intuitively, consider an MFI with great success in lending, earning an abnormally high growth factor. If $GF > \frac{1}{p(1-f)}$, the MFI will be able to sell originated loans to the CMC, receiving $GFp(1-f)$ in cash. This amount would be greater than the cash used to originate the loans, so the MFI would be able to increase its intraperiod cash balance with each round of sales to the CMC. As this would present large firm-specific risk to the CMC, we may simply assume that the CMC sets a maximum MLGF for each MFI in a given year. A limit will be chosen in the empirical section.

Summary of Theory

The combination of origination costs with downward sloping demand allows for an optimal interest rate for the MFI that is not a maximum nor a minimum. Profit maximization demands that the MFI select a rate that balances the opposing forces of costs and revenue generation, leading to an outcome similar to that of the credit rationing literature. With this maximization in place, a nonprofit Central Microcredit Clearinghouse has been shown to potentially enhance MFI returns, and concomitantly loan balances offered to the poor, with repeated intraperiod purchases of loan originations.

It has been shown that the CMC may choose an optimal discount rate for asset purchases from

the MFI, as well as a ratio of which the purchase price is paid for with securities instead of cash. The discount rate chosen is the highest that allows for an acceptable risk/return profile of the resulting CMC security, so that investors are minimally satisfied. The securities purchase ratio is selected with consideration of the tradeoff between leveraging the MFI's portfolio and limiting risk. This assumption connects the discount rate and the securities purchase ratio, so that an unconstrained optimization can be completed with consideration of a single variable.

While it is possible that an MFI may be able to infinitely leverage its portfolio within the confines of the model, this shortfall can clearly be addressed in practice. If the growth factor of the MFI is truly large enough to allow for this possibility, and is also sustainable over several rounds of intraperiod growth, and is not contained by risk levels, then it would eventually be contained by market saturation, which falls outside of the model.

1.3.3 Solutions Offered by the CMC to Direct Securitization Challenges

In this final section of the introduction of the Central Microcredit Clearinghouse, I will revisit each of the challenges identified as threats to direct securitization, and show how they are addressed by the CMC's near-direct securitization innovation. This is a qualitative discussion of factors leading to the original market failure of microloan securitization, now with an eye on the CMC as modeled in section 3.2.

The Legal and Regulatory Environment, Macro Policy, and Currency Risk

An investor looking for the chance to assist impoverished citizens of south Asia while making a fair risk adjusted return would not likely want to assume the risk associated with purchasing

claims on microloans in Afghanistan, for example. Most investors are unfamiliar with foreign law, and want a simple way to invest with some basic level of security. The CMC of a region such as south Asia would choose to locate in a country with the most favorable regulatory environment, and the most stable and popular currency for ease of hedging the portfolio to it. While country risk, political risks, currency risks, policy risks, etc. all remain for a direct investor, a CMCU would minimize these risks by allowing foreign investors to purchase CMCUs, and then have the option to hedge their domestic currency.

Donated Funds

Donors will need a new focus. Donations for direct MFI funding will only serve to crowd out market activity, and retard the growth of the sector. Subsidized microlending should give way to commercial microlending. The CMC would provide donors with an option that makes their gift much more powerful than one offered to an MFI. A gift to the CMC for the microloan purchase and securitization program, much like an investment dollar, would translate directly into an additional loan, but with the security of knowing that the micro lender is serving its clientele in a way consistent with the donor's social objectives, and in the most effective and sustainable way. Even though this would be a popular and dominant portion of the CMC's activities, most donors would choose to give to other programs within the CMC. Education initiatives, geographic expansion efforts, micro-borrower advocacy programs, and entrepreneurial guidance efforts are all potential activities for a CMC. These various programs would present benefactors with a more effective use of donor dollars than direct lending; they could target special initiatives of choice under the umbrella of the CMC.

Extremely Short-Term Loans

This presents significant problems for any direct securitization. Loan packages would need to be created so often, that securitization would be very costly on an annualized basis, compared to other types of securitizations. However, the ongoing creation of CMCUs negate the importance of average loan term. As new loans come into the pool, and old loans are paid, (or fall into default), the loan acquisition formula is updated to ensure that the CMCU value is relatively stable.

Lack of Financial Sophistication in Small MFIs

Smaller MFIs do not possess the expertise in myriad areas necessary for successful loan securitizations. The presence of the CMC would allow the smallest MFI to securitize their loan portfolio into CMCUs with minimal training and an internet connection. An online portal for CMC loan acquisitions would be made simple for the microlender, offering a rate to each lender based on the criteria discussed above, and in any regional language that is required.

Moral Hazard

The presence of the moral hazard problem is one of the main reasons that direct securitizations are not expected to ever play a large role in MFI financing. It does indeed appear to be the Achilles' heel of traditional securitization of microloans. The CMC battles this problem in multiple ways. First, MFIs will initially be permitted to sell only a portion of their portfolio to the CMC, receiving a combination of fraction $1-f$ in cash and f in CMCUs. Third, the value that the MFI receives in each securitization will be directly linked to past performance of loans,

encouraging the close contact and utilization of social pressures that have made microlending success stories in recent decades.

1.4 Numerical Simulation of a South Asia CMC

In order to better demonstrate the possibilities that exist, this section presents a pseudo-hypothetical simulation of MFI activity, using data available on actual MFIs operating in South Asia, for the ten-year period of 2001-2010. Following a brief analysis of the growth of microlending in South Asia during this decade, I will introduce the South Asia CMC (SACMC), and run a comparative simulation of what may have transpired during the same time given the existence of a regional CMC.

1.4.1.1 Data

The Microfinance Information eXchange (MIX) Market collects and processes annual data submitted by roughly 2,000 microfinance institutions around the world, representing over 90 million borrowers. Information is submitted by representatives of MFIs, or obtained from external audits, financial statements, management reports, and other sources. All data are converted from local currencies into USD using an average conversion rate for the period under survey. Some reporting periods are more or less than a full year; in these cases, data are annualized using an "annualization factor" calculated based on the number of days in the given reporting period.

A full set of MIX Market data is available for download at www.mixmarket.org. The dataset is updated periodically with new rounds of quarterly (for most recent) and annual data. The earliest

records date to 1995, with a relatively small amount of data available before 2000. Each MFI is awarded a diamond rating from 1 to 5, based on its perceived level of data disclosure and transparency. Diamond ratings of 4 or 5 diamonds indicate that data was submitted, and at least an external audit was performed. The majority of MFIs in the MIX Market database have a rating of at least 4 diamonds. Data available from MFIs include the name and location, legal status, and periodic information about total assets, gross loan portfolio, equity, deposits, various calculated financial ratios and averages, return, financial expense, numbers of borrowers, and personnel. Nearly 11,000 records of annual data are available in the full download, offering data on more than 1,900 microfinance institutions. These institutions are broken down into 6 regions around the world, covering 116 countries.

For purposes of this simulation, only data from South Asia was retained, and only for years 2001-2010. Some data records are quarterly data provided for years 2010 and 2011, in addition to 2010 annual data. The quarterly records were deleted, and only the annual records were retained. Some annual records were deleted for missing both asset and return data. Debt was calculated from equity and the debt to equity ratios provided. Net income was calculated using the average ROA and ROE ratios provided. Net income was then divided by beginning of period assets to serve as a proxy for the MFIs growth factor in a given year.

To err on the side of conservative in the comparative simulation, records with missing return data that were retained were given an estimated growth factor of one, sufficient to negate CMC activity for the following year, given that it was also assumed to not have CMC activity associated with it in the current year. If so, this would provide distortion to the results, and the record was deleted. Any record with missing return data for a year within a series of operational

years with CMC activity had returns estimated based on surrounding ROA data, since deletion of these records would be more disruptive to the simulation. This adjustment was made for just 5 records.[19] Assets were estimated for 2 records.[20] Two MFIs were removed from the dataset for having only 2001 balance sheet data, and no activity.[21]

1.4.1.2 Microfinance Institutions in South Asia

The South Asian region per Mix Market demarcation includes the countries of Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka. Some basic information for reported activity and financial position is shown in Table 4.1.2.1, along with indicators of income and poverty which are provided by the World Bank.

Country	# of MFIs	Gross Loan Portfolio	Number of Active Borrowers	Average Loan Size	GNI Per-capita, current $	Poverty Headcount Ratio	# of 4-5 Diamond MFIs
Afghanistan	12	$ 127,276,014	268,431	$474	$410	36.0%*	6
Bangladesh	29	$2,633,780,287	22,656,208	$116	$700	31.5%	11
Bhutan	1	$ 94,992,904	24,476	$3,244	$1,870	23.2%*	0
India	94	$5,251,114,050	31,794,850	$165	$1,270	37.2%*	47
Nepal	28	$ 153,710,606	725,187	$212	$490	25.2%*	19
Pakistan	27	$ 261,192,518	1,883,013	$139	$1,050	22.3%*	16
Sri Lanka	18	$ 526,524,296	1,334,744	$394	$2,240	8.9%	6

Table 4.1.2.1[22]
**indicates that data is for a year close to 2010*

[19] This was done for VYCCU in Nepal for 2006, BMSCCSL in Nepal for 2006, BASTOB in Bangladesh for 2008, CSS in Bangladesh for 2007, and Shakti in Bangladesh for 2010.
[20] This was done for WDFH in Sri Lanka for 2005 and 2006, using asset/gross loan portfolio ratios and the surrounding asset balances for 2004 and 2007. Growth factors of one were assumed in these years.
[21] These were CCODER in Nepal and NLCL in Pakistan.
[22] Data is from the Mix Market (www.mixmarket.org), and the World Bank (data.worldbank.org)

There are several initial items of note. First, while there are 209 MFIs operating in the 7-nation region designated by the MIX as South Asia, only 105 of these possess the necessary history and transparency to earn a 4 or 5 diamond Mix Market rating. The SACMC could start securitizing loans from 6 of the 7 countries, but efforts in Bhutan would initially be limited to assisting MFIs with reporting and transparency issues so that they can achieve membership status. For this reason, Bhutan will not be included in the remaining analyses.

The MFIs reporting data in south Asia combine to a gross loan portfolio as of 2010 of $9 billion. Dividing the gross loan portfolio by the number of active borrowers in each nation provides an average loan size for the reported loan activity in each country. When we compare this with the GNI per-capita, we find that the average borrower of Afghanistan's MFIs actually borrows over 100% of their per-capita GNI. For the other five countries, the average loan size ranges from 13% to 43% of per-capita GNI, with an overall weighted mean of 16.3%[23]. These numbers indicate that an average micro-borrower in this region receives about 2 months of the nation-wide average income for a typical microloan. The final column counts only the four and five diamond rated MFIs. This reduces the gross loan portfolio under consideration from $9 billion to $7.7 billion, but removes half of the original 209 MFIs represented. This relatively small reduction in total assets demonstrates that the largest MFIs are also those with sufficient history and transparency to earn those higher diamond ratings.

The headcount ratio is captured here only as an input to a rough indication of market penetration. Assume that just half of all impoverished persons (found as the product of each nation's

[23] With Afghanistan removed, and ignoring Bhutan, Nepal is the new outlier, with borrowers having an average of 43.3% GNI per capita. The other 4 are all between 13.0% and 17.6%.

headcount ratio and population) would both qualify for a microloan, and choose to accept it. Dividing the number of active borrowers by this figure shows us market penetration estimates for each nation, displayed in the second column of Table 2. This estimate is skewed by those MFIs reporting microloans that are of above average size (under the assumption that many loans are claimed as microloans, although they are granted to borrowers with higher incomes). To adjust for this, we might consider loan size, dividing this penetration estimate$_1$ by an adjustment figure[24] to create a Market penetration estimate$_2$. This exercise provides us with a reasonable suggestion that expansion of loan originations is desirable in south Asia.

Country	**1/2 of population assumed poor**	**Market penetration estimate$_1$**	**Market penetration estimate$_2$**
Afghanistan	10,482,120	0.6%	0.1%
Bangladesh	51,793,875	39.1%	36.6%
India	440,685,708	6.5%	7.8%
Nepal	7,454,916	8.4%	3.0%
Pakistan	37,967,980	3.1%	3.6%
Sri Lanka	1,316,490	20.4%	18.0%

Table 4.1.2.2

1.4.1.3 Completion and Augmentation of Actual Data

A number of assumptions must be made to make use of existing data in imposing a Central Microcredit Clearinghouse in south Asia. First, only the 4 and 5 diamond MFIs were used in the simulation, under the assumption that the CMC would not purchase loans from MFIs that lacked

[24] This adjustment was also simple: I divided the loan average as a percentage of GNI per capita as mentioned earlier by its average for the area of 0.163, the average for the area, creating an adjustment figure increasing in above average loan size. I then divided the original penetration estimate by this adjustment figure to arrive at Market penetration estimate$_2$.

this level of transparency. Also, it is assumed that if an MFI qualifies for CMC affiliation, and purchase of receivables, the MFI will sell all receivables to the CMC when $p > p_{min}$, and use all cash received to originate more loans for sale, continuing this intraperiod loop to take advantage of the multiplier effect, reaching the Maximum Leveraged Growth Factor (MLGF) as modeled.

From here, the growth factor (GF) and MLGF for each MFI shall be indexed by $m = 1...M$, and time shall be indexed $t = 1...T$, allowing for a matrix of empirical growth factors represented by GF_{mt}. Recall from the note at the end of section 3.2, that when $GF_{mt} > \frac{1}{p(1-f)}$, $MLGF_{mt} < 0$, which indicates an infinite multiplier. There are instances in the data when the proxied GF_{mt} exceeds this "limit," which would allow the MFI to originate loans, sell fraction f at the discounted rate to the CMC, and still receive more cash back from the sale than it had in assets at the beginning of the period. To address this, some maximum was needed, and that maximum was set rather arbitrarily at 3.[25]

The procedure for simulating MFI data begins with its first financial position of record. In its second financial position of record, income statement activity is reported for that year. Two years of financial position are then the minimum for provision of a growth factor estimate, from which subsequent CMC eligibility can be determined. The third year of record provides the third financial position, and the second set of return data. This is the MFI's first possible chance to enhance their activity in partnership with the CMC. For each year of record, if $p > p_{min}$ for the

[25] In an effort to leave the simulation free from constraints as much as possible, 3 was chosen as a rather high limit. Note that this means an MFI would be able to use CMC cash to triple its size in a given year. Also, of the 686 MLGFs estimated in the dataset, only 11 reached this maximum value, and in only 6 of those instances was the MFI eligible for CMC funding in that period, and so was able to triple its simulated value.

MFI in the prior year, then the MFI will sell all loans to the CMC in the current year. Since 10 years of data were collected and used for this simulation, each MFI retained in the dataset has 1-9 years of financial activity reported, and 0-8 years of financial activity augmented with receivable sales to the CMC. Table 4.1.3.1 provides a snapshot of what data is available from each year.

A total of 133 MFIs are included in the dataset. The first 3 columns of Table 4.1.3.1 demonstrate a considerable amount of turnover in reporting (and potentially, operation) of these organizations. Only 12 MFIs reported data for all 10 years under observation. All MFIs in the dataset reported a continuous and uninterrupted set of years. A few items had to be imputed, as reported in the previous section.

The summation of balance sheet items grew at roughly the same pace from year to year. On average, MFIs in this region expanded with largely the same debt/asset and debt/equity ratios. Assets grew at an average rate of 37.6% over this time period, debt at an average rate of 38.8%, and equity at an average rate of 35.0%. Meanwhile, the balance of outstanding loans grew at an average rate of 38.8%, maintaining a relatively consistent ratio of loans to both assets and debt. This indicates that perhaps MFIs choose to maintain a stable debt ratio, and that perhaps an expansion of assets via a CMC receivables purchase program would precede an expansion of debt, furthering asset expansion even more. However, this is not an assumption made in the simulation. Actual debt values are assumed in the simulation to be unchanged. Additional lending made possible by the CMC is assumed to expand the asset balance of the MFI, and also the equity of the MFI in the same amount.

Year	MFIs with data	Assets	Gross Loans	Debt	Equity	Estimate of originations
2002	35	$792M	$569M	$586M	$206M	2.5M
2003	62	$1,118M	$773M	$781M	$336M	11.7M
2004	86	$1,551M	$1,102M	$1,138M	$414M	15.6M
2005	98	$2,174M	$1,578M	$1,704M	$471M	21.8M
2006	107	$2,935M	$2,131M	$2,324M	$610M	27.7M
2007	102	$4,377M	$3,208M	$3,563M	$813M	34.0M
2008	110	$5,942M	$4,432M	$4,703M	$1,238M	43.4M
2009	107	$8,79M	$6,707M	$7,068M	$1,719M	50.7M
2010	97	$9,899M	$7,638M	$7,737M	$2,167M	63.3M

Table 4.1.3.1

The number of loans originated by each MFI is not included in the dataset. Assumptions must be made regarding loan activity to estimate this number. Since the purpose of the simulation is a comparison of MFI activity with and without the presence of the CMC, these assumptions become less important. For the purposes of the simulation, it is assumed that the number of loans granted in a year is the average of the number of loans outstanding at the beginning and the end of a given year, divided by the average loan balance. Average loan balance, if missing, is assumed to be the prior year's average loan balance. This methodology produces an estimate of the number of loans in each period that is comparable to the number of active borrowers reported.

1.4.1.4 Simulation of the South Asia CMC

The CMC, as modeled in section 3.2, was shown to offer an expansion of an MFI's growth factor to that of a maximum leveraged growth factor. This was calculated explicitly with the variables introduced in the model, but this alone fails to demonstrate the real impact that a CMC might have on both lenders and borrowers in a geopraphical region. For instance, the number of loans

and the loan amounts both with and without CMC inclusion are not calculated in the model, as many things such as loan demand, loan tenor, optimal interest rates, etc. would all need to be estimated.

By reaching to actual empirical data, these values can be obtained by calibrating the model, and estimating several items of interest to policymakers, asking questions such as: How many extra borrowers would be served? What would the differential effects be across the nations? Would market saturation be reached anywhere? How would the expansion of investor dollars compare to the total asset balances already in place in microfinance institutions? Through this final effort, some estimates may be provided for these questions.

To begin a simulation of the CMC model in South Asia, a growth factor for each MFI for each year of observation was needed. Such a growth factor could be estimated as modeled, using a cost per loan, interest income, etc. However, this would ignore idiosyncratic and systematic risks that affected microlending in this region over the decade. The growth factor, under the assumption that cash is inelastically supplied to the microloan market by each MFI in each period, serves as a measure of growth for the organization given beginning period assets. For this reason, the return on assets (ROA) measure provided was used to calculate net income for each period, and this was used in conjunction with the beginning period asset balance to create a proxy for the growth factor in each of the 10 years, across each of the 133 MFIs.

With the array GF_{mt}, the array $MLGF_{mt}$ can be calculated, using (3.2.2.1), with the additional parameters for the fraction of loan value purchased for noncash consideration f and the gross

purchase discount factor *p*. The gross discount factor *p* has two main effects that essentially "compete" with each other in terms of CMC profitability and coverage. Higher gross discount rates approaching one leave the CMC with little or negative gross return to pass along to investors, compromising its ability to facilitate a securitized microloan market. However, a low discount rate, such as below 0.90, would disallow participation of most MFIs in most years. To see this, consider again equation (3.2.2.2) which provides p_{min}, the smallest gross discount rate at which an MFI would find it advantageous to participate in the receivables purchase program. A higher GF_{mt} directly translates into a lower p_{min}; for instance, given $f = 0.25$, and $GF_{mt} = 1.1$, or a growth rate of 10%, together provide a $p_{min} = 0.93$.[26]

From (3.2.2.2) we can also see that:

(4.1.4.1) $$\frac{\partial p_{\min}}{\partial f} \frac{\frac{g(I)}{g(I)+w}(1+I)^m(1-d)-1}{\left[f+(1-f)\frac{g(I)}{g(I)+w}(1+I)^m(1-d)\right]^2}$$

As long as the growth factor is greater than one (a condition for eligibility to transact with the CMC), this derivative is positive, showing that a higher noncash purchase fraction *f* increases the p_{min} for each MFI, making it less likely to participate. Therefore, a sufficiently low *f* and a relatively high *p* will allow more MFIs to participate in the CMC program.

