The Impact of Islamic Finance on Financial Crises and the Volatility of the Business Cycle
PRELIMINARY- ROUGH DRAFT

Leah Jager*
U.S. Naval Academy

Katherine A. Smith†
U.S. Naval Academy

Jacob Stevens-Haas‡
U.S. Navy

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Abstract

Over the last decade, global financial crises have intensified the discussion concerning regulating firm leverage. At the start of the 2008-2009 global crisis, many firms and households in the U.S. were historically overleveraged which potentially propagated a debt-deflation type of crisis. By limiting the amount of debt that firms carry, caps on leverage may help to prevent future macro financial crises. This crisis prevention may come at a cost. According to financial accelerator theory, if firms' debt is limited, the relationship between investment and equity prices may become stronger, as firms must issue equity to raise capital. Given the cyclical nature of asset prices, investment swings deepen recessions and expansions, exacerbating the volatility of the business cycle. The development of an interest-free financial system under Islamic finance offers insight into the effects of a leverage constraint. To comply with Islamic financing principles, concerned firms may be persuaded to hold less debt or use debt-like instruments rather than conventional debt. This paper attempts to measure the impact of Islamic finance on the likelihood of a financial crisis and the volatility of the business cycle. The results show that Islamic, interest-free finance decreases crises by decreasing the total amount of external debt liabilities. Meanwhile, the model shows no significant impact of Islamic finance upon the volatility of the business cycle.

JEL Codes:

Key Words: Financial Crisis, Financial Liberalization, Capital Controls

*Math Department, U.S. Naval Academy Email: jager@usna.edu.

†Economics Department, U.S. Naval Academy Email: ksmith@usna.edu.

‡Ensign, U.S. Navy .

1 Introduction

Optimal capital structure combines both debt and equity. However, many blame overleverage and binding leverage constraints for having caused the 2008 world financial crisis, the sudden stops in emerging markets in the 1990s, and other crises in history. In these cases, international capital markets penalized overleveraged firms and households. Lenders realized that borrowers were overleveraged and downgraded the debt of borrowers. The borrowers could not roll over their debt; margin constraints became binding. In the recent US housing crisis, as mortgage defaults spread, people and banks sold or foreclosed houses to pay off debt as homeowners dipped into negative equity. As a result, asset prices spiraled downwards, and more people were unable to roll over their debt. Debt-deflation can trigger sovereign debt crises as well.

Given the link between overleverage and financial crisis, various countries have considered regulations to limit leverage in the hopes that doing so will protect them from future financial crises. Last year, the Congress of the United States passed a bill limiting leverage on banks that pose a systemic risk to the economy. Previously, banks were limited to holding assets worth 21 times their paid-in capital, retained earnings and reserves (US Code 2004). Starting in 2013, Basel III now encourages baks and other financial institutions to hold much more capital, limiting leverage significantly. Additionally, the US Commodity Futures Trading Commission proposed a 10:1 leverage limit for foreign exchange traders in the US. Clearly, then, legislators and regulators believe that overleverage can trigger crises.

While a restriction on leverage may decrease crises, theoretical models suggest that limiting leverage could exacerbate the volatility of the business cycle. Models of financial accelerators find that financial accelerators propagate economic shocks more strongly in the presence of limits on leverage. By prohibiting, or limiting, debt, firms' investment is much more tied to their net worth and the ability to issue equity. Thus, economic conditions affect investment more strongly and investment varies pro-cyclically, exacerbating recessions.

Motivated by the timeliness and current policy discussion, this paper aims to understand the potential costs and benefits of policies that discourage or prohibit interest-bearing contracts. Such policies would have the effect of limiting the types of liabilities companies could have. In the

countries like the United States, such policies might include eliminating the tax incentive of debt and constraining the leverage of large, critical financial firms and futures traders. In other countries, government and financiers have already been pursuing interest-free finance for religious reasons. By prohibiting or discouraging the charging of interest on debt, such countries may decrease their leverage. Interest-free finance as an idea is best represented by the experience of Islamic finance, and any empirical analysis of prohibitions on interest is best studied with Islamic finance.

Islam includes rules for finance that scholars and financiers have adopted in order to develop an alternate financial system. The most distillable tenet of Islamic finance is the prohibition on interest. The aversion to interest-bearing debt manifests as a soft constraint on the leverage of firms - soft in that firms are often not legally prohibited from carrying debt, but comply in order to access a financing base. The Islamic finance movement has developed alternative financial products and a body of literature all designed around a lack of interest-bearing debt. Indeed, one may examine Islamic finance to draw empirical conclusions about interest-free finance. According to Sharia, the legal interpretation of Muslim religious proscription, charging interest upon loans is riba, or usury. Sharia also prohibits, gharar, outright bets on the economy (such as credit default swaps) and qimar, anything judged to be excessively risky. Since the middle ages, Muslim governors have sporadically attempted to eradicate the charging of interest on loans. Such a practice was not limited to Islam, as both Christianity and Judaism have prohibitions on charging interest. The Islamic religious revival of the latter half of the 20th century has lead to thought on how to develop a financial system that did not charge interest on debt. Many Muslims desired to create a more religiously compliant financial system. These practitioners avoided or prohibited charging or paying interest on debt.