[26] Ideally, a CMC would actuarily calculate this discount rate for each MFI continuously as a dynamic "offer" rate, addressing firm-specific risk and any changes in repayment rates. This intraperiod flexibility would insure the CMC against losses which will be shown as a higher variability of returns in the simulation; this assumption of a single, annual *p* for each MFI is then conservative, as far as the financial health of the CMC is concerned.

The choice of *p* for each MFI in each year is set as in the model, where the CMC chooses the highest discount rate that will satisfy investors in the resulting CMC securities. This is given by equation (3.2.2.5). The market rate is taken as the average S&P500 return from 1926-2008, which was 12.26%. The standard deviation of these returns was 19.97%. A risk-free rate proxy is taken for each year, using the 3-month T-bill rate. These figures were provided by the FRED St. Louis database. The cash purchase ratio of *f* offered by the CMC is also calculated from the model, using the loan number maximizing value given by equation (3.2.2.8). The last parameter to estimate is the scalar *k*, which is designed to reconcile the emerging standard deviation of returns for the CMC securities with investor demand. A level of k=0.1 was chosen for the simulation, as this nicely approximated the ratio of estimated sigmas for the CMC security and the market portfolio over the period, and left the resulting geometric return a conservative 5.2 percentage points in excess of the estimated capital asset line.

Using calculated values of *f* and *p* for each MFI in each year, each element $MLGF_{mt}$ was then calculated. As stated above, this leveraged factor was limited to 3, so that none approached infinity. For each year that an MFI had a sufficient prior year return to qualify for origination sales, it was assumed that the MFI expanded its balance sheet through a repeated intraperiod cycle of sales and microloan originations. In instances when GF_{mt} was insufficient to justify sales, the MFI's loan portfolio was assumed to expand at the same rate as it originally did for that year. As assets increase beyond the original balances, equity is assumed to increase in tandem, holding debt fixed at the actual observed levels.

Year	MFIs with data	# MFIs participating with CMC	Assets	Estimate of originations	CMC Cash out	CMC cash in	CMC Net Return
2002	35		$792M	2.5M			
2003	62	7	$1,258M	36.5M	$1,981M	$2,243M	13.26%
2004	86	11	$2,179M	87.7M	$5,440M	$5,983M	9.96%
2005	98	15	$3,586M	187.6M	$9,569M	$10,498M	9.71%
2006	107	11	$5,380M	337.1M	$16,923M	$18,967M	12.07%
2007	102	10	$8,308M	310.3M	$16,600M	$17,912M	7.90%
2008	110	15	$11,046M	115.9M	$2,094M	$2,201M	5.13%
2009	107	30	$14,595M	241.7M	$19,527M	$21,115M	8.13%
2010	97	28	$16,859M	308.0M	$24,247M	$26,425M	8.98%

Table 4.1.4.1

Table 4.1.4.1 provides a summary of the simulated microfinance activity in South Asia for years 2003-2010 with the presence of a SACMC. Even among this censored sample of MFIs with a four or five diamond rating from the Mix Market, the vast majority of MFIs still fail to qualify for CMC receivable sales in any given year, having an insufficient return on assets for the prior year. However, even though MFIs only qualified for CMC purchases approximately 13% of the time, for those successful MFIs, these opportunities provided explosive growth. For instance, while total assets of this subset of MFIs increased 12.5 times from 2002 to 2010, the CMC-simulated asset level rose over 21 times that of 2002, even with the assets of most MFIs unchanged.

The number of microloans granted was shown to expand at a much greater rate than assets. The continual cycle of origination, sales, and repayment in the period allows the number of loans to increase from 270 million during the ten year period to over 1.6 billion loans. Ignoring any primary effects of poverty reduction, and any secondary effects of economic development in the

region from this massive expansion of microcredit in South Asia, penetration rates should be notably different if this simulation is a fair representation of what is possible.

Country	1/2 of population assumed poor	Market penetration estimate$_1$	Market penetration estimate$_2$
Afghanistan	10,482,120	0.6%	0.1%
Bangladesh	51,793,875	343.0%	328.4%
India	440,685,708	8.7%	10.6%
Nepal	7,454,916	8.8%	3.2%
Pakistan	37,967,980	4.0%	4.8%
Sri Lanka	1,316,490	20.4%	18.4%

Table 4.1.4.2

Afghanistan and Sri Lanka had no participating MFIs, and so assuming no cross-border effects, market penetration is unchanged. The estimated penetration in Bangladesh indicates that market saturation would likely have been reached with the effect of a CMC, as over 89 million new active borrowers are added to the original figure, which is excessive given a total population in Bangladesh of about 164 million. The other significant addition of active borrowers is in India, where more than ten million new borrowers are serviced, allowing the penetration estimate to jump from 6.5% to 8.7%. Nepal enjoys a modest increase, and Pakistan adds only a few thousand new borrowers.

With the simulation complete, we can now address the questions posed at the beginning of section 4.1.4. Of course, these results are dependent upon the accuracy of the calibration, the parameters chosen, and the absence of any complicating factors that may not be considered.

However, to the extent that these factors are minimal, some summary results may be offered to these questions:

How many extra borrowers would be served? By comparing tables 4.1.3.1 and 4.1.4.1, the estimated number of originations is extraordinary. Where the microcredit market in South Asia grew from an estimated 2.5 million loans to 63 million loans over the decade, expansion of this activity by a SACMC would have possibly allowed this level to be reached in just two years rather than eight, achieving six times the number of loans over the period.

What would the differential effects be across the nations? Would market saturation be reached anywhere? We can see that Bangladesh would have reached a point of market saturation, while Afghanistan and Sri Lanka would be unaffected, due to the underdevelopment of MFIs there. This is a consistent outcome with the main focus of the CMC, which is to accelerate the progression of microcredit markets, rather than to offer nascent growth in regions where there is little or none. Again, the innovations in microlending are expected to come from local lenders. Therefore, the CMC is not in a position to guarantee expansion of microcredit everywhere; rather, it serves to reward successful efforts where they arise.

How would the expansion of investor dollars compare to the total asset balances already in place in microfinance institutions? Assets of South Asian MFIs grew to $10 billion by 2010. With the CMC, this would have been roughly $16 billion. This is a rather modest increase in percentage terms, but as discussed, the increase in origination activity would have been much larger. The investor dollars committed to lending activity would have reached $26 billion in 2010. These

numbers suggest that new dollars introduced to the market via CMC securitizations may be more efficient in achieving market completion than those placed on the balance sheets of MFIs. Where a new loan is originated for every $156 of assets with an MFI in South Asia, a loan can be generated with just $99 of investor purchases of CMC securities.

1.4.1.5 Viability of CMC Securities

The parameterization of the simulation suggested that a CMC security over this decade would have provided a geometric return of 9.37% to investors, with a standard deviation of returns of just 2.36%. Again, this simulation allowed the CMC just one level of *f* and *p* for the year, regardless of the continual performance of loans and loan payment remittance.

Expected CMC Security Returns as a function of *k*

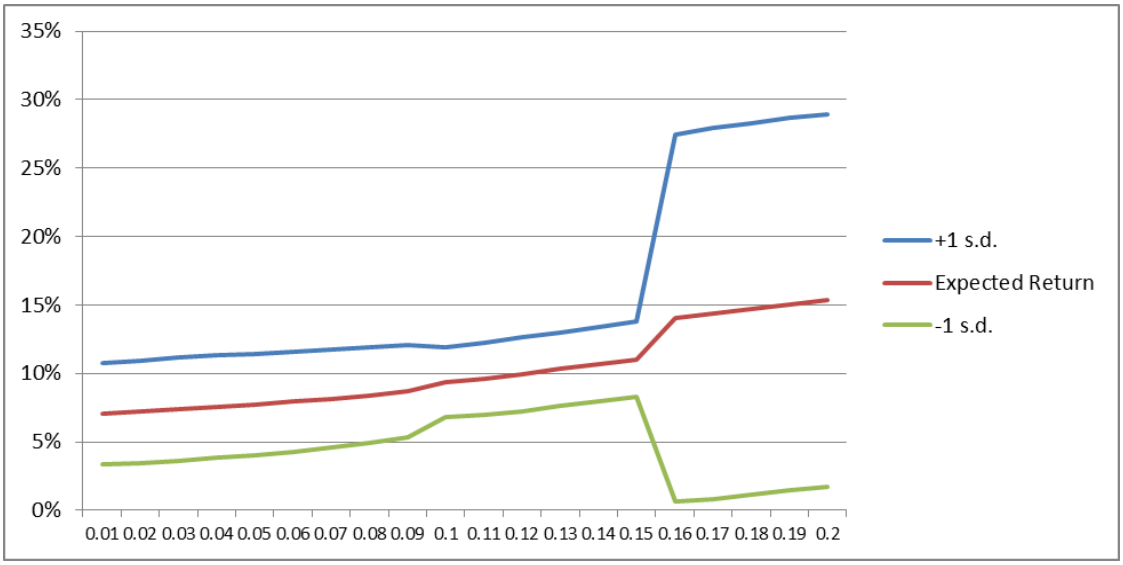

Figure 4.1.5.1

Clearly, if investors were willing to place a social premium on CMC security returns, it may be feasible for the CMC to increase its discount rate to encourage more participation. Such a marked differential in performance between participating and nonparticipating MFIs perhaps would, in the presence of the CMC, encourage best practices and adoption of efficiencies among smaller organizations that may further spur growth of the microfinance industry.

The behavior of the CMC securities varies significantly with the choice of the parameter k. At lower levels, the assumed variance in the CMC security is very low, allowing for a lower optimal choice of f^*. However, returns are lower, given that this makes origination sales viable for a greater subset of MFIs, adding lower performance loans to the average.

It is also important to note that the number of new loans generated varies widely with the choice of the *k* parameter. Although it appears that a higher estimate is more beneficial to the CMC in achieving its goal, this is not the case. Figure 4.1.5.1 shows satisfaction of the constraint. But the goal of increased loan takeup falls rapidly at higher levels of k. In fact, recall that the CMC's simulated activity provided an additional 1.3 billion loans to the microcredit markets in southeast Asia during the ten year period, given the choice of $k = 0.1$. If this parameter was $k = 0.12$ instead, the estimated number of new loans would be less than half of this figure. This demonstrates, perhaps most clearly, the importance of organizing microloans into a diversified, well-monitored, and low risk security.

1.5 Conclusion

As we start to seriously consider the viability of an organization such as the South Asia Central Microcredit Clearinghouse, many aspects of its size, structure, form, management, missions, and scope should be the subject of discussion. It's organization as a nonprofit arose from a logical analysis of the challenges confronting the potential of a microloan securitization market, and future work will determine if this is indeed the correct organizational form for a CMC.

A legal analysis is required. Only an introduction to this important contribution is provided here, but a detailed legal opinion would contribute a great deal to this initial effort. The development of a tailored CMC software system would show operational viability. Leading MFIs from the region could provide insight as to whether this effort would be a welcome addition to their financing options. Investors would need to be convinced of the strength and backing of a CMC security.

While a large MFI might be the logical point for the spawning of a prototype CMC, independence is arguably of importance. It would likely be most beneficial to the sustainability of the program to have its origination minimally connected with a specific MFI, but rather a project of an NGO with a mission of poverty alleviation that is itself not a direct lender. Starting with one CMC, perhaps in South Asia, would provide a springboard to other regional CMCs beginning operation in other parts of the world as microfinance services continue to develop.

A CMC would not contest the desire of MiCDOs. Diversified lending to MFIs has served as a useful bridge between some investors and microlenders. While MiCDOs are arguably the best

way of funding MFIs within the framework of a traditional financial tool set, I have shown here that a near-direct securitization of microloans is possible, with the help of a regional nonprofit organization to serve as a Central Microcredit Clearinghouse.

With the aid of a CMC, regional MFIs could have greater access to investor funds by allowing them the "pure play" on the underlying asset, which is attractive to many foreign investors. Local MFIs would themselves hold some securities as partners of the securitization program. Loans to impoverished citizens would be expanded. Profits of MFIs would rise. The existence of a CMC would allow the securitization of microloans to be a sustainable and socially beneficial reality. The organization at the center of these solutions may indeed usher in a new chapter in microcredit capital market access. If successful, perhaps we could witness this industry moving into a competitive equilibrium in years, rather than decades.

Chapter 1 Appendix A

Cash at discrete times

The equation (3.2.1.1) of $C_t = C_{t-1}(1+R) + \sum_{k=t-m}^{t-1} O_k \frac{(1+I)^m}{m}(1-d(I)) - O_t\left(1+\frac{W}{g(I)}\right)$ assumes that cash is zero. That is, imagine that the MFI gets all payments on the first of every month exactly at noon, then immediately re-loans that money to new borrowers waiting at the door. The instant that time t-1 becomes time t is at noon on the first. At time t, the money has come in, gone out, and cash is zero again. This is why there's no return on past cash.

Alternatively, we could reformulate the equation so that time t is exactly at noon on the first of that month, in that split second when cash is moving from the inbox to the outbox. In this case, the equation would be

$$C_t = \left[C_{t-1} - O_{t-1}\left(1+\frac{W}{g(I)}\right)\right](1+R) + \sum_{k=t-m}^{t-1} O_k \frac{(1+I)^m}{m}(1-d(I)).$$

Now, cash is a positive balance each period; payments have just come in, they are about to go out, but haven't quite yet. The last origination was now *last* period, so the final term is indexed as t-1. Also, the cash return is not multiplied by t-1 cash, but by t-1 cash that was unused as originations and related fees.

Given these options, I opted for the former.

Chapter 1 Appendix B

Existence of bounded roots for (3.2.1.4)

It is necessary that (3.2.1.4) yield both an I_{max} and I_{min} when this inequality holds with equality, so that an interior maximizing value I^* also exists. Here, I show the existence of these two real values. I have assumed that there is positive demand for funds which is everywhere differentiable and decreasing in *I*. Also, there is a positive default rate which is everywhere differentiable and increasing in *I* (up to some finite value of *I* where *d(I)* = 1, the area beyond which is trivial). Also, negative interest rates are assumed to not exist. Given these assumptions, for a given interest rate *I*, there must exist some value of origination cost *w* such that

$$\frac{g(I)}{g(I)+w}(1+I)^m(1-d(I))=1$$

This value is found as

$$w=g(I)\left[(1+I)^m(1-d(I))-1\right]$$

It is possible, if $(1+I)^m(1-d(I))<1$, that the value of *w* that allows this equality is negative. However, the origination cost *w* is assumed to be greater than zero. Therefore, given some functions of *g(I)* and *d(I)*, it is possible that (3.2.1.4) does not hold. This is simply the condition when lending is unprofitable, and does not occur. To allow for lending, we allow for the condition

$$\frac{g(I)}{g(I)+w}(1+I)^m>\frac{R}{(1-d(I))}$$

so that lending is profitable for the MFI, and occurs. As *w* increases, the left hand side is reduced, and this inequality moves toward equality. There is, therefore, some maximum real value of origination cost $\bar{w}$ that makes this equal, such that

$$\frac{g(I)}{g(I)+w}(1+I)^m = \frac{R}{(1-d(I))}$$

At this level of origination cost, the growth factor is *R*, and the MFI is indifferent between microlending and investment in the risk-free asset. However, we can return to (3.2.1.4), taking the first derivative of the GF with respect to *w*:

$$\frac{\partial GF}{\partial w} = (1+I)^m (1-d(I)) \frac{-g(I)}{[g(I)+w]^2}$$

This value is clearly negative, showing that decreasing origination costs allow for a larger growth factor. Therefore, when origination costs are below the maximum, interest rates may be lowered. At an interest rate of zero, (3.2.1.4) clearly becomes zero. The intermediate value theorem therefore provides for the existance of some value I_{min} that allows (3.2.1.4) to hold with equality.

Since the default function *d(I)* = 1 for some finite value of *I*, this interest rate level also forces the growth factor to be zero. Once again, the intermediate value theorem dictates that there then must exist some value I_{max} for which the growth factor is equal to *R*. Again, it is not important that these are the only two roots, but that these roots exist as growth factor minimums. The assumptions made then allow for the growth factor to be convex and differentiable, creating the growth factor maximizing interest rate level I^* as provided by (3.2.1.8).

Chapter 2

Disbursements of ODA:

A Function of the Business Cycle?

Chapter Summary

I analyze Official Development Assistance (ODA) commitment and disbursement activity in terms of motivation, considering that the difference between bilateral aid commitments and disbursements may be related to the business cycle of the donor country. A cumulative commitment variable is calculated for 23 donor countries and 151 recipient nations, over a 41 year period of 1970-2010, as well as the sub-period of 1991-2010. Cyclicality of aid is briefly analyzed first, with mixed results of procyclicality that depend on the business cycle proxy. The annual disbursement gap is calculated for each pair for each year, as well as a cumulative disbursement gap, and these are regressed against multiple cyclicality measures of income and a set of control variables. It is found in multiple specifications that the cumulative disbursement gap is generally procyclical, much as aid itself, although the cyclicality of aid depends on the cyclicality measure. This is confirmed with four extensions designed mainly as robustness checks.

2.1 Introduction

Official Development Assistance (ODA) has been a long-debated subject in terms of both effectiveness and motivation. Suggested motivations of nations to engage in bilateral foreign aid are numerous. McKinlay & Little (1977) recognized the main motivations of bilateral foreign aid as a dichotomy of the desire to truly help a recipient nation, and the goal of imperialism and donor self-interest, finding some evidence of the latter for some aid during the 1960s. Many agree that one of the main motivations of aid appears to be the donor's own interest (Berthelemy & Tichit, 2004; Berthelemy, 2006; Alesina & Dollar, 2000; Nielsen, 2009), including the desire to strengthen political relationships, trade interests, and influence within the recipient nation (Maizels & Nissanke, 1984). Additionally, political variables, such as a shift within the donor nation's conservative regime, is shown to be related to aid flows to poor nations (McGillivray & Oczkowski, 1992; Tingley, 2010).

It is noted that corruption does not appear to deter aid; also, aid does not appear to deter corruption (Svensson, 1997; Alesina & Weber, 1999). However, other factors of the recipient country have been isolated as relating to aid flows, such as population of the recipient country. Smaller countries are noted for receiving more aid. This is often explained as donors perhaps feeling a greater effect to their aid; however, this effect is greatly diminished with control variables for exports and political dummies (Dudley & Montmarquette, 1976).

The timing of aid has been shown to be important in the management of a developing economy. Unpredictability of aid can cause a recipient nation to remain in a low-level equilibrium trap (Eifert & Gelb, WP). It has specifically been found to lower investment (Hudson & Mosley,

2008). This variability has been found to be procyclical in studies of the relationship between aid and the business cycle, including commitments (Dabla-Norris, Minoiu, & Zanna 2010). However, commitments have been noted as somewhat less procyclical (Pallage & Robe, 2001).

Bulíř & Hamann (2008) also point to variability of aid as a culprit in making macroeconomies of the poorest nations harder to manage, and demonstrate that one driver of this variation is the difference between aid commitments and disbursements. This difference comes (at least in part) by the structure of donor governments; the agencies approving aid are often not the same as those disbursing the aid. It can take several years for a commitment to be disbursed. A commitment is recorded as disbursed when financial resources are transferred to the recipient, or in the case of services, when payment is made to the provider of the service (oecd.org).

The difference between commitments and disbursements has been shown to change over time. Bulíř & Hamann (2008) show, using loan data the World Bank's Global Development Finance database, that the ratio of loan commitments to disbursements fell throughout the 1980s, for instance, but then stabilize to about 1.5. Further, the disparity appears greater with regard to the lowest-income recipients. This gap between promises and action, also known as the unpredictability of aid, is perhaps not only motivated by bureaucracy, but perhaps also by fiscal balances, credit stance, and the overall business cycle of the donor nation. These relationships, and the timing of cumulative differences between foreign aid commitments and disbursements, are the focus of this paper. Using OECD data on foreign aid grants, loans, and total aid, this disparity will be analyzed with respect to several relevant variables.

Multiple research questions arise as testable assumptions with regard to the behavior of commitments and disbursements with regard to the business cycle. First, several past studies have shown aid to be generally procyclical with respect to donor income; will the same be found in the present dataset? Second, is the simple difference between commitments and disbursements in a given year correlated with donor income, indicating that a donor's failure to pay immediately may be related to economic downturn? Third, can we find similar results by looking at a cumulative measure of foreign aid commitments payable? Finally, are the results we find robust to varying parameterizations and control variables?

While the analysis of the disbursement gap is atheoretic, this initial analysis assumes that there may be some function that describes the disbursement gap, such as

$$CDG = f\left(CYC_d, CYC_r, Y_d, Y_r, FiscSurp_d\right)$$

where a cumulative disbursement gap is related to the cyclicality of income for the donor and recipient, the level of income for the donor and recipient, and the fiscal surplus of the donor nation. The nature of this work will be exploratory, looking for empirical relationships among these variables, in multiple measures, that are robust.

The remainder of the paper is organized as follows: Part 2 presents the data which has been gathered for the present analysis. Part 3 discusses the methods of analysis employed in utilizing the data to help us answer the research questions presented Part 4 concludes.

2.2 Data

Most data was obtained from stats.oecd.org. This website offers data on GDP, ODA commitments, ODA disbursements, and myriad other data. Data was obtained on annual totals for 1966-2010 on ODA grant commitments and disbursements, ODA loan commitments and disbursements, and ODA total commitments and disbursements. These were obtained for each of 23 Development Assistance Committee (DAC) countries, and 151 recipient nations, classified by stats.oecd as either Least Developed Countries (LDCs), Low Income Countries (LICs), Low Middle Income Countries (LMICs), or Upper Middle Income Countries (UMICs). The measurement chosen for each of these datasets was 2010 constant prices in USD. Full time employment percentages were also obtained from stats.oecd for each of the 23 DAC nations, using national definitions of employment, as well as budget surpluses as a percentage of GDP for these 23 nations. A number of foreign aid components are available for analysis, including six types of commitments and 22 types of disbursements. Of these, Total Grants, Total Gross Loans, and Total Net ODA were chosen for analysis. Grant commitments and loan commitments together comprise 99.6% of total net ODA committed.

Data on national income was obtained from unctadstat.unctad.org, the website of the United Nations Conference on Trade and Development. This dataset contained annual GDP per capita figures in 2005 constant prices, in USD. This dataset supplied income figures for both the donor and recipient nations under analysis.

From each of the three ODA strands of grants (*G*), loans (*L*), and total (*T*), differences were calculated between the commitments (*C*) and disbursements (*D*) for each donor (*d*) and recipient (*r*) pairing for each year *y*.

$$DiffG_{dry} = CG_{dry} - DG_{dry}$$

$$DiffL_{dry} = CL_{dry} - DL_{dry}$$

$$DiffT_{dry} = CT_{dry} - DT_{dry}$$

For each element in this matrix where the donor did not fully disburse what was committed in a given year, these difference variables are positive. It is reasonable to expect lags in disbursements. The OECD library provides an accounting of what they consider a commitment to foreign aid: "Commitments are considered to be made at the date a loan or grant agreement is signed or the obligation is otherwise made known to the recipient." This is not to be confused with a pledge, which is merely an announcement of intent to deliver foreign aid. Although the commitment is a signed obligation, it may take several years to disburse the funds, and in fact, recent studies show that a significant amount of funds are not disbursed, as discussed in the introduction. Because of this, cumulative measures of undisbursed commitments $SumDiffG_{dry}$, $SumDiffG_{dry}$, and $SumDiffT_{dry}$ are also calculated, so that analyses may be performed in search of determinants of these persistent unmet obligations.

$$SumDiffG_{dry} = \sum_{i=1970,1991}^{y} CG_{dri} - DG_{dri}$$

$$SumDiffL_{dry} = \sum_{i=1970,1991}^{y} CL_{dri} - DL_{dri}$$

$$SumDiffT_{dry} = \sum_{i=1970,1991}^{y} CT_{dri} - DT_{dri}$$

Cumulative differences will not be generally comparable or even meaningful on a standalone basis, given irregularities in the supply of data that force some nations to "begin" after others. Although some data is available for the full 45 year span from 1966 through 2010, other data is either limited or missing completely for certain nations. The same calculations were also performed for the sub-period of 1991-2010 for comparison.

General information on ODA components by donor is available in Table 1. Nations are sorted into two groups: original OECD nations, and then more recent entrants and non-OECD donor nations.

Table 1: Summary Statistics of Foreign Aid, 1966 - 2010 (millions of 2010 USD)

DAC Nation	Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.	TC/ TD
Austria	$14,334	$13,196	$8,685	$5,974	$23,018	$15,613	1.47
Belgium	$28,470	$30,775	$3,739	$3,763	$32,184	$33,321	0.97
Canada	$65,662	$60,625	$16,596	$12,200	$82,261	$67,987	1.21
Denmark	$29,938	$32,285	$5,927	$5,452	$35,865	$34,793	1.03
France	$153,110	$161,125	$92,812	$73,346	$246,648	$197,190	1.25
Germany	$154,843	$147,047	$104,067	$87,940	$258,964	$184,423	1.4
Greece	$2,322	$2,322	$25	$25	$2,347	$2,347	1
Ireland	$5,513	$5,703	$0	$0	$5,513	$5,703	0.97
Italy	$46,343	$40,770	$38,105	$29,174	$79,457	$57,577	1.38
Luxembourg	$2,652	$2,937	$0	$0	$2,652	$2,937	0.9
Netherlands	$77,813	$77,426	$14,128	$12,255	$91,941	$81,811	1.12
Norway	$42,452	$44,734	$825	$1,042	$43,278	$45,674	0.95
Portugal	$3,839	$4,595	$1,807	$3,239	$5,647	$7,056	0.8
Spain	$20,328	$23,598	$11,437	$14,846	$31,765	$33,158	0.96
Sweden	$45,203	$45,059	$1,537	$1,437	$46,740	$45,855	1.02
Switzerland	$24,569	$23,871	$1,473	$1,509	$26,061	$24,735	1.05
U.K.	$108,354	$104,886	$26,874	$26,483	$137,001	$115,940	1.18
U.S.	$404,778	$347,851	$106,677	$108,595	$523,307	$400,018	1.31
Australia	$67,266	$65,557	$569	$465	$67,865	$65,942	1.03
Finland	$11,438	$9,712	$1,078	$847	$12,517	$10,099	1.24
Japan	$144,762	$140,748	$317,396	$242,882	$462,161	$270,176	1.71
Korea	$3,120	$2,684	$7,081	$2,606	$10,201	$5,021	2.03
N. Zealand	$5,082	$5,054	$45	$52	$5,126	$5,092	1.01
TOTAL	$1,462,191	$1,392,560	$760,883	$634,132	$2,232,519	$1,712,468	1.3

Table 1 allows us to see some relative differences in DAC nations as far as foreign aid volume and type over the 45-year period. We can also calculate from this table that 95% of grant commitments, 83% of loan commitments, and 77% of total commitments were disbursed in this period. This is not conclusive evidence of a lack of follow-through to ODA commitments; indeed, some disbursements are known to take time, and some of the most recent commitments may remain undisbursed simply due to normal timing issues. Therefore, analyses in the next section will take this into account.

Table 2a: Summary Statistics of Foreign Aid, 1966 - 2010

DAC Nation	Avg. Grant Commitments as % of GDP	Avg. Loan Commitments as % of GDP	Avg. Total Commitments as % of GDP
Austria	0.13%	0.09%	0.22%
Belgium	0.25%	0.04%	0.29%
Canada	0.21%	0.07%	0.27%
Denmark	0.35%	0.08%	0.43%
France	0.22%	0.14%	0.36%
Germany	0.16%	0.12%	0.28%
Greece	0.03%	0.00%	0.03%
Ireland	0.08%	0.00%	0.08%
Italy	0.08%	0.05%	0.13%
Luxembourg	0.19%	0.00%	0.19%
Netherlands	0.41%	0.09%	0.50%
Norway	0.48%	0.01%	0.49%
Portugal	0.05%	0.03%	0.08%
Spain	0.05%	0.03%	0.07%
Sweden	0.42%	0.01%	0.43%
Switzerland	0.18%	0.01%	0.20%
U.K.	0.16%	0.04%	0.20%
U.S.	0.11%	0.04%	0.14%
Australia	0.35%	0.00%	0.35%
Finland	0.19%	0.02%	0.21%
Japan	0.09%	0.22%	0.32%
Korea	0.01%	0.02%	0.03%
N. Zealand	0.16%	0.00%	0.16%

Table 2b: Summary Statistics of Foreign Aid, 1966 - 2010

DAC Nation	% of Grant Commitments undisbursed	% of Loan Commitments undisbursed	% of Total Commitments undisbursed
Austria	7.90%	31.20%	32.20%
Belgium	-8.10%	-0.60%	-3.50%
Canada	7.70%	26.50%	17.40%
Denmark	-7.80%	8.00%	3.00%
France	-5.20%	21.00%	20.10%
Germany	5.00%	15.50%	28.80%
Greece	0.00%	0.00%	0.00%
Ireland	-3.40%	0.00%	-3.40%
Italy	12.00%	23.40%	27.50%
Luxembourg	-10.70%	0.00%	-10.70%
Netherlands	0.50%	13.30%	11.00%
Norway	-5.40%	-26.30%	-5.50%
Portugal	-19.70%	-79.30%	-25.00%
Spain	-16.10%	-29.80%	-4.40%
Sweden	0.30%	6.50%	1.90%
Switzerland	2.80%	-2.40%	5.10%
U.K.	3.20%	1.50%	15.40%
U.S.	14.10%	-1.80%	23.60%
Australia	2.50%	18.30%	2.80%
Finland	15.10%	21.40%	19.30%
Japan	2.80%	23.50%	41.50%
Korea	14.00%	63.20%	50.80%
N. Zealand	0.50%	-16.10%	0.70%

Tables 2a and 2b provide another viewpoint of initial comparison and general orientation. Here it is evident that the absolute numbers in Table 1 don't provide us with information comparable to that of the relative figures of Table 2a. For example, five nations committed in excess of $100,000 in this period, and while this generosity is not to be ignored, the highest total aid committed as a fraction of national income was by four different nations not on this short list of five; they are Denmark, The Netherlands, Norway, and Sweden.

Table 2b informs us of commitments that were not disbursed, and of those countries disbursing aid in excess of commitments. We can see that there is a much greater volatility of loan disbursements as a percentage of commitments relative to that of grants.

Table 3: Summary Statistics of Foreign Aid, 1966 - 2010

DAC Nation	Employment Average	Average (geo) growth rate of GDP	Number of years of GDP decline	Avg. Budget Surplus, % of GDP	# years of Budget Surplus
Austria	88.20%	2.50%	4	-2.10%	4
Belgium	84.90%	2.20%	4	-5.60%	2
Canada	82.80%	2.90%	3	-2.80%	12
Denmark	77.50%	1.90%	8	-0.50%	17
France	87.70%	2.30%	4	-3.20%	7
Germany	82.30%	2.00%	5	-2.80%	22
Greece	95.00%	2.40%	9	-5.40%	1
Ireland	88.10%	4.10%	4	-4.40%	10
Italy	92.60%	2.00%	5	-6.70%	0
Luxembourg	90.00%	3.80%	3	1.80%	35
Netherlands	70.50%	2.50%	3	-2.80%	6
Norway	73.30%	3.10%	2	6.00%	38
Portugal	91.00%	2.90%	7	-5.20%	6
Spain	92.50%	2.90%	4	-2.70%	5
Sweden	76.60%	2.10%	7	5.80%	20
Switzerland	70.50%	1.60%	7	-1.10%	23
United	76.30%	2.20%	7	-3.10%	5
United States	83.00%	2.90%	7	-3.30%	3
Australia	80.20%	3.20%	2	-1.70%	10
Finland	89.90%	2.60%	5	2.30%	31
Japan		2.60%	6	-3.00%	8
Korea		7.30%	2	2.10%	37
New Zealand	82.40%	2.30%	6	0.50%	29

In the next section, a cyclical derivative of GDP will be used to measure correlations with aid flows, to determine cyclicality of aid. Employment is also used as a correlate with aid flows, for a second business cycle proxy. Government budget surpluses as a percent of GDP will be used with disbursement gap regressions as a control variable. Table 3 presents some basic information about these variables for the same period of 1966 - 2010, (although GDP figures are

only from 1970 -2010). As noted earlier, unemployment is measured using national definitions, so international comparisons are not meaningful. However, it is the annual percentage point change that will be used for analysis, so this comparison is unnecessary.

2.3 Methods of Analysis and Results

This section explains and compares the methods used in estimating movements in the business cycle, calculation of cumulative aid commitments, and tests of pro-cyclicality. Results of these tests are presented, and the section ends with three extensions used as robustness checks on the baseline analyses.

2.3.1 The Business Cycle

Business cycle fluctuations are measured with several proxies. One standard method of calculation is a simple deviation from detrended GDP per capita, using a detrending technique such as the Hodrick & Prescott (1997) filter, which is built on the assumption that a time-series variable y_t is composed of a growth (trend) component g_t and a cyclical component c_t such that $y_t = g_t + c_t$ for $t = 1,...,T$. These components are calculated with minimization of the expression:

$$\sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T} \left[(g_t - g_{t-1}) - (g_{t-1} - g_{t-2}) \right]^2$$

A smooth trend would indicate a near-constant growth figure; therefore, the difference between growth and lagged growth for two consecutive periods should be very small. The HP filter accounts for this by squaring this difference, and applying a multiplier λ on the sum of these squares. A higher choice of λ then "penalizes" changes in the growth component over time. There appears to be little consensus about the choice of this parameter for annual data; suggested estimates range from a low of 6.5 (Ravn & Uhlig, 2002) or 10 (Backus & Kehoe, 1992) to 100

(Pallage & Robe, 2001). To ensure that results are robust to the choice of this parameterization, I will begin by showing results for all three of these values on per-capita GDP levels. The final cyclicality measure is then the natural log of the per-capita GDP level in time *t* minus the natural log of the HP trend component *g*. I will refer to this cyclicality measure in time *t* as $HP_{\lambda t}$, where λ is the smoothing parameter chosen in the Hodrick-Prescott filter:

$$HP_{\lambda t} = \ln(GDP_t) - \ln(g_t)$$

Another popular proxy for the business cycle, especially among developed nations, is the Output Gap provided by Beffy et al., (2006). This methodology and resulting figures as provided by OECD is the difference between real and potential output as calculated using the nation's capital stock, potential labor force, and assuming a constant inflation rate. The output gap is highly correlated with the HP cyclicality component, as shown in table 4 below.

Table 4: Correlations of Business Cycle Proxies, 1970 - 2010

	OECD Output Gap	**$HP_{6.5}$**	**HP_{10}**	**HP_{100}**
OECD Output Gap	1			
$HP_{6.5}$	0.773	1		
HP_{10}	0.806	0.996	1	
HP_{100}	0.884	0.852	0.892	1

We can see that the relationship between the Output Gap is highly correlated with the HP filters, especially at higher levels of the smoothing parameter. As the Output gap is built from a theoretical base of production rather than a simple smoothing of actual national income, it will

serve as more of a standard in subsequent analyses in measurement of business cycles and shocks.[27]

2.3.2 Cyclicality of Aid

It has been generally found that aid tends to be pro-cyclical with donor income. While not the focus of this paper, I begin by testing the cyclicality of commitments to confirm this finding in the current dataset. Beginning with per-capital donor GDP in constant USD, each series is detrended with the HP filter, creating $HP_{6.5}$, HP_{10}, and HP_{100} as shown in the previous section. The OECD output gap is also used as a 4th sample of GDP cyclicality.

Recipient income, for purposes of subsequent analyses, is also detrended using the HP filter. A low parameter value of λ=1, following Dabla-Norris et al. (2010) to allow for shorter business cycles. The proxy for recipient cyclicality of income is then HP_1. The majority of bilateral aid flows are "missing values," of which nearly all are zeroes. It is not uncommon to then regard these data points as zero aid flows, rather than to ignore them as missing values (Arndt et al. 2010; Dabla-Norris et al., 2010). This assumption is also used presently. Further, the OLS regression coefficients can be considered elasticities if aid flows are transformed using a semi-log form:

$$G_{dry} = sign\left(G_{dry}\right)\ln\left(1+\left|G_{dry}\right|\right)$$

$$L_{dry} = sign\left(L_{dry}\right)\ln\left(1+\left|L_{dry}\right|\right)$$

$$T_{dry} = sign\left(T_{dry}\right)\ln\left(1+\left|T_{dry}\right|\right)$$

[27] This is true for donor nations, where OECD output gap data is available. Recipient nations must be analyzed with HP filtered GDP levels.

These detrended donor series were all correlated with each component of transformed recipient aid. Most correlations were insignificant, given the small number of observation points for each pairing. Only correlations that were significant at the $\alpha = 0.05$ level were retained. The number of remaining correlations, divided into positive and negative correlations, are shown in Table 5 for each category of summary data, out of the possible 3,519 donor/recipient pairings.

Table 5: Cyclicality of aid, 1970 - 2010

		Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
Output Gap	# pos.	64	74	37	59	70	83
	# neg.	195	237	44	69	200	243
$\lambda = 6.5$	# pos.	45	41	29	26	52	46
	# neg.	31	27	29	19	36	29
$\lambda = 10$	# pos.	52	45	32	30	59	51
	# neg.	31	33	28	21	37	34
$\lambda = 100$	# pos.	107	77	26	44	108	95
	# neg.	60	77	32	35	66	83

It is clear that the choice of the lambda parameter affects the proportion of GDP variation that is "claimed" for the cyclical component, causing higher parameter values to generally result in a greater number of significant correlations. Interestingly, even though the parameter value of λ=100 allowed income cyclicality to be correlated most closely with the OECD output gap, evidence regarding the procyclicality of aid using these two measures is contradictory. Use of the OECD output gap shows commitments, disbursements, and bilateral aid totals to be decidedly more countercyclical. For example, 75% of total disbursement observations significantly correlated to the OECD output gap are negatively correlated. The HP filtered cyclicality measures, however, tend to show slight procyclicality for these aid flows at low

parameter values, and this preponderance grows as the lambda value increases. The exception to this is the ambiguous procyclicality of HP filter correlations that relate to loan commitments.