Since the late 1970s, members of countries in which the majority of the population practices Islam have attempted to direct their finance to comply with Sharia. The first modern Islamic financial institutions emerged in 1963: the Mit Ghamr bank in Egypt and the Pilgrimage Savings Corporation in Malaysia. The Malaysian experiment continued, but Mit Ghamr closed after four years. During the 1970s, the Islamic Development Bank was incorporated as a multinational development bank that sponsored research into interest-free economics. Scholars from the International Monetary Fund (IMF) researched theoretical interest-free finance a great deal during the 1980s.

In the 1990s, several international organizations attempted to clarify the regulations that Islam mandates. Most prominent among them, the Accounting and Auditing Organization for Islamic Financial Institutions, or AAOIFI, was formed in 1990 to provide standards for Islamic finance. Their work has aided and impelled other firms to pursue Sharia-compliant financing. The establishment of the AAOIFI at the same time that several Muslim countries were attempting to bring their financial systems in compliance with Islam marks a watershed in the development of Islamic finance.

Many governments have lead national efforts to implement Islamic finance, and the attempts have not occurred simultaneously, identically, or even according to the same interpretation of Sharia. Pakistan, Iran, and Sudan all attempted to transform wholly their financial system to be Islamic by 1983. On the other hand, some countries, such as Tunisia, have pursued no government-led effort to change finance. Other countries, like Malaysia and Bahrain, let Islamic Banks develop within their larger, conventional financial system in the 1980s. The first Islamic bank in Bahrain was established in 1979, and the first in Malaysia in 1983. Later, the central bank established regulatory support for Islamic finance. However, Malaysian Islamic jurisprudence has traditionally been more liberal than that of Saudi Arabia or Sudan. As a result, some Islamic financial products are occasionally declared non-compliant with Sharia by another arbiter. However, since Malaysia is one of the most financially developed Muslim countries, it is the only one in which certain financial services are widely available, such as consumer saving and deposits for the average person. In fact, Malaysia is the only country that fully segregates conventional demand deposits from their Sharia-compliant counterparts.

To address the financing needs of firms that are prohibited from taking a conventional loan, Sharia-compliant financial institutions have developed a variety of substitutes. For example, the legal theory recommends profit-and-loss-sharing (PLS) schemes, where a manager and investor each take a proportional share of profits based upon percentage contribution to the fund, with a slight favor towards the manager. Thus, PLS functions similarly to a mutual fund. As another example, instead of borrowing money from a bank to buy an office building, a firm will arrange for the bank to buy or build the building and then rent it to the firm. There is even the option for the firm

to take ownership of the building once the lease expires. Although a rent-to-buy contract behaves in a similar fashion to a loan in normal times, this loan substitute behaves more like permanent capital in distress situations. Similarly, mudarabah (mutual fund) managers may forego some of the profits on their capital in order to create some buffer capital, which can even out the returns of investors in the mudarabah. These products can be securitized in what are termed sukuk. Currently, consumer analogs are rare, but exist. For everyday consumers in much of the Muslim world, most do not have access to special Sharia-compliant financing or depositary institutions. Thus, they accept conventional finance (though it continues to be replaced by Islamic finance).

Currently, the market for Islamic financial products is small but growing. Even before Islam motivated the development of a modern, robust financial system, it still had an effect on the market. Where there were no Islamic financial institutions, some Muslims simply hoarded money rather than deposit it in an interest-bearing account or put all of their investments in equity (Habibi, 1987). Even still, in regions where specialty finance does not penetrate, many Muslims refuse conventional finance (Karim et al 2008). By comparison, in financial centers, new secondary market issuance in Islamic products grew at roughly 48% per year from 2001 to 2009 (Damak 2010). As evidence, the Dow Jones recently started tracking the Islamic securities market with an indicator in 2005. Most international investment banks such as Deutsche Bank, Banque Nationale de Paris (BNP)-Paribas, and Hong Kong-Shanghai Bank of China (HSBC) have arms that deal in Islamic financial products, and the biggest skyscrapers in Cairo, Dubai, and Bahrain house Islamic banks providing finance without interest to firms and investors in the region and in the United Kingdom. Malaysia has the most robust regulatory infrastructure for Islamic finance in that it authorizes firms to participate in both conventional finance as well as their Islamic Banking System (IBS), with active participation by the central bank, so long as finance from the two sources are completely segregated. Singapore, Indonesia, Bahrain, Dubai, Pakistan, Saudi Arabia, Iran, and many others have some Islamic financial institutions or are fully Sharia-compliant.