The HP cyclicality measure is a popularly used proxy for the business cycle, and the OECD output gap is quickly becoming more of an accepted standard, especially for donor nations. However, it may be interesting to look at a third relative measure, such as the simple annual change in employment. This variable was also calculated for each donor nation, for the years 1970-2008. The results of bilateral aid flow correlations with this variable are shown in Table 6. Again, some procyclicality is demonstrated, as a positive change in employment in a donor nation is more often correlated with aid. Interestingly, grants and total bilateral aid flows are found to be somewhat procyclical here, in accordance with analyses in Table 5 using the HP measure. Loan amounts appear countercyclical, more in line with the OECD output gap.

Table 6: Cyclicality of Aid, Correlations with Change in Employment, 1970 - 2008

	Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
# pos.	118	161	19	24	125	159
# neg.	118	129	58	69	114	117

We may opt to explore the data just a bit deeper at this point to examine whether, as purported in past empirical works, the procyclicality of aid is particularly strong with respect to lower income countries. The 153 recipient nations can easily be subdivided per the OECD classifications of Least Developed Countries (LCDs), Low Income Countries (LICs), Low Middle Income Countries (LMICs), and Upper Middle Income Countries (UMICs). With these four categories

of recipients in groupings, we can repeat the analyses of Tables 5 and 6 to answer this question with the current dataset.

Table 5a: Cyclicality of aid, Correlations with OECD Output Gap, 1970 - 2010

		Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
LDCs	# pos.	21	27	11	24	20	29
	# neg.	69	85	8	18	68	89
LICs	# pos.	1	1	7	2	3	2
	# neg.	14	17	5	7	15	13
LMICs	# pos.	19	24	15	25	22	28
	# neg.	62	75	21	33	65	81
UMICs	# pos.	23	22	4	8	25	24
	# neg.	50	60	10	11	52	60

Table 5b: Cyclicality of aid, Correlations with $HP_{6.5}$, 1970 - 2010

		Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
LDCs	# pos.	15	11	11	8	16	14
	# neg.	12	9	4	7	13	9
LICs	# pos.	2	3	3	1	4	5
	# neg.	1	0	2	1	3	1
LMICs	# pos.	14	14	10	11	16	13
	# neg.	9	9	13	9	9	11
UMICs	# pos.	14	13	5	6	16	14
	# neg.	9	9	10	2	11	8

Table 5c: Cyclicality of aid, Correlations with HP_{10}, λ=10, 1970 - 2010

		Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
LDCs	# pos.	17	13	12	9	18	17
	# neg.	12	9	3	7	13	9
LICs	# pos.	3	4	3	1	6	6
	# neg.	0	0	3	1	1	1
LMICs	# pos.	17	15	12	14	18	14
	# neg.	11	12	13	8	12	14
UMICs	# pos.	15	13	5	6	18	14
	# neg.	8	12	9	5	10	10

Table 5d: Cyclicality of aid, Correlations with HP_{100}, 1970 - 2010

		Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
LDCs	# pos.	31	21	9	17	32	27
	# neg.	18	21	7	11	17	22
LICs	# pos.	7	4	2	1	9	6
	# neg.	3	4	6	4	5	4
LMICs	# pos.	36	25	10	18	35	32
	# neg.	24	29	8	11	25	34
UMICs	# pos.	33	27	5	8	32	30
	# neg.	15	23	11	9	19	23

Table 6a: Cyclicality of Aid, Correlations with Change in Employment, 1970 - 2008

		Grant Comm.	Grant Disb.	Loan Comm.	Loan Disb.	Total Comm.	Total Disb.
LDCs	# pos.	36	62	6	8	42	62
	# neg.	32	38	15	16	39	35
LICs	# pos.	16	20	2	5	18	19
	# neg.	17	17	5	9	17	13
LMICs	# pos.	37	46	7	8	38	47
	# neg.	41	47	26	30	38	36
UMICs	# pos.	29	33	4	3	27	31
	# neg.	28	27	12	14	30	33

A similar dichotomy is shown in Tables 5a-5d and 6a, where the OECD output gap tends to show the opposite relationship with most aid flows than does the cyclicality measure derived from the HP filter. Focusing on the Least Developed Countries (LDCs), the output gap has more significantly negative correlations with most bilateral aid flow types, indicating a tendency to be countercyclical. These same transformed aid flows to the poorest countries are more correlated with HP income procyclicality, again with generally stronger ratios as the parameter is increased. Table 5 shows that employment changes are also positively correlated with bilateral aid flows to the poorest countries, providing more evidence for procyclicality.

2.3.3 Undisbursed Commitments

The main focus of this paper is to examine the difference between commitments and disbursements, and to explore whether this difference is related to the business cycle of the donor country. We can start by noting that Table 2 gives us a clear picture of the variance between nations with regard to undisbursed commitments. Some nations, such as Korea, allow up to half of their committed foreign aid to remain undisbursed during this time period, while other nations such as Luxembourg and Portugal actually give substantially more aid than they promise. It is quite likely that these differences rest on multiple variables, only a few of which will be explored. But any overall measure of undisbursed commitments would average these fixed effects, losing much information about these overall differences between nations.

The differences of $DiffG_{dry}$, $DiffL_{dry}$, and $DiffT_{dry}$ have been calculated as shown, and have also undergone the semi-log transformation used for previous aid figures. The results are now correlated with the OECD output gap as the business cycle proxy, as were the six individual aid flows themselves. The correlations for each donor nation are shown in Table 7.

With Table 7, we can see a marked difference between the cyclicality of bilateral aid flows and the payment of committed bilateral aid flows. Recall from section 3.2 that the aid flows were consistently shown to be countercyclical in correlations with the OECD output gap. Here, the output gap is generally procyclically correlated with disbursement gaps. The majority of correlations (69%) in Table 7 are positive.

Table 7: Disbursement Gap Correlations with the OECD Output Gap, 1970 - 2010

DAC Nation	Grant Gap	Loan Gap	Total Gap	Grant Gap (LDCs only)	Loan Gap (LDCs only)	Total Gap (LDCs only)
Austria	-0.216	-0.031	0.128	-0.111	0.209	0.054
Belgium	0.237	-0.020	0.191	0.280*	0.091	0.242
Canada	0.137	-0.075	0.178	0.156	0.237	0.364**
Denmark	0.140	0.152	0.053	0.128	0.040	0.270*
France	0.186	0.005	0.104	0.135	-0.323**	-0.089
Germany	-0.400*	-0.146	-0.279	-0.168	0.045	-0.107
Greece			0.055			
Ireland						
Italy	-0.240	0.029	0.110	-0.178	-0.099	-0.173
Luxembourg	-0.200		-0.200	0.235		0.235
Netherlands	0.266*	0.173	0.319**	0.342**	0.022	0.375**
Norway	0.256	-0.407**	0.226	0.091	0.032	0.098
Portugal	0.001	-0.282	-0.117	-0.012	-0.382**	-0.126
Spain	-0.053	0.196	0.391**	-0.053	-0.113	0.237
Sweden	0.006	0.046	-0.088	-0.022	0.064	-0.091
Switzerland	0.448**	0.112	0.476***	0.229		0.210
United Kingdom	0.386**	0.090	0.506***	0.342***	0.188	0.438***
United States	0.223	0.249	0.063	0.111	0.082	0.144
Australia	0.147	0.266*	0.163	0.307*		0.307*
Finland	0.295*	0.238	0.310*	0.041	0.201	0.123
Japan	-0.102	0.178	-0.021	0.013	-0.066	-0.069
Korea						
New Zealand	-0.112		-0.112	0.040		0.040

*Significance of these correlations at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

In the right three columns, the same calculations are shown for just the 49 LDCs, in case a similar bias was found as in Tables 4a and 5a. Because of the relatively small number of disbursement gaps, few of the correlations are highly significant. It is not clear from browsing this grid of numbers whether the disbursement gaps are necessarily more procyclical for LDCs, but 70% these of correlations are positive, comparable to 69% for the entire sample. A simple average of these correlations across numbers provides only about 0.080 for total aid, and 0.082

for LDCs. This provides an indication that LDCs are not significantly disadvantaged in this regard.

At this point, the subperiod of 1991-2010 is introduced to test for differences in analyses covering the entire 41-year time span, and the most recent 20-year span. In Table 7b, the same output is generated for this limited time period.

Table 7b: Disbursement Gap Correlations with the OECD Output Gap, 1991 - 2010

DAC Nation	Grant Gap	Loan Gap	Total Gap	Grant Gap (LDCs only)	Loan Gap (LDCs only)	Total Gap (LDCs only)
Austria	-0.300	0.142	0.039	-0.142	0.177	0.033
Belgium	-0.053	-0.155	-0.030	-0.050	0.093	0.092
Canada	0.193	-0.354	0.052	0.460**		0.460**
Denmark	0.164	0.089	-0.130	0.055	-0.467**	0.027
France	0.340	-0.014	0.156	0.313	-0.338	0.116
Germany	-0.400*	-0.146	-0.279	-0.168	0.045	-0.107
Greece			0.125			
Ireland						
Italy	0.016	0.391*	0.348	-0.087	0.315	0.192
Luxembourg	-0.294		-0.294	0.306		0.306
Netherlands	0.329	-0.069	0.271	0.352		0.364
Norway	-0.061	-0.533**	-0.117	-0.218	0.024	-0.206
Portugal	0.044	-0.453**	-0.194	0.015	-0.608***	-0.191
Spain	-0.052	0.286	0.483**	-0.050	-0.209	0.258
Sweden	-0.016	0.260	-0.086	-0.042	-0.244	-0.046
Switzerland	0.378*	0.351	0.338	0.196		0.179
United Kingdom	0.113	-0.212	0.520**	-0.016	-0.123	0.218
United States	0.246	0.432*	-0.066	0.034	0.229	-0.197
Australia	0.269	0.230	0.270	0.358		0.358
Finland	0.181	0.160	0.194	0.111	0.285	0.186
Japan	0.126	-0.038	-0.128	0.120	0.281	0.174
Korea						
New Zealand	-0.139		-0.139	-0.005		-0.005

*Significance of these correlations at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

The average correlation in this subsample drops with the earliest years removed, to 0.053 for the entire sample, and 0.059 for the LDC countries. A reduction in procyclicality of the disbursement gap is also indicated by the raw count of positive correlations. Where the 41-year sample showed 69% of correlations to be positive, this subsample shows just 58% of correlations to be positive.

2.3.4 Cumulative Undisbursed Commitments

A simple comparison of commitments and disbursements from year to year provided some evidence that the business cycle is related to the timing of fund disbursements. Some evidence was found for procyclicality for the disbursement gap in the previous section. However, what may be more telling is the cumulative undisbursed funds committed from each donor to each recipient. To facilitate this, a simple variable of cumulative normalized commitments, C_{cum}, is calculated for each donor/recipient pairing for each year. Again, a semi-log transformation of this cumulative undisbursed balance is used in analyses.

We may again run correlations in order to search for a simple preponderance of positive or negative values, with few significant results. However, a multivariate regression of this distribution gap over the 41-year period and 20-year subperiod would allow us to include control variables that may provide a better idea as to some of the factors that influence this timing.

The cyclicality of donor income is the main variable of focus; however, is this relationship robust through varying fiscal stances? Perhaps the donor nation's budget surplus as a percentage of

GDP is also related to the ease with which disbursements of aid flow to recipient nations. And what of recipient GDP, or even relative GDP between the donor and the recipient? We have seen that LDCs tend to receive the most procyclical funding; is this relationship true of the disbursement gap as well? And finally, is it reasonable to expect that the donor nation may make disbursement decisions in part based on the cyclicality of the recipient nation's income per capita?

To answer these questions, the matrices of $SumDiffG_{dry}$, $SumDiffG_{dry}$, and $SumDiffG_{dry}$ are calculated, each normalized again by division of GDP in the year *y* of analysis, and regressed with the equations:

$$SumDiffG_{dry} = \alpha_d + \beta_{dr} Cyc_d + \Omega + \varepsilon_{dr}$$

$$SumDiffL_{dry} = \alpha_d + \beta_{dr} Cyc_d + \Omega + \varepsilon_{dr}$$

$$SumDiffT_{dry} = \alpha_d + \beta_{dr} Cyc_d + \Omega + \varepsilon_{dr}$$

where Cyc_d is the vector over the 41-year period of the cyclical component of donor income per capita, and the omega matrix is a series of control variables such as the donor's budget surplus as a percentage of GDP, total donor GDP per capita, total recipient GDP per capita, the ratio of donor/recipient per capita GDP, the size of the aid flow, and the cyclicality of recipient GDP per capita.

The analysis begins with OLS regressions without the omega vector; only the lone regressor of the donor's cyclical component of income was used. The dataset includes 23 donors, 153 recipients, and three aid flow types, which allows for just over 10,000 potential regressions to be

evaluated. Many pairings have insufficient aid data, and many others are insignificant. Removing regressions that fail to be significant at the $\alpha = 0.10$ level leaves only 899 regressions for total aid. These 899 total aid regression results are summarized in Table 8.

Table 8: Significant regression results, cumulative disbursement gaps in total aid on cyclicality of income, 1970 - 2010

DAC Country	OECD Output Gap, full sample		OECD Output Gap, LCD countries		HP_{100}, full sample		HP_{100}, LCD countries	
	+	-	+	-	+	-	+	-
Austria	16	17	4	10	1	3	1	1
Belgium	5	24	4	5	5	0	3	0
Canada	7	7	1	1	3	5	0	0
Denmark	4	12	0	2	3	6	1	0
France	4	27	0	7	5	1	3	0
Germany	0	3	0	1	0	2	0	1
Greece	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0
Italy	5	85	1	30	4	3	2	0
Luxembourg	1	0	1	0	1	0	1	0
Netherlands	2	14	0	6	3	2	1	0
Norway	4	6	2	2	0	14	0	2
Portugal	0	1	0	1	0	1	0	1
Spain	33	13	11	8	9	8	3	6
Sweden	24	7	7	6	23	2	10	1
Switzerland	40	31	13	11	3	0	1	0
United Kingdom	6	24	1	8	7	7	1	2
United States	1	6	0	4	1	3	0	2
Australia	17	18	7	5	10	0	5	0
Finland	2	19	0	5	0	8	0	3
Japan	2	6	2	1	0	3	0	0
Korea	0	0	0	0	0	0	0	0
New Zealand	3	20	0	10	4	3	2	0
TOTAL	176	340	54	123	82	71	34	19

Note: From this stage, Korea must be omitted from most analyses, as it does not have a calculated OECD output gap.

Note that a majority of negative coefficients indicates that business cycle booms are related to an decrease in the donor's disbursement gap. A summary across the DAC donor countries leaves initial evidence of countercyclical disbursement gaps with the OECD output gap, and procyclical disbursement gaps with the HP cyclicality measure, much as before. We do not see any noticeable difference among the poorest countries.

These results are without any control variables that may also have significant relation to the timing of disbursements. Also, we may interpret procyclicality here as either relating to a reduced incidence of payment, or a higher incidence of commitment. A conditional lag will be introduced later to address this question.

For a closer initial investigation, the omega vector is now added to the matrix of regression results. Fixed effects variables are used for each donor/recipient pairing. Table 9 shows the results of three specifications across all donors, recipients, and time periods.

Table 9: The Cumulative Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

DAC Nation	Full Dataset			LDCs			UMICs		
OECD Output gap	0.012***			0.004			0.010***		
Donor HP_{100}		2.212***			1.530***			0.966***	
Change in unemp.			-0.012*			-0.004			0.002
Donor per-capita GDP (thou)	0.026***	0.025***	0.018***	0.032***	0.032***	0.016***	0.025***	0.023***	0.020***
Donor budget surplus	-0.049***	-0.054***	-0.023***	-0.039***	-0.048***	-0.019***	-0.033***	-0.035***	-0.022***
Recipient per-capita GDP (thou)	-0.112***	-0.090***	-0.120***	-0.027***	-0.017**	-0.006	0.008**	0.007***	0.004
Recipient HP_1	0.730***	0.605***	0.817***	0.217	0.190	0.278	0.033	0.093	0.031
n =	*108,308*	*126,224*	*81,666*	*37,947*	*44,482*	*28,422*	*30,437*	*35,489*	*22,917*
Within R^2 =	*0.0443*	*0.0451*	*0.0361*	*0.0388*	*0.0465*	*0.0075*	*0.0378*	*0.0393*	*0.0177*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

In Table 9, we can see several consistencies in relation to the disbursement gap. First, the incidence of undisbursed commitments in a given year is clearly procyclical for the donor. Both the OECD output gap and the cyclical component of donor income are positively related to the disbursement gap. This relationship is very highly significant in most specifications, while unemployment change is a weak indicator.

Across all specifications, the control variables are much the same. Greater donor income per capita is related to larger disbursement gaps. However, it is quite possible that this relationship may be due to slower movements in the governments of wealthier nations. The conditional lag, investigated next, will provide some clues as to whether this may be the case. Donor budget surplus is negatively related to the disbursement gap. Nations with budget surpluses appear more likely to pay their commitments immediately. The reader may question whether this relationship is really just a fiscal stance in relation to the business cycle of the donor country. This is possible. The correlation between this budget surplus ratio and the OECD output gap is 0.40, and the correlation between budget surplus and the detrended cyclicality measure is 0.29. But given that these correlations are not extremely high, and that foreign aid disbursements and budgetary decisions are typically made by different factions of a government, this control variable is retained.

Recipient GDP is significantly related to the disbursement gap in the full sample, with wealthier recipient nations receiving more timely disbursements. There may be a nonlinearity in this relationship, as the wealthiest recipient countries show positive coefficients on this control variable, suggesting that the wealthiest nations in this group suffer from larger disbursement

gaps. Interestingly, the business cycle of the recipient nation appears positively related to the disbursement gap in the full sample specifications. Donors are more likely to pay less on their commitments when recipient income is above trend. Again, the disbursement gap is a combination of both commitments and payments, the timing of which is hidden in this initial analysis.

In Table 9b, we are able to see the same regressions for the more recent subset of 1991-2010. Within this 20-year time frame, we can see that the disbursement gap remains procyclical for both measures of cyclicality, although not so for LDCs. Employment changes remains a poor predictor of the disbursement gap. Wealthier donor nations still tend to have larger disbursement gaps, larger budget surpluses reduce the disbursement gap, and cumulative disbursement gaps grow as recipient nations show above trend income, as was the case in the full 41-year dataset.

Table 9b: The Cumulative Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

DAC Nation	Full Dataset			LDCs			UMICs		
OECD Output gap	0.020***			-0.007*			0.006*		
Donor HP_{100}		4.218***			0.192			0.407	
Change in unemp.			0.002			0.015**			-0.000
Donor per-capita GDP (thou)	0.001*	0.003***	-0.001	0.010***	0.012***	0.003*	0.009***	0.009***	0.006***
Donor budget surplus	-0.022***	-0.040***	0.004**	-0.005*	-0.011***	0.005*	-0.012***	-0.011***	0.000
Recipient per-capita GDP (thou)	-0.128***	-0.108***	-0.126***	0.005	0.014*	0.004	0.016***	0.014***	0.007
Recipient HP_1	1.016***	0.936***	1.093***	0.284	0.259	0.316	-0.090	-0.064	0.028
n =	*62,832*	*65,688*	*53,181*	*21,274*	*22,241*	*18,006*	*17,578*	*18,377*	*14,860*
Within R^2 =	*0.0452*	*0.0376*	*0.0416*	*0.0030*	*0.0047*	*0.0014*	*0.0063*	*0.0065*	*0.0028*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

If we abandon employment changes as a potential regressor in explaining the disbursement gap, we may choose to look at the relationship between the disbursement gap and the business cycle across each nation. Table 10 provides the coefficients for both the OECD output gap and the HP cyclical component of income for each donor nation, with the same omega vector of control variables as used above.