In some ways, the difference between Islamic and conventional finance is only in nomenclature. Do religiously compliant financial products merely mimic Western ones with different wording? Some sukuk traders feel that, at least to firms, Islamic finance merely offers a different set of

investors and therefore another avenue to raise money, usually at the same cost of capital as conventional debt. However, differences exist in bankruptcy settlement, whether the intermediary needs to take physical delivery of goods, and other details; these are the details that matter when facing a crisis. Perhaps, then, the debt-like Islamic alternatives to conventional debt reduce some of the costs of a binding leverage constraint. Thus, firms financed as such may get the benefit of leverage without contributing to systemic risk.

This paper uses islamic financing activity as an instrument to understand how non-market pressure to reduce leverage may help to minimize crises. Legistlation used to minimized debt typically is a enacted in response to past events and is therefore clearly affected by past crises riddling any empirical exploration with endogeneity issues. Islamic financing on the other hand evolved from religious beliefs and is therefore is unrelated to crisis. Empirically we test whether the non-market punishing limitation on debt held by firms due to efforts to comply with interest-free decreases the frequency of crises. In addition, countries may wish to enact regulation to limit leverage or encourage firms to take less leverage. Certainly, the absence of crisis is a public good. On the other hand, constraining firm financing may increase the volatility of the business cycle.

2 Related Literature

Very little empirical research on the macroeconomic effects of interest-free finance exists. Research on Islamic finance has generally consisted of heuristic claims that profit-and-loss sharing can cure financial cycles by scaling liabilities with assets or empirical analysis of one segment. Darrat (1998) empirically examined the volatility of non-debt money (demand deposits and cash) versus debt-money (savings accounts, etc) of Tunisia. Cihak and Hesse (2008) showed empirically that Islamic banks could compete with western banks in many cases. Archer and Karim (2006) theoretically analyzed capital structure and cost of capital, finding stylized facts to differentiate a Sharia-compliant firmâĂŹs capital structure from the structure under Modigliani-Miller (1958), which held capital structure to be irrelevant.

The question of whether Islamic finance attenuates credit cycles has attracted increasing attention in the past thirty years. Minsky (1982) argued that lenders and borrowers will necessarily

become over-zealous during good economic times. Firms will finance long-term assets with short-term debt until the marginal return on capital is equal to the interest rate, making their balance sheet extremely susceptible to a critical change in the interest rate. In doing so, the relative maturities of their assets and liabilities would not matter to them. When a critical change in the interest rate inevitably comes, their assets devalue and their leverage increases. Moreover, a higher proportion of firms become critically leveraged. The interest rate they are charged rises as their leverage increases, and the process continues until they can no longer roll over their debt. Then they must sell off most of their assets to repair their capital structure, depressing prices, and entering debt-deflation.

Islamic financial scholars piggybacked onto the theories proposed by Minsky (1982) and argued that by prohibiting interest and encouraging profit-and-loss sharing, liabilities would scale with assets. Thus, there could be no debt-deflation crises because firms would not need to sell assets at discount to meet maturing liabilities. Khan (1986) showed stylistically how flexible-price and fixed-price models could be adapted to reflect an economy where the nominal value of deposits was not guaranteed. This nature of deposits manifests as a prohibition on loaning for interest, because deposits become equity shares in the financial sectorâĂŹs investments. He found that equilibrium rates of return, money supply, and output would still exist in such a framework. Moreover, he posited that the profit-and-loss-sharing mechanism in Islamic finance would minimize the credit cycle. Chishti (1985) complemented the work of Khan with a different stylistic model. He developed an heuristic explanation into a stylistic model based upon two differential equations, relating external cash commitments to investment. He claimed that cash commitments lag investments and that this lag creates a cycle. Ultimately, he asserts that Islamic finance would prevent firms from reaching the point where they have taken on many cash commitments but investment has dried up, because cash commitments scale with asset returns. Thus, they would never enter debt-deflation and their ability to solicit new investments would not depend on firm value, as in the financial accelerator. Chishti does not calibrate his model or compare it to empirical data.

More recently, Chapra (2008) asked whether Islamic Finance could prevent financial crises similar to the 2008 crisis. He answered yes and qualitatively explained that profit-and-loss sharing,

as well as the prohibition on gharar and qimar (uncertainty and betting) would protect the economy from the failures of collateralized debt obligations, credit default swaps, and more. However, neither provided empirical evidence to support their conclusions. This paper combines the ideas of Islamic finance, different capital structure, debt-deflation crises, and financial accelerator. It also adds to the qualitative explanation of Islamic finance with empirical research. On the one hand, overleveraged firms and countries hitting financial constraints can trigger crises. This paper should detect that. On the other hand, proponents of Islamic finance propose stylistic models showing that the restrictions on capital structure due to Islamic finance would prevent financial crises and decrease the severity of recessions. This paper tests the costs and benefits of encouraging less leverage.

3 A Simple Model of Debt Deflation and Financial Crisis

In trying to estimate empirically the impacts of Islamic finance on an economy, we first turn to the effect on a country's likelihood of a crisis. The main mechanism by which a prohibition on charging interest may affect financial crises is via debt deflation. Going back to the early theories of crisis, Fisher (1933) argued that crises arose because, for exogenous reasons, firms need to sell assets to pay off liabilities. If enough firms sell assets at once, the rapid sale of assets drives their price down, hurting the balance sheets of all borrowers and increasing leverage throughout the market. As borrowers divert money to pay off debt, they spend less on goods and curtail output, hurting the economy as a whole. Moreover, as more debt becomes due, firms must sell off more debased assets to pay off debts or take on new debt to pay off old debt. Eventually, the price of assets drops enough that firms go into negative equity, default on their loans, and go bankrupt. In other words, over-indebtedness is not easy to escape, since taking action to get out of debt and into a healthy financial state may result in a worse debt situation.

This debt=deflation story is formalized in the following model which is derived from Mendoza and Smith (2014). Domestic agents are modeled as a risk-averse, representative-agent small open economy subject to non-diversifiable productivity shocks. With full financial integration, this economy trades bonds and equity with the rest of the world. The economy's ability to borrow is limited by a collateral constraint, and to make this constraint nontrivial, there is also a short-selling con-

straint that imposes a lower bound on domestic equity holdings. Foreign agents are made of two entities: a set of foreign securities firms specialized in trading equity of the small open economy, and the usual global credit market of non-state-contingent, one-period bonds that sets the world's real interest rate via the standard small-open-economy assumption. Foreign traders face recurrent and per-trade costs in trading equity with the small open economy.

3.1 Domestic Firms

The tradables output is in the form of an endowment y^T. The price of tradable goods is the numeraire, and it is assumed to be set in world markets and equal to 1 for simplicity.

The nontradables sector consists of a large number of identical firms that use labor (L_t) and imported intermediate goods (m_t) as variable factors of production, along with a fixed amount of capital (K). Firms produce this good using a Cobb-Douglas technology $exp(\varepsilon_t)L_t^{\psi}m_t^{\zeta}K^{1-\psi-\zeta}$ where $exp(\varepsilon_t)$ is a Markov productivity shock. Nontradables output is priced at p_t^n, which is the relative price of nontradables to tradables and determines the real exchange rate. Firms choose labor L_t and imported intermediate goods m_t in order to maximize profits taking wages, w_t, intermediate goods prices, p_t^{m*}, and the price of nontradables as given. Profits are defined as follows:

$$p_t^n \exp(\varepsilon_t)L_t^{\psi}m_t^{\zeta}K^{1-\psi-\zeta} - w_tL_t - p_t^{m*}m_t \tag{3.1}$$

The assumption that the stock of capital is an exogenous constant is adopted for simplicity.

Factor demands for $t = 0, ..., \infty$ are given by standard marginal productivity conditions:

$$\psi p_t^n \exp(\varepsilon_t)L_t^{\psi-1}m_t^{\zeta}K^{1-\psi-\zeta} = w_t \tag{3.2}$$

$$\zeta p_t^n \exp(\varepsilon_t)L_t^{\psi}m_t^{\zeta-1}K^{1-\psi-\zeta} = p_t^{m*} \tag{3.3}$$

Dividend payments for $t = 0, ..., \infty$ are thus given by:

$$d_t = (1-\psi-\zeta)p_t^n \exp(\varepsilon_t)L_t^{\psi}m_t^{\zeta}K^{-\psi-\zeta} \tag{3.4}$$

Productivity shocks follow a two-point, symmetric Markov chain. The shocks take a high or low value $\varepsilon_H, \varepsilon_L$. Symmetry implies that $\varepsilon_L = -\varepsilon_H$. The long run probabilities of each state satisfy $\Pi(\varepsilon_L) = \Pi(\varepsilon_H) = 1/2$. Transition probabilities follow the simple persistence rule (**?**): $\pi_{\varepsilon_i \varepsilon_j} = (1 - \vartheta)\Pi(\varepsilon_j) + \vartheta I_{\varepsilon_i \varepsilon_j}$ $I_{\varepsilon_i \varepsilon_j} = 1$ if $i = j$ and 0 otherwise, for $i, j = L, H$. This specification minimizes the size of the exogenous state space E without restricting the variance and first-order autocorrelation of the shocks. Under these assumptions, the shocks have zero mean, their variance is $(\varepsilon_H)^2$, and their autocorrelation coefficient is given by ϑ.