Table 10: The Cumulative Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

	Full Sample		LDCs		UMICs	
DAC Nation	**OECD**	**HP**	**OECD**	**HP**	**OECD**	**HP**
Austria	0.009	-5.193***	0.018	-3.810***	0.002	-2.991**
Belgium	0.002	2.487***	-0.013	0.913	0.011	1.863
Canada	0.042***	2.750***	0.045***	4.390***	0.020	-1.365
Denmark	0.013	4.200***	0.024	5.333**	-0.005	0.223
France	-0.028*	2.441*	-0.054*	6.158**	0.003	1.145
Germany	-0.028***	-7.766***	-0.010*	-6.674***	-0.015	-4.253*
Greece	0.000	-0.341***			0.001	-1.085***
Ireland	0.000	0.000	0.000	0.000		
Italy	-0.080***	-5.152***	-0.023	-6.117***	-0.065***	-1.977*
Luxembourg	-0.003*	-0.171	0.001	0.107	0.002	-0.068
Netherlands	0.100***	11.697***	0.142***	21.098***	0.026*	2.739**
Norway	-0.009	0.753	-0.019	0.035	-0.004	0.108
Portugal	-0.001	0.059	-0.001	0.452	-0.001	-0.117
Spain	-0.049***	-3.080***	-0.045***	-2.701***	-0.012	-0.566
Sweden	0.038***	6.392***	0.049***	11.259***	0.009	-0.707
Switzerland	0.002	1.962**	0.054***	3.535***	0.023**	4.027***
United Kingdom	-0.007	0.354	-0.009	1.118	0.021*	0.201
United States	-0.004	-2.591*	-0.010	-3.794	-0.028	-3.392
Australia	0.010	2.606*	0.027	6.373**	-0.002	1.042
Finland	0.013***	0.724	0.012*	0.914	0.001	-0.146
Japan	-0.056***	-7.328***	-0.057***	-7.269***	-0.058***	-5.019***
Korea	-0.049	0.830**	0.830**	1.133**	-0.049	1.213*
New Zealand	-0.051***	0.883**	-0.014**	-0.519	-0.052***	2.476**

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Using the OECD output gap as a regressor for the full sample, 9 of the 23 DAC donor nations show a coefficient significant at a minimum of the $\alpha = 0.05$ level. Of these, 4 are positive, providing no further evidence of procyclicality of the cumulative disbursement gap with this measure. Using the HP filter, there are 13 significant regressors in this table, and 7 of these are positive. Again, no procyclicality of the disbursement gap is evident here. This is similar to the results in the LDC subset, where 4 of 7 significant regressors are positive for the output gap, and 7 of 12 for the HP filter. The general result from these baseline analyses is that there appears to be no evidence suggesting that the disbursement gap from year to year across donor nations tends to be procyclical or countercyclical with donor income, even though the cumulative disbursement gap has been shown to be significantly procyclical overall.

In the most recent subsample, the results are similar. There are 9 significant coefficients (again, at the $\alpha = 0.05$ level) on the OECD output gap in the full subsample, and 7 of those are negative, indicating a potential shift toward countercyclicality of the disbursement gap in recent decades. Results for the HP filtered cyclicality measure are neutral, with 5 of 11 positive and significant coefficients. A cursory glance at the results for low income countries over this time period suggests that the disbursement gap is becoming more countercyclical for these nations as well.

Table 10b: The Cumulative Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

	Full Sample		LDCs		UMICs	
DAC Nation	**OECD**	**HP**	**OECD**	**HP**	**OECD**	**HP**
Austria	-0.025***	-3.605***	-0.021	-2.882*	-0.008	-1.044
Belgium	0.009	1.962*	-0.011	-1.107	0.009	1.094
Canada	0.004	0.791	-0.015	-0.779	-0.001	-0.429
Denmark	-0.010	0.884	-0.007	0.652	-0.016	-0.624
France	0.136***	10.299***	0.225***	19.18***	0.041	1.631
Germany	-0.033***	-3.631***	-0.010*	-1.289***	-0.026	-2.958*
Greece	0.000	-0.082			0.001	-0.299
Ireland						
Italy	-0.019***	-1.211*	-0.017*	-1.548	-0.013	-1.161
Luxembourg	-0.003*	-0.318**	0.002	0.198	0.002	-0.006
Netherlands	0.104***	9.280***	0.103***	16.32***	0.030**	2.684**
Norway	-0.053**	-5.772***	-0.120***	-11.92***	-0.026	-3.511*
Portugal	0.001	0.254	0.007	0.877	-0.002	-0.286
Spain	-0.019	-1.730	-0.036	-2.902	0.004	-0.081
Sweden	0.011	2.716**	0.007	3.778*	-0.035*	-4.349**
Switzerland	0.014	3.182**	0.041*	4.953**	0.015	3.047**
United Kingdom	-0.017*	0.172	-0.045**	-1.596	0.014	3.411**
United States	-0.090***	-6.122**	-0.094*	-7.787**	-0.078*	-7.035*
Australia	-0.027	-3.569	-0.117***	-19.72***	-0.010	1.851
Finland	-0.011*	-0.797	-0.015*	-0.764	-0.006	-1.479
Japan	-0.041**	-5.589***	-0.029	-4.044*	-0.041**	-
Korea	0.039	-1.011	-1.011	1.136	0.039	-0.031
New Zealand	-0.032***	4.873***	-0.047***	-5.935***	0.002	12.07***

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

2.3.5 Extensions

So far, we have only seen the results of the disbursement gaps and cumulative as measured within a year. Here, a conditionally lagged disbursement gap is introduced. Second, there has been no analysis of whether the disbursement gap is related to particularly large cyclical fluctuations for either the donor or the recipient. Third, there may be significance to be found in non-linear relationships between cyclicality and the disbursement gap. To test this, higher-order

terms for the cyclical regressors may be explored. Fourth, the best known target for DAC nations in bilateral foreign aid is a 0.7% of GNI target. As this is measured by disbursements rather than commitments, this threshold may induce commitments to be more likely backed by cash. In this section, these additional tests will be presented.

We start with the addition of cubed cyclical variables and the introduction of two "large negative shock" dummy variables; one for donors, and another for recipients. For donor nations, this variable is one if the OECD output gap of a donor nation is in the lowest 5% of the output gaps in the total sample, and zero otherwise. For recipient nations, this variable is one if the semi-log transformed HP filtered cyclicality measure is in the lowest 10% of values across all recipient observations. The percentile level of 5% was chosen arbitrarily, in order to capture the worst downturns of the donors. The 10% level was chosen with a simple supposition that unfavorable shocks are perhaps twice as likely in recipient nations. In the dataset, there is evidence that the poorest countries have a disproportionate share of large negative shocks. The LDCs in the dataset are shown to have large negative shocks 11.8% of the time with this measure.

Table 11: The Cumulative Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

DAC Nation	Full Dataset				LDCs			
OECD Output gap	0.005*	0.005			-0.002	-0.002		
Cubed Output gap /100	0.029***	0.005			0.026*	0.029*		
Donor HP_{100}			2.000***	1.853***			0.873**	0.883**
Cubed HP filtered donor per-capita GDP, λ=100			97.487	1.162			299.82**	281.33**
Donor per-capita GDP (thou)	0.026***	0.026***	0.025***	0.025***	0.032***	0.032***	0.032***	0.032***
Donor budget surplus	-0.049***	-0.050***	-0.054***	-0.056***	-0.039***	-0.039***	-0.048***	-0.048***
Recipient per-capita GDP (thou)	-0.112***	-0.112***	-0.090***	-0.090***	-0.026***	-0.025***	0.017**	0.016**
Recipient HP_1	0.735	-0.183	0.607***	-0.341	0.218	-0.177	0.191	-0.250
Large donor shock		-0.116***		-0.114***		0.014		-0.018
Large recipient shock		-0.149***		-0.153***		-0.057**		-0.062***
n =	*108,308*	*108,308*	*126,224*	*126,224*	*37,947*	*37,947*	*44,482*	*44,482*
Within R^2 =	*0.0444*	*0.0451*	*0.0451*	*0.0459*	*0.0389*	*0.0390*	*0.0465*	*0.0466*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Adding these new variables to the original omega vector used previously allows for several specifications, which are displayed in Table 11. Across the entire sample, procyclicality of the cumulative disbursement gap continues to be predominant, using either measure of cyclicality. The cubed cyclicality measures are not significant across the full sample, but especially large movements from trend appear to be especially disadvantageous to the poorest recipient nations. Large negative shocks to donor income tend to reduce the disbursement gap, as do large negative shocks to recipient income. This is a welcome result, as we tend to think of foreign aid as being particularly relevant to circumstances of recipient downturns. With these additional controls, it is clear that lower income donor countries and donor nations with higher budget surpluses continue to have smaller disbursement gaps. Also, evidence is consistent that wealthier recipients collect more of their bilateral aid commitments. Most of these regularities are also true for the subsample of LDCs. Finally, the cyclicality of recipient income appears to be less related to the cumulative disbursement gap with these additional control variables.

Table 11b: The Cumulative Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

DAC Nation	Full Dataset				LDCs			
OECD Output gap	0.019***	0.020***			0.001	0.002		
Cubed Output gap /100	0.003	0.011			-0.027**	-0.019		
Donor HP_{100}			3.280***	3.239***			0.004	0.226
Cubed HP filtered donor per-capita GDP, λ=100			396.05***	420.32***			77.365	161.450
Donor per-capita GDP (thou)	0.002*	0.001	0.003***	0.003***	0.009***	0.008***	0.012***	0.011***
Donor budget surplus	-0.022***	-0.022***	-0.039***	-0.039***	-0.005*	-0.005*	-0.011***	-0.009***
Recipient per-capita GDP (thou)	-0.128***	-0.128***	-0.108***	-0.108***	0.005	0.004	0.014*	0.013*
Recipient HP_1	1.016***	0.149	0.951***	-0.003	0.282	-0.016	0.260	-0.064
Large donor shock		0.036		0.010		0.043		0.083***
Large recipient shock		-0.153***		-0.168***		-0.050*		-0.054**
n =	*62,832*	*62,832*	*65,688*	*65,688*	*21,274*	*21,274*	*22,241*	*22,241*
Within R^2 =	*0.0452*	*0.0458*	*0.0390*	*0.0397*	*0.0033*	*0.0035*	*0.0047*	*0.0053*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

The most recent subperiod shows largely the same results as in Table 11. The cumulative disbursement gap remains generally procyclical, the gap is greater for wealthier donors, donor nations with budget deficits, and is greater for poorer recipients. Large recipient shocks to income are paired with lower cumulative disbursement gaps, as before.

Finally, a conditional lagged disbursement gap is calculated from the data. Since some bilateral aid commitments can take years to be disbursed, it is not unreasonable to allow at least one year for disbursement of a given commitment. The lagged variable is then defined as:

$$SumLagDiffT_{dry} = \sum_{i=1970}^{y} CT_{dri} - DT_{dri} \text{ if } \sum_{i=1970}^{y} CT_{dri} - DT_{dri} \leq 0,$$

$$= \sum_{i=1970}^{y} CT_{dri-1} - DT_{dri} \text{ if } \sum_{i=1970}^{y} CT_{dri-1} - DT_{dri} \geq 0,$$

$$= \sum_{i=1970}^{y} CT_{dri} - DT_{dri} \text{ if } \sum_{i=1970}^{y} CT_{dri} - DT_{dri} > 0 \text{ and } \sum_{i=1970}^{y} CT_{dri-1} - DT_{dri} < 0$$

This variable then allows one extra year for a commitment to be disbursed, addressing a portion of pure timing issues by eliminating simple one-year lags.[28] Chronic underpayments of commitments or multi-year lags will still be reflected in this variable, although with less effect.

[28] In comparing the original set of cumulative disbursement gaps with the conditional lag, approximately 22% of the 144,279 observations change with the conditional lag rule.

Table 12: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

DAC Nation	Full Dataset		LDCs		UMICs	
OECD Output gap	0.010***		0.000		0.009***	
Donor HP_{100}		1.943***		1.197***		0.848***
Donor per-capita GDP (thou)	0.025***	0.024***	0.029***	0.030***	0.024***	0.022***
Donor budget surplus	-0.046***	-0.051***	-0.034***	-0.043***	-0.031***	-0.034***
Recipient per-capita GDP (thou)	-0.099***	-0.079***	-0.027***	0.017**	0.011***	0.009***
Recipient HP_1	0.631***	0.527***	0.183	0.158	-0.034	0.056
n =	*108,308*	*126,224*	*37,947*	*44,482*	*30,437*	*35,489*
Within R^2 =	*0.0403*	*0.0416*	*0.0353*	*0.0429*	*0.0383*	*0.0396*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 12b: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

DAC Nation	Full Dataset		LDCs		UMICs	
OECD Output gap	0.018***		-0.008**		0.005*	
Donor HP_{100}		3.795***		-0.098		0.339
Donor per-capita GDP (thou)	0.001*	0.003***	0.008***	0.010***	0.008***	0.008***
Donor budget surplus	-0.021***	-0.037***	-0.004*	-0.010***	-0.011***	-0.010***
Recipient per-capita GDP (thou)	-0.115***	-0.096***	0.006	0.015**	0.018***	0.017***
Recipient HP_1	0.838***	0.766***	0.164	0.148	-0.108	-0.076
n =	*62,832*	*65,688*	*21,274*	*22,241*	*17,578*	*18,377*
Within R^2 =	*0.0390*	*0.0335*	*0.0026*	*0.0039*	*0.0066*	*0.0067*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

The question of slower disbursements related to larger bureaucracies in wealthier nations may be partially answered by a comparison between Tables 9 and 12. The cyclicality measures as predictors of the conditionally lagged cumulative disbursement gap has nearly the same coefficient as for the original cumulative disbursement gap measure. Only a small decline in the magnitude of these coefficients is seen, offering little empirical support that there are significant

timing differences in aid payment. Most values across all specifications are very close to those in Table 8, indicating that short-term timing is not a primary issue in explanation of the disbursement gap overall.

In Table 12b, we look at the same analyses for the 1991-2010 subperiod. Comparing this to the cumulative disbursement gap analysis in Table 9b, we can again note a small decline in the magnitude of the effects of the cyclicality measures.

Table 13: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

DAC Nation	Full Sample		LDCs		UMICs	
	OECD	HP	OECD	HP	OECD	HP
Austria	0.007	-4.872***	0.013	-3.617***	0.003	-2.847**
Belgium	0.000	2.121**	-0.015	0.512	0.009	1.656
Canada	0.036***	2.013**	0.040***	3.799***	0.024	-0.830
Denmark	0.009	3.535***	0.014	3.902*	-0.005	0.106
France	-0.029*	1.423	-0.045	5.233**	-0.002	0.131
Germany	-0.035***	-8.534***	-0.012	-7.872***	-0.028	-5.165**
Greece	0.000	-0.294***			0.000	-0.944***
Ireland	0.000	0.000	0.000	0.000		
Italy	-0.081***	-5.018***	-0.023*	-5.762***	-0.066***	-2.024**
Luxembourg	-0.003*	-0.175	0.001	0.094	0.002	-0.066
Netherlands	0.087***	9.620***	0.126***	17.247***	0.023*	2.255**
Norway	-0.013	0.424	-0.024	-0.442	-0.003	-0.034
Portugal	-0.001	0.066	-0.001	0.463	-0.001	-0.093
Spain	-0.046***	-2.816***	-0.042***	-2.572***	-0.011	-0.442
Sweden	0.038***	5.908***	0.043**	10.016***	0.011	-0.610
Switzerland	-0.004	1.530*	0.040**	2.716**	0.019	3.694***
United Kingdom	-0.017**	-0.558	-0.027**	-0.519	0.023**	0.136
United States	-0.023	-4.603***	-0.043	-6.935***	-0.034	-4.018*
Australia	0.008	2.151*	0.024	5.462**	-0.002	1.050
Finland	0.013***	0.621	0.012*	0.792	0.002	-0.119
Japan	-0.054***	-6.425***	-0.049***	-5.229***	-0.062***	-5.260***
Korea	-0.036	0.705*	0.705*	0.933**	-0.036	1.265*
New Zealand	-0.044***	0.755**	-0.013**	-0.386	-0.050***	1.971*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 13 provides coefficients for regression of the conditionally lagged cumulative disbursement gap on both the OECD output gap and the HP cyclical component of income for each donor nation given the omega vector of control variables, as Table 10 provided for the cumulative disbursement gap. The OECD output gap as a regressor for the full sample shows 19 of the 23 DAC donor nations with a coefficient significant at a minimum of the $\alpha = 0.05$ level. Of these, 11 are positive, showing a much higher preponderance of positive coefficients using the conditional lagged disbursement gap than with the cumulative disbursement gap. Using the HP filter, there are 16 significant regressors in this table, and 11 of these are positive. Again, this is greater evidence of procyclicality of bilateral aid disbursements when a single lagged year is taken into account. The LCD countries also show greater procyclicality of aid disbursements than before, with 9 of 13 significant regressors are positive for the output gap, and 13 of 16 for the HP filter. There remains greater evidence of procyclicality with this timing adjustment, although the poorest countries to not seem to suffer this effect disproportionately.

In the subperiod of 1991-2010, the conditional lag adjustment does not show the procyclicality shift as it appeared in the full sample. Only 2 of 10 significant regressions are positive when using the OECD output gap, and 4 of 11 for the HP cyclicality measure. This method of analysis tends to provide mixed results of cyclicality of the cumulative disbursement gap, or perhaps a slight shift toward countercyclicality.