3.1.1 Households

A large number of identical, infinitely-lived households inhabit the small open economy. Their preferences are represented by the Stationary Cardinal Utility (SCU) function proposed by Epstein (1983), which features an endogenous rate of time preference:

$$U = E\left[\sum_{t=0}^{\infty} exp(-\sum_{\tau=0}^{t-1} \nu(c_\tau))u(c_t)\right] \tag{3.5}$$

where c_t represents a CES composite good of tradable and nontradable goods:

$$c(c_t^T, c_t^N) = [z(c_t^T)^{-\mu} + (1-z)(c_t^N)^{-\mu}]^{-1/\mu}, \quad z > 0, \quad \mu \geq -1 \tag{3.6}$$

The elasticity of substitution between tradables and nontradables is given by $1/(1+\mu)$, and the CES weighting factor is given by z. The period utility function u is a standard continuously differentiable, concave utility function. The time preference function ν must satisfy $\nu(*) > 0$, $\nu'(*) > 0$, $\nu''(*) < 0$, and $u'(*)exp(\nu(*))$ non-increasing.

Preferences with endogenous impatience are useful in stochastic small open economy models with incomplete insurance markets because foreign asset holdings diverge to infinity with the standard assumption of an exogenous rate of time preference equal to the world's interest rate. Preferences with a constant rate of impatience support a well-defined stochastic steady state only if the rate of interest is set lower than the rate of time preference arbitrarily, but in this case the mean foreign asset position is largely determined by the ad-hoc difference between the two rates

(see Arellano and Mendoza (2003)) for details). In models with credit constraints, endogenous impatience is also useful for supporting stationary equilibria in which these constraints bind.

Households maximize SCU subject to the following period budget constraint:

$$c_t^T + p_t^N c_t^N = y_t^T + \alpha_t K d_t + w_t L_t + q_t(\alpha_t - \alpha_{t+1})K - b_{t+1} + b_t R \tag{3.7}$$

where α_t and α_{t+1} are beginning- and end-of-period shares of the domestic capital stock owned by domestic households, b_t and b_{t+1} are holdings of one-period international bonds denominated in units of tradables, q_t is the price of equity, and R is the gross real interest rate faced by the small open economy in world credit markets. The supply of labor is assumed to be inelastic and set to 1 for simplicity. Hence, labor in the model is used only so that endogenous variability in labor demand in response to shocks and relative price movements induces non-insurable variability in wages, and thus in household income.

At equilibrium, the relative price of nontradables affects the households budget constraint directly and indirectly. Directly, because p_t^N affects the value of the expenditure on non-tradables consumption in the standard way. Indirectly, because the price of nontradables affects producers plans, and thus dividends and wages.

In addition to the budget constraint, households face a collateral constraint or margin requirement, according to which they cannot borrow more than a fraction κ of the value of assets offered as collateral:

$$b_{t+1} \geq -\kappa q_t \alpha_{t+1} K \tag{3.8}$$

Households also face a short-selling constraint $\alpha_t \geq \chi$ for $-\infty < \chi < 1$ and $t = 1, ..., \infty$. The case in which χ is positive can be interpreted as a portfolio requirement, or as a constraint stating that only a fraction of the capital stock of the emerging economy is tradable in international equity markets. The constraint $\alpha_t \geq \chi$ is needed to ensure that the state space of portfolio holdings is compact and that the collateral constraint is not irrelevant. With unlimited short selling of equity, domestic agents could always undo the effect of the credit constraint (see Mendoza and Smith

2006)) for further details).

The first-order conditions of the household's problem are

$$U_{c_t^T}(\cdot) = \lambda_t \tag{3.9}$$

$$U_{c_t^N}(\cdot) = p_t^N \lambda_t \tag{3.10}$$

$$q_t(\lambda_t - \eta_t \kappa) = E_t[\lambda_{t+1}(d_{t+1} + q_{t+1})] + \upsilon_t \tag{3.11}$$

$$\lambda_t - \eta_t = E_t[\lambda_{t+1} R] \tag{3.12}$$

$U_{c_t^T}(\cdot)$ and $U_{c_t^N}(\cdot)$ denote the lifetime marginal utilities of date-t consumption of tradables and nontradables respectively (including the effects of consumption changes on the infinite stream of subjective discount rates), and λ_t , η_t , and υ_t are the nonnegative Lagrange multipliers on the budget constraint, the margin constraint, and the short-selling constraint respectively.

Given the optimality conditions for α_{t+1} and b_{t+1}, we can derive the following two key asset pricing conditions:

$$E_t[R_{t+1}^q - R] = \frac{\eta_t(1-\kappa) - \upsilon_t/q_t - cov_t(\lambda_{t+1}, R_{t+1}^q)}{E_t[\lambda_{t+1}]} \tag{3.13}$$

$$q_t = E_t \left(\sum_{i=0}^{\infty} \left[\prod_{j=0}^{i} \left(E_t \left[R_{t+1+j}^q \right] \right)^{-1} \right] d_{t+1+i} \right) \tag{3.14}$$

where the sequence $\left[R_{t+1+j}^q \right]$ is given by equation 3.13. Equation 3.13 is the model's equity premium, and equation 3.14 represents the forward solution for equity valuation from the perspective of the small open economy. Notice that this condition can also be expressed in the more familiar form using stochastic discount factors, adjusted for the shadow values of financial frictions, to represent the pricing kernel (see Mendoza and Smith (2006)).

3.1.2 Foreign Securities Firms

Foreign securities firms are modeled in the same way as in Mendoza and Smith (2006). They maximize the present discounted value of dividends paid to their global shareholders, facing trading costs that are quadratic in the volume of trades (see Aiyagari and Gertler (1999)) and in a fixed recurrent cost. These costs represent the disadvantaged position from which foreign traders operate relative to domestic agents, which may result from informational frictions, or from institutional features or government policies that favor domestic residents. The recurrent cost represents fixed costs for participating in an emerging equity market that foreign traders incur just to be ready to trade, even if they do not actually trade in a given period.

Foreign traders choose α_{t+1} for $t = 0, ..., \infty$ so as to maximize the value of foreign securities firms per unit of capital:

$$D/K = E_0 \left[\sum_{t=0}^{\infty} M_t^* \left(\alpha_t^*(d_t + q_t) - q_t \alpha_{t+1}^* - q_t \left(\frac{\phi}{2} \right) (\alpha_{t+1}^* - \alpha_t^* + \theta)^2 \right) \right] \tag{3.15}$$

where $M_0 = 1$ and M_t^* for $t = 1, ..., \infty$ are the exogenous marginal rates of substitution between date-t consumption and date-0 consumption for the world's representative consumer. For simplicity, we set $M_t^* = R_t^{-1}$. Trading costs are given by $q_t(\phi/2)(\alpha_{t+1}^* - \alpha_t^* + \theta)^2$. The recurrent cost is θ and ϕ is an adjustment cost coefficient that determines the price elasticity of the foreign trader's demand for equity, as shown below. Note that θ induces an asymmetry in the manner in which trading costs operate. With $\theta = 0$, the total cost of increasing or reducing equity holdings by a given amount is the same, but with $\theta > 0$ the total cost of reducing equity holdings is higher.

An important implication of the incompleteness of asset markets is that, despite financial globalization, the stochastic sequences of M_{t+1+i}^* and M_{t+1+i} for $i = 0, .., \infty$, are not equalized. With complete markets, or under perfect foresight, both sequences are equal to the reciprocal of R (compounded i periods). Under uncertainty and incomplete markets, however, domestic stochastic discount factors are endogenous and reflect the effects of financial frictions.

The first-order condition of the above problem yields the following "partial adjustment" asset

demand function:

$$\alpha^*_{t+1} - \alpha^*_t = \frac{1}{\phi}\left(\frac{q^f_t}{q_t} - 1\right) - \theta \tag{3.16}$$

where we define the "fundamentals price" $q^f_t \equiv E_t\left(\sum_{i=0}^{\infty} M^*_{t+1+i} d_{t+1+i}\right)$. The key implication of this demand function is that foreigners only buy more domestic equity when the market price falls sufficiently below the fundamentals price (i.e. $\alpha^*_{t+1} - \alpha^*_t > 0$ requires $(\frac{q^f_t}{q_t}) > (1 + \theta\phi)$).

The behavior of the "fundamentals" price differs from that in the Mendoza and Smith (2006) setup because, as explained earlier, in this model the stream of dividends is affected by the endogenous equilibrium dynamics of the nontradables price and output. Because of this, in fact it is not very appropriate to call it a "fundamentals" price in this model. Intuitively, if dividends fall when the credit constraint binds because of the adverse effects on nontradables price and output, the "fundamentals price" also falls, but this means that at equilibrium, the actual equity price has to fall even more to support a given change in equity holdings than it would if the fundamentals price were invariant to the financial frictions.

3.1.3 Asset Pricing Dynamics of Financial Globalization

The asset pricing conditions of the small open economy and the foreign traders' asset demand function are helpful for providing some intuition about the transitional dynamics of asset prices triggered by financial integration.