Table 13b: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

DAC Nation	Full Sample		LDCs		UMICs	
	OECD	HP	OECD	HP	OECD	HP
Austria	-0.023**	-3.467***	-0.019	-2.539	-0.005	-0.902
Belgium	0.005	1.606	-0.021	-2.057	0.010	1.101
Canada	0.009	1.278	-0.011	0.148	0.011	0.781
Denmark	-0.010	0.740	0.004	1.555	-0.016	-0.561
France	0.118***	8.765***	0.202***	17.22***	0.030	0.245
Germany	-0.038***	-4.372***	-0.012	-2.237***	-0.034	-3.865**
Greece	0.000	-0.067			-0.001	-0.245
Ireland						
Italy	-0.024***	-1.795**	-0.019*	-1.912*	-0.020*	-1.657*
Luxembourg	-0.003*	-0.311**	0.002	0.191	0.002	0.010
Netherlands	0.095***	8.612***	0.084**	14.79***	0.028**	2.613**
Norway	-0.056***	-5.839***	-0.115***	-11.45***	-0.028	-3.820**
Portugal	0.002	0.254	0.007	0.857	-0.001	-0.246
Spain	-0.021	-1.620	-0.035	-2.993*	0.004	0.072
Sweden	0.012	2.610**	0.005	3.444*	-0.029	-3.841**
Switzerland	0.006	2.108*	0.022	2.656	0.015	2.953**
United	-0.022**	-0.474	-0.052**	-3.433*	0.016	3.965***
United States	-0.103***	-8.038***	-0.143***	-12.59***	-0.067	-6.534*
Australia	-0.021	-1.669	-0.105***	-16.72**	-0.008	2.146
Finland	-0.005	-0.700	-0.013	-0.776	-0.001	-1.268
Japan	-0.050***	-6.169***	-0.049*	-5.704**	-0.051***	-5.035***
Korea	0.015	-1.350*	-1.350*	0.903	0.015	-0.274
New Zealand	-0.027***	4.262***	-0.039***	-5.068***	-0.003	10.286***

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 14: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

	Full Dataset				LDCs			
OECD Output gap	0.003	0.003			-0.006	-0.005		
Cubed Output gap /100	0.030	0.009			0.026**	0.029*		
Donor HP_{100}			1.674***	1.541***			0.464	0.472
Cubed HP filtered donor per-capita GDP, λ=100			123.44	35.386			334.63***	316.17**
Donor per-capita GDP (thou)	0.025***	0.025***	0.024***	0.024***	0.030***	0.029***	0.030***	0.030***
Donor budget surplus	-0.046***	-0.046***	-0.051***	-0.053***	-0.034***	-0.034***	-0.043***	-0.043***
Recipient per-capita GDP (thou)	-0.099***	-0.099***	-0.079***	-0.078***	-0.026***	-0.025***	-0.017**	-0.015**
Recipient HP_1	0.636***	-0.244	0.530***	-0.383**	0.184	-0.180	0.159	-0.269
Large donor shock		-0.100***		-0.105***		0.015		-0.018
Large recipient shock		-0.143***		-0.147***		-0.052**		-0.060***
n =	*108,308*	*108,308*	*126,224*	*126,224*	*37,947*	*37,947*	*44,482*	*44,482*
Within R^2 =	*0.0404*	*0.0410*	*0.0416*	*0.0424*	*0.0354*	*0.0355*	*0.0431*	*0.0432*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

In Table 14, we see the results of fixed effect regression of donor/recipient pairings across the entire sample, as was done for the cumulative disbursement gap in Table 11. Using the conditional lagged cumulative disbursement gap, we see little difference. Nearly all coefficients show the same sign, significance, and level.

In the more recent subperiod of 1991-2010 there is little change, except for the stronger evidence of procyclicality of the cumulative disbursement gap. Once the conditional year lag is included, we can see that the OECD output gap is also highly significantly procyclical across the full sample, as is the HP cyclicality measure.

Table 14b: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

	Full Dataset				LDCs			
OECD Output gap	0.016***	0.016***			-0.002	-0.001		
Cubed Output gap /100	0.007	0.014			-0.022*	-0.017		
Donor HP_{100}			2.877***	2.828***			-0.369	-0.191
Cubed HP filtered donor per-capita GDP, λ=100			387.82***	403.76***			111.82	178.74
Donor per-capita GDP (thou)	0.001*	0.001	0.003***	0.003***	0.007***	0.007***	0.011***	0.009***
Donor budget surplus	-0.021***	-0.021***	-0.037***	-0.037***	-0.005*	-0.004*	-0.009***	-0.008***
Recipient per-capita GDP (thou)	-0.115***	-0.114***	-0.096***	-0.096***	0.006	0.006	0.015**	0.015**
Recipient HP_1	0.840***	0.005	0.781***	-0.131	0.162	-0.090	0.149	-0.120
Large donor shock		0.031		0.004		0.029		0.066**
Large recipient shock		-0.147***		-0.161***		-0.042		-0.045*
n =	*62,832*	*62,832*	*65,688*	*65,688*	*21,274*	*21,274*	*22,241*	*22,241*
Within R^2 =	*0.0391*	*0.0396*	*0.0337*	*0.0343*	*0.0027*	*0.0029*	*0.0039*	*0.0043*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Finally, the ODA/GNI target of 0.7% is examined for its potential effect on donor behavior. In 1970, this target was largely agreed upon, after suggestion by the Pearson Commission in 1969 and a U.N. resolution in October of 1970. This goal has been reiterated many times since, and so it is reasonable to expect that donor nations would prefer to demonstrate compliance in bilateral foreign aid decisions. This measure is reported as the net total disbursements divided by GNI for each year. It is possible, then, that those nations around the 0.7% mark may demonstrate a tendency to "stretch" their disbursements beyond what they may otherwise choose, decreasing the disbursement gap when they are close to the threshold.

To answer this question, the series of ODA/GNI measures were taken for each DAC donor nation from stats.oecd.org, to be introduced in each of the econometric specifications of Table 14. On average, donor countries continually fail to reach this goal, as the average of this ratio over all observations is 0.41%. The standard deviation of these observations is 0.26%, with a minimum of 0.02% (mostly by Korea and Portugal) and a maximum of 1.17% (largely Norway).

If it is true that those near the 0.7% mark tend to stretch their disbursements, then we may begin by choosing a simple dummy variable to denote those observations where this ratio is near the mark, such as 5 basis points in either direction. Such a variable was created for those observations where the ODA/GNI ratio was between 0.65% and 0.75%. There are 2,754 observations within this band, over 20,000 above the band, and over 100,000 below. This "threshold dummy" variable is shown in Table 15. One potential criticism of using this measure is that, since the chosen range surrounding 0.7% is near the upper end of the overall range of the ODA/GNI measure, perhaps there is a simple relationship between the ODA/GNI ratio and the

disbursement gap that is being connected with the dummy variable. To control for this, the ODA/GNI ratio is included in some specifications.

Another way of using this information to test for disbursement behavior near this threshold is to not use an arbitrary cutoff for a dummy variable, but simply measure the dispersion of ODA/GNI around the threshold. For this, a continuous variable, the "squared threshold gap," is also created. This is simply $\left(\frac{ODA}{GNI} - 0.7\%\right)^2$. If donor nations do tend to disburse more to reach the much celebrated threshold of 0.7% of GNI, then we should expect to see the threshold dummy to have a negative impact on the disbursement gap, and we should also expect to see the squared threshold gap have a positive impact on the disbursement gap.

Table 15: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1970 - 2010

	Full Dataset							
OECD Output gap	0.004	0.005**	0.009***	0.008***				
Donor HP_{100}					1.569***	2.236***	2.478***	2.348***
Donor per-capita GDP (thou)	0.025***	0.030***	0.029***	0.030***	0.024***	0.028***	0.027***	0.029***
Threshold dummy	-0.351***	-0.310***			-0.290***	-0.248***		
Squared threshold gap			1.276***	0.867***			0.795***	0.312***
ODA/GNI ratio		-0.531***		-0.299***		-0.452***		-0.371***
Donor budget surplus	-0.046***	-0.054***	-0.054***	-0.055***	-0.053***	-0.062***	-0.061***	-0.063***
Recipient per-capita GDP (thou)	-0.099***	-0.105***	-0.104***	-0.104***	-0.079***	-0.087***	-0.087***	-0.087***
Recipient HP_1	-0.224	-0.105	-0.162	-0.133	-0.367**	-0.247	-0.290	-0.260
Large donor shock	-0.121***	-0.144***	-0.130***	-0.137***	-0.116***	-0.117***	-0.105***	-0.110***
Large recipient shock	-0.140***	-0.126***	-0.134***	-0.129***	-0.144***	-0.136***	-0.143***	-0.138***
n =	*108,308*	*104,976*	*104,976*	*104,976*	*126,224*	*116,553*	*116,553*	*116,553*
Within R^2 =	*0.0420*	*0.0469*	*0.0472*	*0.0472*	*0.0430*	*0.0459*	*0.0447*	*0.0456*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 15 shows the results of these new specifications. It is clear from the coefficients on the ODA/GNI ratio that the disbursement gap is correlated with smaller levels of ODA as a fraction of income. This in itself is an interesting relationship, considering that larger levels of ODA should logically allow for a larger potential gap between commitments and disbursements. We can see that this is not the case. The threshold dummy shows us that, given the use of the OECD output gap as our cyclicality measure, those donor nations close to disbursing 0.7% of GNI in foreign aid do contract their disbursement gap significantly more than those far from this range. Similar evidence is demonstrated in the coefficients of the squared threshold gap, where nations giving at greater distances from the 0.7% threshold are significantly more likely to increase, or fail to decrease, their foreign aid disbursement gap. Clearly this goal, emphasized in the arena of bilateral aid for more than 40 years, appears to serve as an incentive for more timely ODA payments.

Table 15b: The Conditionally Lagged Disbursement Gap as a Function of Cyclicality and Controls, 1991 - 2010

	Full Dataset							
OECD Output gap	0.018***	0.017***	0.021***	0.019***				
Donor HP_{100}					3.520***	3.359***	4.153***	3.601***
Donor per-capita GDP (thou)	0.001	0.011***	0.006***	0.011***	0.003***	0.012***	0.008***	0.013***
Threshold dummy	-0.280***	-0.265***			-0.277***	-0.266***		
Squared threshold gap			1.396***	0.741***			1.075***	0.308***
ODA/GNI ratio		-0.714***		-0.561***		-0.758***		-0.693***
Donor budget surplus	-0.020***	-0.031***	-0.029***	-0.033***	-0.037***	-0.048***	-0.047***	-0.050***
Recipient per-capita GDP (thou)	-0.114***	-0.115***	-0.115***	-0.115***	-0.096***	-0.098***	-0.097***	-0.097***
Recipient HP_1	0.008	0.067	0.039	-0.062	-0.135	-0.077	-0.106	-0.083
Large donor shock	0.005	-0.017	0.012	-0.002***	-0.030***	-0.050**	-0.029	-0.040
Large recipient shock	-0.147***	-0.134***	-0.141***	-0.135***	-0.160***	-0.147***	-0.153***	-0.147***
n =	*62,832*	*62,132*	*62,132*	*62,132*	*65,688*	*64,988*	*64,977*	*64,988*
Within R^2 =	*0.0401*	*0.0469*	*0.0450*	*0.0471*	*0.0346*	*0.0420*	*0.0385*	*0.0417*

*Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Finally, Table 15b is provided for the subperiod of 1991-2010, with the same results as shown in Table 15 for the full 41-year sample. As before, greater evidence of procyclicality is demonstrated here relative to the OECD output gap. Again, those donor nations giving a greater percentage of their GNI to recipients have lower disbursement gaps, and the 0.7% bilateral foreign aid target continues to appear significant in motivating payment of aid commitments.

2.4 Conclusion

Aid flows continue to appear to be procyclical in nature, although the strength of this relationship changes with the specific measure chosen. This paper summarizes the disbursement gap and cumulative disbursement gap, searching for connections between payments of signed bilateral aid obligations and the business cycle of the donor nation. Multiple tests and specifications revealed that the disbursement gap was significantly positively related to both standard measures of the business cycle, both with and without control variables, and with each extension explored. This relationship appears robust across all donor nations as a set, although counts of individual donor/recipient pairings do not show the same procyclicality in all specifications.

As research develops surrounding bilateral aid, disbursements, and motivations, evidence continues to develop that efforts appear to be procyclical in nature, and connected in many ways more to the donor nation than the recipient nation. The benevolent motivation is hard to justify, both theoretically and empirically. The present work adds to this growing literature in showing that, even in the face of a signed commitment of bilateral foreign aid, nations still tend to make payment decisions based more on their own business cycle and fiscal stance than the apparent

needs of recipient nations. Also, the 0.7% of GNI target disbursement ratio appears to affect aid payments to a much larger degree than the need of recipients.

The reasons to why this empirical regularity exists are likely to be found at pairing-level analyses. The function describing the cumulative disbursement gap is likely much more complex than this initial attempt, and may well include the spectrum of conservativism of the governing parties in donor nations, measures of bureaucratic complexity, key dates regarding the millennium development goals, etc. This body of knowledge is within the purview of future research.

Chapter 3

The Effect of Cohabitation Exit Costs on Cohabitation, Marriage, and Marriage Hazard

Chapter Summary

Using both the round six and 2006-2008 National Survey of Family Growth (NSFG) data for both male and female respondents along with macroeconomic data over the same time period, I test a number of theoretical questions regarding changes in relationship exit costs and their effects on behavior in cohabitation, marriage, and separation. I find that our proxy for cohabitation surplus and exit costs significantly affects subsequent decisions of cohabitation, marriage, separation, and divorce. Also, marriage hazard rates are related to these changing exit costs in ways consistent with recent advances in theory.

3.1 Introduction

Couples dating in high-income countries are increasingly likely to cohabitate prior to marriage. Traditional mores are quickly giving way to pragmatic, economical living arrangements that espouse a "try before you buy" attitude regarding marriage. The number of unmarried cohabiting couples is at record levels; but what is even more significant, perhaps, is the rate of acceleration in this trend. In fact, while the census bureau estimated 12 million unmarried cohabitors in the U.S. in its 2005-2007 survey, that number exceeded 13 million in 2009, and reached 15 million in 2010 (U.S. Census Bureau, 2010). Even these numbers may be understated. It is widely cited that between 1960 and 2000, unmarried cohabitation grew tenfold (U.S. Census Bureau, 2000). However, adjustments to survey data performed by Fitch, Goeken, and Ruggles (2005) suggest that the reported cohabitation rates prior to 1980 are likely overstated, suggesting that this increase in cohabitation between 1960 and 2000 may more accurately be a 28-fold increase. Stevenson & Wolfers (2007) provide an excellent summary of the considerable changes in dynamics of the household in recent years, leading to fewer marriages and divorces, and the driving forces behind this pervasive acceleration in incidence of cohabitation.

Arguably, cost sharing is part of the reason for this recent surge, and is indeed one focus of this paper. Theory reasonably suggests that couples are more likely to marry when there are significant cost savings to do so, and the economic downturn that began in 2006 and has persisted in recent years has presented couples with attractive incentives to join this trend. However, this short-run cyclical effect is simultaneous with the long-term trend toward increased cohabitation which has been noted for decades. With the better information regarding their potential mate generated by cohabitation, one might expect that marriages formed after

premarital cohabitation are more successful than those without. But empirical studies reveal a persistent "marriage hazard puzzle," as marriages preceded by cohabitation seem subject to higher divorce rates. Much literature has explored this marriage hazard puzzle (for example, see Bennett et al., 1988; Axinn & Thornton, 1992; Hall & Zhao, 1995; Brown & Booth, 1996; Bramlett & Mosher, 2002; and Brien, Lillard, & Stern, 2006). More recent evidence indicates that, given the right set of control variables, there is empirical support for premarital cohabitation as a "marriage trial," and that it may actually reduce rates of subsequent divorce (Kulu & Boyle, 2010). Other research focuses on the change in this relationship over time, concluding most generally that this negative effect of premarital cohabitation on marital success appears to have weakened in recent decades (Kamp Dush et al., 2003; Hewitt & De Vaus, 2009; Reinhold, 2010). In summary, the "marriage hazard puzzle" remains an active area of research.

The focus of this paper is not the "trial" motivation for premarital cohabitation, but rather shared living costs, cohabitation surplus, and other economic influences in relation to cohabitation, marriage, and separation decisions. The remainder of the paper is organized as follows: In section 2 recent advancements in theory are explored regarding cohabitation, marriage, and divorce, empirical work that has been done in concert with that theory, and additional testable research questions that have been chosen from recent advances in theoretical literature. Section 3 describes the data used in the empirical analysis. In section 4 this dataset is used to test the theoretical predictions regarding exit costs and relationship decisions that have been introduced. Section 5 concludes, and discusses limitations to empirical tests that may be addressed by more complete data in the future.

3.2 Relevant Literature and Empirical Questions

The works of Becker may perhaps be considered the starting point for the mainstream branch of economic theory that includes cohabitation and marriage as a subset. Gains from marriage can be shown by considering the production of household and market goods. Within this dichotomy, it is posited that, in a partnership, household goods can be produced more efficiently, and cooperation may allow the substitutability of time away from household goods and toward market goods (Becker, 1974). Other explanations of marriage are acknowledged, including love, desire for children, etc. which are also valid. However, the focus of this paper will remain on quantifiable, financial gains and from cohabitation and marriage over and above that of a single-person household.

If we consider the substitutability of time in the production of the necessary household good and the consumable market good, then, ceteris paribus, a rise in market wages can be shown to increase the utility of market work, making a cohabitation or marriage arrangement of greater value (Becker, 1974). It has been shown empirically that, when controlling for years of schooling, higher-wage individuals tend to marry earlier (Keeley, 1979). There is also evidence from longitudinal studies that delayed marriage allows career development and wage enhancement, although later marriages are often formed with partners of lower income levels (Loughran & Zissimopoulos, 2004). However, the macroeconomic climate is also been shown to have an inverse relationship to marriage formation. Inflation is positively related to marriage formation in recent theory, and this is supported empirically (Burdett et. al, 2011). Also, differential tax treatment also affects cohabitation and marriage decisions; specifically, while the

decision to marry seems to be only minimally related to tax code, the decision to progress from cohabitation to marriage is significantly related (Alm & Whittington, 2003).

It is widely reported in popular press that recessions are associated with increases in cohabitation. A 2010 Census Bureau report acknowledges that cohabitation increased 13% between 2009 and 2010, a much faster rate of increase than is the long-run trend, and during what some term the "great recession" (U.S. Census Bureau, 2010). Additionally, it has been shown in a European study that co-residential decisions are statistically related to perceived job insecurity (Becker et. al, 2010) and with poor performance of the labor market (Card & Lemieux, 2000). This is a logical behavioral choice, given the significant economic advantages presented to cohabitors (Lundberg & Pollak, 2007; Bütikofer & Gerfin, 2009). Given these findings, perhaps the most basic question to ask is: Do we find evidence that changes in the returns to shared living expenses (proxied by varied economic environments) increase the likelihood of cohabitation? If cohabitation is driven, at least partially, by the cost-sharing living arrangement that accompanies it, then there should be clear empirical data to substantiate this. Many informal studies present data that worsening economic environments usher in larger numbers of cohabitating couples, and this is a logical expectation. In this paper, data are explored to examine this question in the context of recent theoretical advances.

Once a couple cohabits, there is generally a point in time where the couple decides to escalate to marriage, or to separate. There is some evidence that this "deadline" effect exists. Summary statistics provided of the 1987-1988 National Survey of Families and Households dataset indicate that may be approximately two years; less than 40% of cohabitations last that long

without proceeding to marriage or ending in separation, and the median cohabitation length at that time was just 1.3 years (Bumpass & Sweet, 1989). However, other evidence suggests that the mean lengths of cohabitation have risen from about 2.5 years in the 1980s to 3.5 years around the year 2000 (United Kingdom Household Longitudinal Study). Further, Kennedy & Bumpass (2008) use the 1995 and 2002 rounds of the NSFG to determine that average cohabitation length has increased since the early 1990s, when two-thirds of cohabitations ended within two years, either in marriage or separation. Their more recent data suggests that only 56% of cohabitations end within two years, as more couples experience longer cohabitation periods. Still, only one in ten cohabitations persists after ten years, according to the General Household Survey 1979–2007.

If and when the decision to marry or separate approaches, we should expect exit costs, expense sharing, etc. to affect this decision. A second empirical question is then: Does a "deadline effect" exist, and if so, what exogenous factors affect both the deadline effect, and the decision to marry or separate? Data are utilized to attempt to answer this question as well.