First, it is straightforward to infer from eq. 3.13 that, on impact, financial openness induces two effects on the agents of the small open economy that push down on expected equity returns. First, the risk-free rate drops as agents can now borrow from the infinitely-elastic global supply of credit. Second, the risk premium drops, because the improved ability to smooth consumption by borrowing from abroad makes the covariance between marginal utility and equity returns "less negative." In turn, lower expected returns imply lower discount rates on the stream of expected future dividends and thus higher equity prices.

There are also indirect effects on the asset valuations of domestic agents operating via the expected sequence of the price of nontradables, p^N_{t+1+i}, which are less straightforward. On impact, the increased consumption of tradables that financial integration allows agents to access pushes

up the price of nontradables. Producers of nontradables respond to the allocational incentives of higher prices by demanding more inputs and producing more nontradables, but at equilibrium tradables consumption rises more than nontradables consumption (since effectively tradable goods have a higher supply elasticity). The rise in nontradables prices thus increases dividends on impact, because of both the higher nontradables prices and production, and this also pushes for higher equity prices.

In addition to the above effects, there are also important effects due to the risk of financial crises. These are present since the first period in the transitional dynamics of financial integration, but they are negligible because the economy's leverage at that point is far from what is needed to trigger a financial crisis. As the transition progresses and leverage rises, the risk increases and becomes a more relevant determinant of asset prices. In a financial crisis, the binding collateral constraint induces a jump in expected equity returns because of three effects visible in eq. 3.13: the direct effect of the positive shadow value of collateral, the indirect effect because the credit constraint hampers consumption smoothing and thus makes the covariance term in the equity premium "more negative," and a second indirect effect because the credit constraint forces consumption to be postponed, thereby lowering the expected marginal utility of future consumption in the denominator of the equity premium expression.

A financial crisis also contributes to lower asset prices via a deflation in the price of nontradables and its effect on nontradables producers. During a crisis, tradables consumption falls more rapidly, again because tradable goods are more elastic, and thus the nontradables price falls. Since dividends can be expressed as $d_t = (1-\psi-\zeta)p_t^n \frac{\exp(\varepsilon_t) L_t^{\psi} m_t^{\zeta} K^{1-\psi-\zeta}}{K}$, it follows that the response of nontradables producers lowers dividends because of both lower relative prices and lower output. Lower dividends then contribute to lower equity prices.

As the transitional dynamics triggered by financial integration evolves, the increased debt and leverage of domestic agents endogenously increases the future probability of triggering the collateral constraint and experiencing a crisis. This in turn strengthens the risk effects described above, and thus eventually induces agents to re-balance their portfolio and reduce their equity holdings, even in states in which the constraint is not actually binding. Now the foreign trader's adjustment costs

to selling equity becomes relevant, because they are willing to increase their equity holdings only if the price falls. This enables the model to generate the boom-bust equity cycle observed in empirical studies of financial liberalization Martell and Stulz (2003), even in the absence of actual financial crises. If there is a crisis, the costs faced by foreign traders are also very important, because they determine how low prices need to go when domestic agents enter the market to fire-sale domestic assets.

4 Empirical Methodology and Data

The preceding model emphasize that many crisis episodes may be preceded by significant build-ups in domestic credit as well as large real appreciation of the currency. Interest-free finance may limit financial crises by limiting debt. This research estimates the effects that Islamic finance has upon the likelihood of a crisis. Legislation that imposes limits on debt may be a response to past crises and mired in endogeneity issues. Thus we use the presence of Islamic Finance as an instrument to better understand the influence non-market-punishing debt limits might have on crisis.

To empirically estimate the influence that Islamic Financing restrictions may have on mitigating financial crises, we amend a fairly standard model of financial crisis developed by Gourinchas and Obstfeld (2014). We use a cross country panel logit model to capture these effects. As in Gourinchas and Obstfeld (2012) we include various types of financial crises that that tend to be closely interrelated in practice: currency crises (managed exchange rate hit by speculative pressure), banking crises (including shadow banking crises), and government default crises. Data from the 1970s through 2010 (covering the impact as well as the frequency of events) is used to date these crises. The dating of systemic banking crises and sovereign default crises follows from Reinhart and Rogoff (2009); Caprio et al. (2003); Laeven and Valencia (2010); Cantor and Packer (1995); Chambers (2011); MoodyâĂŹs (2009); and Sturzenegger and Zettelmeyer (2007). To date the currency crises, we use the criterion of Frankel and Rose (1996).