The hazard rate, or divorce rate of couples, is often studied as to contributing factors, including supposed effects of premarital cohabitation (for example, Axinn & Thornton, 1992; Lillard, Brien, & Waite, 1995; Kulu & Boyle, 2010). Changes in unemployment levels have specifically been studied in various contexts, with empirical evidence suggesting that higher unemployment translates into a job loss within a home, providing a reason for divorce (Jensen and Smith, 1990; Boheim and Ermisch, 2001; Kraft, 2001; Eliason, 2004). Theoretical justification for this most commonly involves a simple comparison between expected utility of marriage continuance and divorce, given a shock to the earnings of one spouse. Charles and Stephens (2004), for example,

develop a simple model of marriage where dissolution is assumed to occur whenever the value of marriage (i.e. surplus above that of being single) drops to a negative value, which occurs with a job loss. Given this empirical regularity, we expect to see the same in the current dataset. However, our focus is conditional upon the macroeconomic conditions in which the marriage was formed. Specifically, a third question is posed: Are marriages formed during poor economic climates subject to higher hazard rates? That is, if a couple marries in due in part to changes in monetary incentives, is their marriage more likely to end in divorce? We may expect to see lower quality matches proceed to marriage in times of economic distress (Farmer & Horowitz 2012), and if this lower expected marriage quality leads to greater divorce rates, we might also expect to see this third research question answered affirmatively by data, when controlling for the effects of higher unemployment rates at the time of divorce or separation.

One final test of the importance of exit costs is their effect on decisions to end cohabitation when a relationship has reached the stage of separation. This end is signaled clearly by divorce for married couples, even though the cohabitation may be delayed due to economic conditions, much as the start of cohabitation may similarly affected. This is a growing trend often reported in popular press[29], but is still a relatively underdeveloped area of study. Many reasons for choosing to continue cohabitation after divorce as reported in informal sources are similar to those given for other cohabitation arrangements: cost savings. Expense sharing appears to be a powerful motivator in causal anecdotal evidence, and so a fourth question is formulated for further investigation: When divorce is imminent, does cohabitation last significantly longer when

[29] There were 37,000 results in a 4/21/12 Google search with the quoted terms "living together after divorce," and just four results on Google scholar, none dealing with the specific issue of post-divorce cohabitation by couples.

exit costs are higher? While much as been written on divorce, most of the literature does not distinguish between separation of living quarters and divorce. But if exit costs are higher, we may expect to see the date of physical separation delayed relative to the date of divorce. Fortunately, the richness of the chosen cohabitation dataset allows us to test this directly.

3.3 Data

To empirically test the effect of exit costs on cohabitation patterns, multiple datasets were used. The cohabitation data is from the 2002 (Cycle 6) and 2006-2008 National Survey of Family Growth (NSFG) surveys, which were designed and administered by the National Center for Health Statistics (NCHS), in collaboration with other Federal agencies. These were the 6th and 7th such surveys conducted by the NHCS in the past 30 years, and were the first two to have both male and female datasets. The 2002 survey was conducted from January 2002 to March 2003, and the 2006-2008 survey was conducted from June of 2006 to December of 2008.

Face to face interviews were used to collect data from 14,960 women and 11,063 men all between the ages of 15 and 45 years of age in the combined two rounds of the survey. The trained interviewers were all women, who used laptop computers to conduct the interviews. The interviews lasted an average of about one hour. The date of the interview was captured as a variable and included in the database. Thousands of variables were captured, including detailed data regarding pregnancy, sexual activity, childbearing, healthcare, cohabitation, marriage, divorce, adopted children, and attitudes about these things. Respondents were paid $40 for their time, and sampling weights were provided to address, among other things, the oversampling of blacks, Hispanics, and respondents of age 15-24.

To protect the anonymity of the respondents, personal identifying variables are not in the dataset. The excluded variables include even the state of residence. Therefore, interstate variation is impossible to study in the NSFG dataset. However, the richness of the dataset in terms of the cohabitation, marriage, and divorce variables, which include month and year of each event, make the NSFG seemingly the best choice for empirical analysis of cohabitation behavior.

Table 1: Descriptive Statistics

	n	Mean	Standard deviation
Age at interview	26,021	29.17	8.63
Age at the start of 1st cohabitation	16,053	22.21	4.42
Age at the start of 1st marriage	10,034	23.73	4.58
Length of 1st cohabitation in months *(of those ended)*	7,516	46.24	48.39
Length of 1st premarital cohabitation in months *(nonzero)*	4,538	26.20	28.90
Length of 1st marriage in months *(of those ended)*	2,614	76.72	56.40
Lived in an intact family until the age of 18	26,021	0.606	0.489
Mother has a four-year college degree	26,021	0.192	0.394
Father has a four-year college degree	26,021	0.225	0.418
Respondent was born into Catholic religion	26,021	0.360	0.480
Respondent was born into Baptist religion	26,021	0.196	0.397
Respondent was born into other Protestant religion	26,021	0.272	0.445
Respondent attended church at least monthly at age 14	26,021	0.278	0.448
Respondent reports religion as "very important"	26,021	0.434	0.496

Table 1 presents a set of descriptive statistics of the variables chosen for analysis. The average age of the respondents surveyed in this combined dataset was 29.17 years at the time of the interview. Of the 26,021 respondents, 10,034 reported having been married at least once, at an average age of 23.7 years at the time of their first marriage. Of this subset, 2,614 had divorced by the time of the interview. Varied information was gathered about each respondent's childhood and family background. When asked if he/she lived in an intact family until the age of 18, 60.6% of respondents surveyed claimed that they had. The educational level of attainment

by both parents was also recorded, and possession of a four-year college degree was chosen as the cutoff for an educational attainment binary variable for each parent. 19.2% of respondents' mothers and 22.5% of respondents' fathers have at least a four-year college degree.

Each respondent reported the religion in which they were raised. The broad categories include Catholic, Baptist, or other Protestant, and 82.8% of the sample reported one of these as representative of their childhood religious affiliation. Nearly 28% claimed to have attended church either once per month, one to three times per month, or every week at the age of fourteen. Finally, respondents were asked how important religion is in their daily life. Among the choices of "very important", "somewhat important", and "not important", 43.4% said that their religion is very important to them.

In exploration of the choices people make in cohabitation, marriage, and divorce, the NSFG dataset is fairly rich. Each respondent is asked a series of questions about the century month (the month and year converted to a standard four digit code) in which their first former cohabitation began, and the century month in which it ended, if so. The respondent provided the same information for subsequent cohabitations, and also for the starting month of their first marriage, second marriage, etc. Also, the starting month of their current cohabitation, if applicable, was collected. From the resulting series of variables, it is possible to ascertain the first cohabitation by starting date, whether it was premarital or upon marriage. This first cohabital relationship then either proceeded to marriage, ended in separation, or was in continuation at the time of the interview. All of this information was captured and formatted in a linear fashion for analysis of the first cohabitation of each respondent. For example, the starting and ending dates of the j^{th}

cohabitation of respondent *i* are defined as $Start_i^j$ and End_i^j. The age of the respondent $Sage_i^j$, $Eage_i^j$ and the unemployment rate SU_i^j, EU_i^j were also recorded as of these dates, and then the change in unemployment $Uchange_i^j = SU_i^j - EU_i^j$ was calculated.

The average length of first marriages ending by the interview was 6.4 years, whereas the remaining 7,420 first marriages reported to be in progress had an average age at the time of the interview of 9.3 years. The average length of first cohabitations ending by the interview was 3.9 years. Cohabitations include marital cohabitation, whether or not the start of cohabitation began before marriage. The range of these lengths is significant; some cohabitations/marriages ended in the same month in which they began. The oldest cohabitations/marriages in the current dataset began in the early 1970s. Half of the more than 16,000 cohabitations in the dataset (2nd and 3rd quartile by time) began between March of 1989 and February of 2000.

The NSFG dataset contained responses about home ownership, children, and other variables that could potentially be used to measure exit costs. However, these measures are endogenously determined, and so cannot be used to measure the effect of an exit cost change. Other measures of exit costs from outside of this dataset that can be argued as relevant include some relative earning potential change, as well as any external measure of "re-matching" cost.

The first of these, potential change in earnings/employment prospects, may be proxied by general economic conditions, measured by macroeconomic indicators such as the national unemployment level. To include this measure, U.S. nationwide unemployment measures for

each month were obtained from The Bureau of Labor Statistics[30]. These numbers were matched with each observation date in the NSFG dataset to create several new variables of the unemployment rate at each respondent's date of start of cohabitation, end of cohabitation, start of marriage, separation, and divorce. Over the range of dates reported in this dataset, the U.S. unemployment rate ranged from 3.8% to 10.8%.

3.4 Exploration of Research Questions

In section 2, four research questions were posed. In this section, these questions are explored with the current dataset, evaluating any supporting empirical evidence. As mentioned in the introduction, the marriage hazard puzzle appears to be a robust empirical regularity in a number of prior analyses. We may first search the current dataset for support of the marriage hazard puzzle. A simple descriptive table is provided to show survival rates of marriages within the groups of respondents who married with and without premarital cohabitation.

Table 2: Marriage Survival Rates

	n	1 year	2 years	3 years	4 years	5 years
Couples premaritally cohabited	3,235	98.6%	95.5%	92.0%	88.4%	84.9%
Couples cohabiting at marriage	4,353	98.3%	95.3%	91.9%	88.4%	85.5%
Difference		0.3%	0.2%	0.1%	0.0%	-0.6%

This sampling is truncated, using only those who married for the first time at least 5 years prior to the interview, so that comparable measures of success could be ascertained. With no control variables, there appears to be no discernible difference between the groups. At five years, there is only minimal evidence of the marriage hazard puzzle, as a slightly larger percentage of

[30] Data were obtained from www.bls.gov; Series ID: LNS14000000.

premarital cohabitors have divorced. To analyze the data further, I allow marital success five years after the wedding to be a binary dependent variable, and offer three regression specifications in Table 3.

Table 3: Probit Regression of Success of Marriage after Five Years

	Mean	St. Err.	Mean	St. Err.	Mean	St. Err.
Cohabited premaritally	-0.029	0.036	-0.108***	0.037	-0.053	0.039
Month of marriage/100			0.077***	0.026	0.098***	0.028
Age at start of cohabitation			0.042***	0.005	0.037***	0.005
Income level *(by categorized variable)*					0.013**	0.005
Intact family until the age of 18					0.092**	0.040
Mother has four-year college degree					0.020	0.060
Father has four-year college degree					-0.049	0.053
Born into Catholic religion					0.140**	0.059
Born into Baptist religion					-0.129**	0.064
Born into other Protestant religion					-0.019	0.061
Attended church at least monthly at 14					0.063	0.181
Religion is "very important"					0.218***	0.038
n =	*7,588*		*7,588*		*7,147*	
Pseudo R^2	*0.0001*		*0.0201*		*0.0326*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

In Table 3, we can continue to see the weakness of premarital cohabitation as a predictor of marital success after 5 years. Both by itself and with control variables, this indicator fails to be significant. In the second specification, it appears to reduce success when only time is controlled for; but again, this result is very fragile. While the coefficient is negative on premarital cohabitation in all three specifications, the indicator is very weak. This is less surprising, given that, as mentioned above, other authors have noted that the marriage hazard puzzle seems to have weakened over time.[31] In fact, to explore the question of whether there is evidence of a weakening of the marriage hazard puzzle over time in the current data, Tables 2a and 3a are

[31] Reinhold (2010) uses rounds 4, 5, and 6 for his analysis, and already sees a weakening in this relationship. Given that only rounds 6 and 7 are used here, a weak relationship is to be expected.

presented, where the dataset is divided into two groups: those cohabitations and marriages beginning before 1994, and those beginning in 1994 and later.[32]

Table 2a: Marriage Survival Rates, Separated Sample

	n	1 year	2 years	3 years	4 years	5 years
Prior to 1994:						
Couples premaritally cohabited	1,746	98.4%	94.9%	91.2%	87.3%	83.6%
Couples cohabiting at marriage	2,893	98.1%	95.0%	91.4%	87.7%	84.2%
Difference		0.3%	-0.1%	-0.2%	-0.4%	-0.6%
1994 to 2003:						
Couples premaritally cohabited	1,489	98.9%	96.3%	92.9%	89.7%	86.3%
Couples cohabiting at marriage	1,460	98.7%	96.0%	92.8%	89.9%	88.2%
Difference		0.2%	0.3%	0.1%	-0.2%	-1.9%

The marriage hazard puzzle again is indicated by negative differences in the survival rates, in time periods shown in Table 2a. Note that these negative differences are seen in the early data at two years and beyond, and in the later data at four years and beyond. Interestingly, this "cohabitation hazard premium" has indeed decreased in comparisons with cutoff lengths between two and four years, consistent with other empirical works. It appears that, cohabitation is connected with larger hazard rates only for those marriages that survive beyond a certain threshold, indicated in the NSFG data as approximately four years. This is especially evident in the subset of more recent marriages.

Premarital cohabitation does appear to be a stabilizing factor for marriages in the first year. The trial marriage theory is supported by the current evidence in the very short term. It appears that, as marriages are evaluated at longer lengths, premarital cohabitation becomes decidedly

[32] 1994 was chosen based on the data; this boundary allowed the observations to be split into two roughly equal groups.

destabilizing. Does this trend continue? To look at a 10-year comparison, we must ignore the most recent marriages, but the combined dataset still provides about 5,000 marriages, about 2,000 of which were formed after premarital cohabitation. Of those, 67% survived to a ten-year anniversary. Of the roughly 3,000 marriages without premarital cohabitation, 72.8% continued after ten years. It seems clear that the marriage hazard puzzle is still observed, but is much more clearly observed at longer periods of comparison.

Table 3a: Probit Regression of Success of Marriage after Five Years, separated sample

	Before 1994		**1994 to 2003**	
	Mean	**St. Err.**	**Mean**	**St. Err.**
Cohabited premaritally	-0.053	0.049	-0.057	0.063
Month of marriage/100	0.113**	0.046	0.002**	0.109
Age at start of cohabitation	0.045***	0.008	0.029***	0.008
Income level *(by categorized variable)*	0.009	0.006	0.019**	0.008
Intact family until the age of 18	0.120**	0.050	0.038	0.066
Mother has four-year college degree	-0.047	0.077	0.111	0.096
Father has four-year college degree	-0.088	0.068	0.006	0.086
Born into Catholic religion	0.142*	0.076	0.154*	0.093
Born into Baptist religion	-0.122	0.082	-0.130	0.103
Born into other Protestant religion	-0.010	0.079	-0.028	0.096
Attended church at least monthly at 14			0.027	0.186
Religion is "very important"	0.242***	0.047	0.178***	0.064
n =	*4,383*		*2,762*	
Pseudo R^2	*0.0353*		*0.0260*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

In Table 3a, a similar separation of the sample for unions formed before and after the first day of 1994 is shown in a repeated probit regression. In both sample subsets, premarital cohabitation remains a weakly negative influence on marital success. While the marriage hazard puzzle is minimally indicated in this specification, its intertemporal change is not. However, given the evidence above on longer-term comparisons, perhaps it would be interesting to see a similar probit regression as in Table 3 for marriage survival at 10 years instead of five years. With a 5.8

percentage point disparity in survival rates, statistical significance is likely to be found at this length.

In Table 3b, the marriage hazard puzzle has been identified as statistically evident at a ten-year comparison. All three specifications show premarital cohabitation to be very highly statistically significant in predicting marriage hazard after a decade. It is clear now that, at least at some level, the marriage hazard puzzle persists.

Table 3b: Probit Regression of Success of Marriage after Ten Years

	Mean	**St. Err.**	**Mean**	**St. Err.**	**Mean**	**St. Err.**
Cohabited premaritally	-0.165***	0.037	-0.258***	0.039	-0.194***	0.040
Month of marriage/100			0.095***	0.033	0.117***	0.034
Age at start of cohabitation			0.058***	0.006	0.052***	0.006
Income level *(by categorized variable)*					0.011**	0.005
Intact family until the age of 18					0.151***	0.042
Mother has four-year college degree					-0.152**	0.063
Father has four-year college degree					0.046	0.057
Born into Catholic religion					0.089	0.063
Born into Baptist religion					-0.190***	0.070
Born into other Protestant religion					-0.066	0.066
Religion is "very important"					0.271***	0.040
n =	*5,226*		*5,226*		*4,935*	
Pseudo R^2	*0.0031*		*0.0303*		*0.0470*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

It is noteworthy that, although this is the most recent data available from the NSFG studies, the marriages constituting the data in Table 3b are not as recent as the reader may assume. The data was gathered from interviews from 2002 to 2008, and these marriages are all at least 10 years of age. This means that even the most recent marriage represented in the table began as early as 1998. In fact, the range of starting months for the marriages represented in Table 3b spans over 26 years, from July of 1972 to December of 1998. The mean starting month is September of 1988.

Future studies will be able to inform us of changes to the marriage hazard puzzle, and if the effects of cohabitation continue to weaken in predicting divorce. Again, the main focus of this paper is on exit costs and their effects. We may now begin addressing the first of four theoretical questions of cohabitation patterns.

Question #1: Do we find evidence that changes in the returns to shared living expenses (proxied by varied economic environments) increase the likelihood of cohabitation?

Shared living expenses are a significant financial benefit for couples, and much theory on cohabitation assumes that this may be a driver in couples choosing to cohabitate, or at least affect the timing of cohabitation. Using the current datasets, simple regressions may be run, considering the unemployment level an exogenous proxy for cohabitation surplus, as greater unemployment levels are correlated with lower household income, and greater uncertainty regarding income flows. As such, I start with a simple probit regression equation:

$$(1) \qquad Cohab = \beta_1 + \beta\Phi + \varepsilon$$

Cohab, or the incidence of premarital cohabitation as a binary variable, provides us some initial insight as to what factors affect cohabitation. It is expected that higher levels of unemployment encourage cohabitation, as this is regularly observed. The omega vector of respondent characteristics may offer additional information on the sample group.

Table 4: Factors Affecting the Advent of a First Premarital Cohabitation Period

	Mean	St. Err.	Mean	St. Err.	Mean	St. Err.
Male	-0.081***	0.020	-0.083***	0.021	-0.122***	0.021
Income level *(by categorized variable)*			-0.008***	0.003	-0.005*	0.003
Intact family until the age of 18					-0.353***	0.022
Mother has four-year college degree					0.013	0.031
Father has four-year college degree					-0.097***	0.028
Born into Catholic religion					0.038	0.031
Born into Baptist religion					0.067*	0.035
Born into other Protestant religion					0.022	0.033
Attended church at least monthly at 14					-0.707**	0.355
Religion is "very important"					-0.384***	0.021
n =	*16,371*		*15,435*		*15,435*	
Adjusted R^2	*0.0007*		*0.0013*		*0.0318*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 4 shows the results of respondents conditional on their reaching the age of 25. Recall that the dataset includes men and women from ages 15 to 45. It is unreasonable to expect that lack of cohabitation with a member of the opposite sex among the very young respondents is due to a conscious decision to abstain; therefore, this truncation was made. Within this truncated group, we can see that fewer male respondents in the dataset reported having cohabited, and those in lower income brackets do indeed cohabitate with greater frequency.

Children are considered to be exogenously assigned into a family's religious affiliation. At birth, a child does not choose whether or not they attend services of a particular affiliation, and the religious environment chosen for the child may affect choices made later in life. The NSFG dataset includes a qualitative variable for church attendance at age 14, and this is also considered to be exogenously assigned, as behavior at that age is still typically dominated by the choices of the guardian. The "traditional values" variables of living in an intact family, church attendance

in youth, and importance of religion all appear to reduce the instance of cohabitation, as does a higher education level of the respondent's father.

The timing of cohabitation, especially when it does not coincide immediately with marriage, is quite likely to be influenced by macroeconomic conditions. One indicator of economic forces encouraging or discouraging cohabitation is to examine only premarital cohabitations, and look for an effect of both the national unemployment level, and its 6-month change prior to the start of the cohabitation. If these proxies for unanticipated changes in cohabitation opportunity cost do affect behavior, we might expect to see that this 6-month change is, on average, positive. In fact, this is not observed in the data; the average 6-month change in unemployment prior to the start of cohabitation for the 10,557 premarital cohabitors is -0.034, providing no initial evidence of this relationship. The average 6-month unemployment change prior to all cohabitations in the dataset was -0.041.

One way we might consider answering this question of the effect of economic conditions on the timing of cohabitation is to look at the age at which the first cohabitation began. If economic conditions were not drivers to cohabitate, then indicators should be insignificant in predicting the age at which a respondent first chose to cohabitate.

Table 5 provides some evidence that this proxy for economic health does, in fact, tend to reduce the age of first-time cohabitors. Higher levels of unemployment are associated with respondents entering into their first cohabitation (be it premarital or marital) at a younger age. A six-month

change of unemployment for the worse also causes couples to move in at a younger age. This is shown both with and without the usual panel of control variables.

Table 5: Factors Affecting the Age at which a First Cohabitation is Undertaken

	Mean	St. Err.	Mean	St. Err.	Mean	St. Err.
Male	1.395***	0.071	1.395***	0.071	0.976***	0.068
Unemployment at start of cohabitation	-0.617***	0.026	-0.474***	0.073	-0.543***	0.069
6-mo. change in unemp. prior to cohab			-0.151**	0.072	-0.388***	0.068
Income level *(by categorized variable)*					0.181***	0.009
Intact family until the age of 18					1.056***	0.067
Mother has four-year college degree					0.194**	0.097
Father has four-year college degree					0.823***	0.090
Born into Catholic religion					0.267***	0.097
Born into Baptist religion					0.140	0.110
Born into other Protestant religion					0.023	0.102
Attended church at least monthly at 14					-3.578***	0.107
Religion is "very important"					0.664***	0.066
n =	*16,053*		*16,053*		*15,164*	
Adjusted R^2	*0.057*		*0.058*		*0.193*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

The question of likelihood of cohabitation in relation to economic conditions is therefore unsupported here. The evidence does not clearly show that economic conditions closely predict the timing of cohabitation, but it does show that poor economic conditions encourage younger cohabitors to begin living together. Shown to exist with and without control variables for income and other characteristics, clearly exit costs are related to cohabitation decisions.

Question #2: Does a "deadline effect" exist, and if so, what exogenous factors affect both the deadline effect, and the decision to marry or separate?

Exploring this question requires us to also examine the length of time of cohabitation for further evidence of the importance of cohabitation surplus and exit costs. A few initial questions might point us toward a possible conclusion. First, is the length of the cohabitation period prior to marriage affected by the economic climate the couple faces? That is, treating the length of cohabitation as an endogenous decision that is affected by macroeconomic conditions and other control variables, what do we find? Do worsening macroeconomic conditions (correlating with greater cohabitation surplus and greater exit costs) lead to shorter cohabitation periods, and is there a differential effect between those cohabitors who ultimately marry, and those who ultimately separate?

Table 6: Factors Affecting Initial Cohabitation Length Prior to Marriage

	Mean	**St. Err.**	**Mean**	**St. Err.**	**Mean**	**St. Err.**
Unemployment change during cohab.	-7.505***	0.376	-7.286***	0.409	-6.181***	0.410
Unemployment at date of marriage			-0.497	0.362	-2.179***	0.379
Age at the start of cohabitation					-1.205***	0.100
Intact family until the age of 18					-1.838**	0.848
Mother has four-year college degree					-0.494	1.239
Father has four-year college degree					-0.942	1.149
Born into Catholic religion					3.869***	1.276
Born into Baptist religion					-0.451	1.450
Born into other Protestant religion					-0.154	1.322
Attended church at least monthly at 14					-13.59***	1.787
Religion is "very important"					-0.219	0.842
n =	*4,529*		*4,529*		*4,529*	
Adjusted R^2	*0.0805*		*0.0807*		*0.1198*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 6 provides some clear, initial evidence of this relationship. The mean length of premarital cohabitation in this sample is 26 months, with a median length of 17 months. In each specification, an increase in the aggregate unemployment rate is very highly significantly

associated with a shorter duration of premarital cohabitation. That is, it appears that decaying economic conditions do coincide with faster decisions to marry, lending credibility to cohabitation surplus as a driver to both cohabitate, and to escalate to marriage. Also, higher unemployment levels during the month of marriage also coincide with a decrease the length of the cohabitation.

And what of relationships ending in separation? If couples were driven to enter into and remain in cohabiting households by worsening economic conditions, the decision to separate should be delayed by higher rates of unemployment.

Table 7: Factors Affecting Cohabitation Length Prior to Separation

	Mean	**St. Err.**	**Mean**	**St. Err.**	**Mean**	**St. Err.**
Unemployment change during cohab.	-8.591***	0.397	-8.850***	0.424	-7.512***	0.424
Unemployment at date of separation			0.729*	0.420	-1.414***	0.439
Age at the start of cohabitation					-0.987***	0.118
Intact family until the age of 18					0.178	0.910
Mother has four-year college degree					-3.306**	1.300
Father has four-year college degree					-1.314	1.269
Born into Catholic religion					4.133***	1.319
Born into Baptist religion					4.812***	1.440
Born into other Protestant religion					1.083	1.371
Attended church at least monthly at 14					-17.398***	1.447
Religion is "very important"					5.719***	0.948
n =	*4,576*		*4,576*		*4,576*	
Adjusted R^2	*0.0926*		*0.0930*		*0.138*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 7 shows the effects of these variables on cohabitation length when the cohabitation ultimately ends in separation. The 4,576 respondents in the sample whose first cohabitation experience ended in separation lived with their significant other for an average of 29 months. I fail to find evidence here that a change in economic conditions keeps cohabitors together longer

when they are bound to separate. Conversely, a worsening economic climate is shown here to decrease the length of nonmarital cohabitation as in the case of those who eventually married. While this is inconsistent with exit costs as drivers of cohabitation, it is consistent with theory discussed in the introduction, suggesting that a shock of unemployment within a household causes divorce, as the utility of marriage has fallen dramatically for one of the agents. Perhaps this effect is also seen in premarital cohabitations, and is the dominating effect in this data.

A more direct way of exploring this question is to look at the decision point itself. One assertion by Farmer & Horowitz (2012) is that an exogenous increase in exit costs will, all else equal, cause cohabitors to be more likely to marry, accepting (on average) a lower quality draw, which will therefore increase marriage hazard in the long run. With the current dataset and a proxy variable for exit costs, we can come very close to directly testing this theory. Given an economic environment at the time of first cohabitation, I again take the change in unemployment to proxy for an exogenous shock to exit costs, and see if evidence suggests that increase in marriage incidence tends to follow worsening economic conditions, and whether those marriages are more likely to fail.

A probit regression for only those respondents entering into a first cohabitation that has either evolved to marriage or ended in separation will allow each of these decisions to be evaluated simultaneously with the same list of control variables. If worsening economic conditions, manifesting as potentially greater cost savings for cohabitors and greater costs for those who split, are legitimate factors affecting these decisions, we should expect such an analysis to show itself clearly in this model.

Table 8: Probit Regression of Variables Affecting the Decision to Marry (=1) or to Separate (=0)

	Mean	St. Err.	Mean	St. Err.
Unemployment at the time of decision			0.054***	0.013
Unemployment change during cohab.	0.030**	0.012		
Age at the time of decision	0.026***	0.003	0.029***	0.003
Intact family until the age of 18	0.291***	0.027	0.285***	0.027
Mother has four-year college degree	-0.094**	0.040	-0.091**	0.040
Father has four-year college degree	0.032	0.038	0.034	0.038
Born into Catholic religion	0.194***	0.041	0.183***	0.041
Born into Baptist religion	0.026	0.045	0.016	0.046
Born into other Protestant religion	0.170***	0.042	0.161***	0.042
Attended church at least monthly at 14	-0.382***	0.049	-0.317***	0.050
Religion is "very important"	0.108***	0.028	0.102***	0.028
n =	*9,105*		*9,105*	
Pseudo R^2	*0.0332*		*0.0343*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 8 shows the results of a probit model with the dependent variable as one if the respondent proceeded to marriage. It is clear that both a higher level unemployment and a positive change in unemployment are instrumental in affecting the decisions of couples to marry. Higher exit costs and greater cohabitation surplus are empirically consistent with theory. Another component of exit costs is the opportunity cost of other potential relationships; that is, there is a higher opportunity cost to marriage when the potential pool of other mates is large. This potential pool declines with age, and so this opportunity cost to marriage falls. This is reflected in the positive and significant coefficient on age at the time of decision, where clearly older respondents were more likely to accept the relationship that they had, rather than to risk another relationship quality draw. While controlling for age, we still see that higher exit costs significantly affect the decision to marry.

Question #3: Are marriages formed during poor economic climates subject to higher hazard rates?

There are certain limitations to using the current dataset to answer this question. The oldest respondent is only 45 years of age, and the average length of first marriages that end in divorce is somewhere from about 8 years (http://www.census.gov/prod/2005pubs/ p70-97.pdf) to about 11 years (http://www.divorceinfo.com/statistics.htm). It can be problematic to rely on the length of marriage as an indicator of success, but we can at least compare the CDFs of divorces in the datasets for marriages borne out of various economic environments.

In the current dataset of over 26,000 respondents, 10,034 have married, and 2,614 have already seen that first marriage end. Those 10,034 marriages began on average 10.86 years prior to the interview. The remaining 7,420 respondents who had remained married to their first spouse had, at the time of the interview, been married an average of 9.27 years.

A total of 7,588 marriages occurred at least 5 years prior to the time of the interview, 5,266 marriages occurred at least 10 years prior to the time of the interview, and 2,848 marriages occurred at least 15 years prior to the time of the interview. In each of these three subgroups, a probit of the incidence of divorce is explored to see to what degree economic conditions and other control variables affected this decision.

Table 9: Probit of Divorce at Various Thresholds of Marriage Age

Minimum length of marriage	**5 years**		**10 years**		**15 years**	
at time of interview	**Mean**	**St. Err.**	**Mean**	**St. Err.**	**Mean**	**St. Err.**
Unemployment at start of cohabitation	0.147***	0.029	0.081**	0.035	0.069	0.042
Unemployment at the time of separation	0.096***	0.033	0.120***	0.036	0.108**	0.044
Age at the time of marriage	-0.018*	0.009	-0.012	0.012	-0.040**	0.019
Income level *(by categorized variable)*	0.085***	0.010	0.081***	0.011	0.081***	0.015
Intact family until the age of 18	0.117	0.071	0.024	0.085	0.093	0.111
Mother has four-year college degree	0.090	0.120	0.115	0.147	0.045	0.191
Father has four-year college degree	0.175	0.113	0.121	0.134	0.345*	0.204
Born into Catholic religion	-0.044	0.110	0.008	0.130	0.033	0.164
Born into Baptist religion	0.077	0.118	0.143	0.141	0.426**	0.183
Born into other Protestant religion	0.192	0.120	0.287**	0.144	0.415**	0.187
Attended church at least monthly at 14	-0.454	0.325				
Religion is "very important"	-0.120*	0.072	-0.145*	0.085	-0.134	0.111
n =	*2,645*		*2,132*		*1,393*	
Pseudo R^2	*0.1002*		*0.0824*		*0.0987*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*
Note: Church attendance at age 14 was omitted from two regressions due to collinearity.

In all three selections of marriage lengths, there is a positive relationship between poor economic conditions at the start of cohabitation and ultimate divorce. This is consistent with recent advances in theory, suggesting that higher exit costs directly affect the decision of couples to escalate from dating to cohabitation to marriage (or directly to marriage), encouraging marriages that are of lower match quality. This increases the likelihood that such marriages will end in divorce, as these data directly confirm. Importantly, this is shown with the inclusion of a control variable for unemployment at the time of separation. Again, the effect of marriage utility being shocked by unemployment suggests that higher unemployment is a driver to separate, which is demonstrated by the positive and significant relationship between unemployment at separation and divorce. With this control in place, the separate effect of a poor economic condition at the time of cohabitation is shown separately as an ultimate driver of divorce.

One final test of economic conditions driving divorce involves investigating only premarital cohabitors. I have demonstrated that premarital cohabitation does have an effect on marital success, but within this group, are exit costs as a driver to cohabitate having a separately identifiable effect on hazard rates? A probit regression of the instance of divorce five years after marriage is offered, using only premarital cohabitors. The results are shown in Table 10.

Table 10: Probit of Divorce at Five years, Given Premarital Cohabitation

	Mean	**St. Err.**	**Mean**	**St. Err.**	**Mean**	**St. Err.**
Unemployment at start of cohabitation	0.148***	0.027	0.146***	0.029	0.147***	0.029
Unemployment at the time of separation	0.102***	0.030	0.094***	0.032	0.096***	0.033
Age at the time of marriage			-0.015*	0.009	-0.018*	0.009
Income level *(by categorized variable)*			0.090***	0.009	0.085***	0.010
Intact family until the age of 18					0.117	0.071
Mother has four-year college degree					0.090	0.120
Father has four-year college degree					0.175	0.113
Born into Catholic religion					-0.044	0.110
Born into Baptist religion					0.077	0.118
Born into other Protestant religion					0.192	0.120
Attended church at least monthly at 14					-0.454	0.325
Religion is "very important"					-0.120*	0.072
n =	*2,770*		*2,645*		*2,645*	
Pseudo R^2	*0.0326*		*0.0893*		*0.1002*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*
Note: Church attendance at age 14 was omitted from two regressions due to collinearity.

We can see immediately that divorce is significantly more likely among couples who began cohabiting at times of economic turmoil. Again, unemployment at time of separation is controlled for to account for the "household disruption" effect. Even when the stabilizing factor of age is accounted for, there is still a relatively large increase in the instance of divorce if higher exit costs and greater benefits of expense sharing are present when a couple begins cohabitation.

Question #4: When divorce is imminent, does cohabitation last significantly longer when exit costs are higher?

A marriage that is doomed to fail would be part of a distribution of cohabitation end dates, which may respond to exit costs. Higher exit costs should delay the end of cohabitation. To measure this, the variable *Stayed* is created, which is the difference between the month of the end of cohabitation and the month of the end of the marriage (*Stayed* will therefore be negative for couples who end cohabitation prior to divorce). If exit costs drive couples to live together longer, we might expect to see *Stayed* respond directly to higher exit costs at the end of the marriage.

Table 11: Drivers of Length of Cohabitation Following Divorce

	Mean	**St. Err.**	**Mean**	**St. Err.**	**Mean**	**St. Err.**
Unemployment at the time of divorce	2.804***	0.394	1.163***	0.405	1.109***	0.408
Age at the time of divorce			0.191	0.124	0.106	0.127
Length of marriage			-0.166***	0.012	-0.160***	0.012
Intact family until the age of 18					4.402***	0.926
Mother has four-year college degree					1.402	1.402
Father has four-year college degree					0.001	1.279
Born into Catholic religion					0.690	1.459
Born into Baptist religion					1.217	1.546
Born into other Protestant religion					0.801	1.496
Attended church at least monthly at 14					-2.025	3.625
Religion is "very important"					-2.117**	0.910
n =	*2,585*		*2,585*		*2,585*	
Adjusted R^2	*0.0188*		*0.1348*		*0.1418*	

*Note: Significance at the 10%, 5%, and 1% levels are denoted by *, **, and *** respectively.*

Table 11 shows the results of this final regression. While most control variables may not be appropriate in this setting, their presence does not detract away from the effect of economic conditions and the length of marriage on the timing of physical separation. Marriages ending in

times of macroeconomic hardship see cohabitors living together longer than those couples separating in better times. Shorter marriages are also shown to be associated with delayed physical separation.

However, as with other analyses, there may well be other stories being told in the data that pervade. For instance, if worsening economic conditions are the cause of added stress, job changes, etc. that precipitate a move by one of the cohabitors, it may affect cohabitation surplus. This is especially true considering that a proxy is used for this surplus. Nonetheless, these data show that post-divorce cohabitation tends to show agreement between theory and empirics.

3.5 Conclusion

A recent theoretical paper has drawn attention to the potential role of exit costs in decisions to cohabitate, marry, and separate. This paper uses changing unemployment rates as a broad proxy of changes in exit costs to test empirically some of the theoretical claims put forth. I find that exit costs have a significant effect on decisions to cohabitate, marry, separate, and divorce.

The regularity of the marriage hazard puzzle is obscured in the current dataset for short-term marriages. Much stronger evidence of this puzzle is found with an examination of marital success at the 10-year mark. Other authors have already noted the decline of this effect in more recent years, so the obscurity of the puzzle in the most recent marriages may indeed be a continuation of this trend.

The first question was whether we find evidence that changes in economic conditions affect the advent of cohabitation. Changing economic conditions can affect union incentive through many channels, including expense sharing in cohabitation (whether marital or not), downside risk, diversification benefits, etc. Using U.S. unemployment data as the proxy for changes in economic gains to cohabitation, there is strong evidence that worsening economic conditions do influence the timing of cohabitation and marriage. Higher risk of job loss does appear to provide incentive for union formation, or forming them perhaps more quickly.

Secondly, I explored whether exit costs significantly affect the choice of marriage or exit, once a couple reaches one of those decisions. The length of cohabitation prior to marriage or separation was examined first, and a greater exit cost proxy was shown to reduce the length of premarital cohabitation, hurrying the couple along to marriage. Paradoxically, an increase in exit costs over the course of the cohabitation also seemed to shorten the cohabitation length for couples that finally separated. But the choice to marry or separate was also examined in Table 8, where an increase in exit costs was clearly associated with the decision to marry rather than to separate.

Next, since exit costs do tend to push couples together in more economical living arrangements, including into marriage, what can we say about the relative strength of such marriages? Are such marriages formed in these times of economic decline more subject to subsequent divorce? Yes. In multiple groups, it appears clear that our exit cost proxy is related to divorce rates in a predictable fashion. It is quite possible from the data that these marriages tend to provide lower utility to the pair, as marriages formed at times of pressure from higher exit costs are more likely

to eventually fail. Also, a separate analysis of only premarital cohabitors showed that unions formed in poor economic climates are also more likely to end in separation.

Finally, when divorce is imminent, cohabitations tend to last longer when exit costs are higher. This is shown with a generated variable of the number of months cohabitation of a couple lasts beyond the month in which they divorce. Interestingly, the length of the marriage is negatively correlated with this variable.

Throughout these analyses, control variables tell us of other interesting relationships that exist in the data. Clearly a person's tendency to premaritally cohabitate, to marry, to separate, or to divorce, is influenced by the relationships that have been modeled to them by their parents, by religious affiliation, and a host of unobservable variables that remain unexplored. Herein, exit costs, as proxied by U.S. national unemployment levels and changes, have been used as a correlate guide to the effect that exit costs may have on these decisions.

One limitation of empirical work at this point is that a more direct and composite measure of exit costs remains unavailable. It is unclear as to what the "best" measure of exit cost would be, as it can be interpreted as such a multifaceted concept as to defy practical measure. Exit costs could be considered a measure of living costs, moving costs, transaction costs, psychological stresses, opportunity costs regarding other potential mates, matching costs, social pressures, etc. We are far from constructing such a measure. Marital satisfaction and utility are also missing variables in the NSFG dataset; and so, such implications of theory with regard to that are not testable. Even if that variable was collected, it would be arguably weakened by the fact that satisfaction is

known to change over the course of the relationship. Limitations to empirical tests that may be addressed by more complete data in the future. With these thoughts in mind, future research may be enhanced by survey modules in longitudinal surveys directly designed to measure several dimensions of exit costs.

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