We estimate a panel discrete choice model with country fixed effects. As in BussiÃÍre and Fratzscher (2006), we assume the occurrence of a crisis in a given window. That is, for each type of crisis j and period t, we define a forward-looking indicator variable y_j^k. We vary k between one and

three years. Our benchmark specification assumes a panel logit model with country fixed effects in which the crisis probability depends on a vector x of macroeconomic variables as captured in the equation below.

$$P(y_j^k = 1|x) = \frac{e^{x'\gamma_j^k}}{1 + e^{x'\gamma_j^k}} \tag{4.1}$$

As in Demirguc-Kunt and Detragiache (2000), the crisis observations are dropped as well as the post-crisis observations for four years afterward. The crisis probability depends on a matrix , x of macroeconomic variables; the ratio of public debt to output, the ratio of domestic credit to output, the ratio of the current account balance to output, the real exchange rate, and the output gap (expressed as percentage deviations from trends as discussed in the previous section), official reserves, and short-term external debt (relative to output). In addition to these macroeconomic variables we add and interact with debt an Islamic Financing variable. In particular we look at the percent of the population of a country that is Muslim after 1990 when the Accounting and Auditing Organization for Islamic Financial Institutions, or AAOIFI, was formed. The results are consistent and robust to a muslim population above 10%.

The macrovariables come from standard cross country datasets. Annual data on nominal GDP and GDP deflator come from the World BankâĂŹs World Development Indicators(WDI), the IMFâĂŹs International Financial Statistics (IFS) and WEO databases, and the Organization for Economic Cooperation and DevelopmentâĂŹs (OECD) National Accounts database. The output gap is constructed with an Hodrick-Prescott filter. When central government debt is not available, we use Gross general government debt, also from Reinhart and Rogoff (2009). The 3-month annualized domestic treasury bill rate from IFS and the Global Financial Database (GFD). Currency comes from the IFS. Based on availability, our benchmark data consist of total domestic claims of depository corporations (central banks and other depository corporations). Gross external assets, gross external liabilities, gross equity and direct investment liabilities in US dollar from Lane and Milesi-Ferretti (2007). All data are divided by nominal GDP in US dollars from WDI. Exchange rate denotes the bilateral US dollar real exchange rate constructed as the nominal end-of-period exchange rate against the US dollar (from IFS and GFD, expressed in domestic currency units per

US dollar) times the US GDP deflator and divided by the domestic GDP deflator.

5 Results

The preliminary results are broken into two parts. First on Tables 1-3 we show the estimation of our model using a muslim financing presence conditional on a muslim population within the country of greater than 5%. Each type of financial crisis, default, banking, and currency are reported separately. Islamic Financing enters independently as a binary variable and is interacted with the two different measures of leverage, credit/GDP and short term debt/GDP. Therefore we can compare the impacts of each of our explanatory variables with and without the pressure to hold less leverage. Given our fixed effect logit estimation, we report the marginal effects, $\partial p/\partial x$, of each dependent variable calculated at the means of the others (second column of Table 1). The third column reports the change in probability resulting from a one standard deviation (listed in first column) increase in variable x, evaluated at the pre-crisis sample mean. Columns four and five replicate columns two and three but for those countries where there is an Islamic financing presence.

Given our interest in Islamic financing as an instrument for regulation on leverage, we will focus the discussion on our two leverage measures. From column two on Table 1, for countries with little to no Islamic financing presence, as credit/GDp increases by 1% the likelihood of a crisis with 1-3 years increases by 1.13%. According to column three a one standard deviation change in credit/GDP from its non-crisis mean, causes the likelihood of a default crisis to increase by 11.45%. Given an Islamic Financing presence (even fairly small at 5%) within a country, both these probabilities fall 0.92% and 10.1% respectively. We see similar declines in crises with the marginal effects of short term debt/GDP. Table 1 also reports the the predicted probability of crisis, evaluated at the pre-crisis sample mean of the explanatory variables for both types of countries. This probability for countries with an Islamic Financing presence falls from 12.2% to 10.26%.

The bottom of Table 1, reports the influences on banking crisis. These are consistent with the results for default crisis but show an even stronger influence of Islamic financing practices on the likelihood of crises. The likelihood of a banking crisis is essentially cut in half by pressure to limit leverage, falling from 9.5% to 4.46% for countries with Islamic financing. Currency crises, reported

on Table 2, do not seem to be influence by leverage and little difference is seen between those countries that have and do not have an Islamic financing presence.

On tables 3 and 4, we repeat similar analysis but change our Islamic Financing indicator to those countries that have over 80% of there population Islamic. In this case credit/GDP and short term debt have no significant influence on the likelihood of a crisis. In fact given a country has an islamic financing presence the likelihood of a default crisis falls by 8.68%, captured in the marginal effect of Islamic financing. Likewise on the bottom of Table 3, Islamic financing presence lowers the likelihood of a banking crisis by 5.1%. Table 4 suggests that even with stronger Islamic presence there is essentially no effect on currency crises.

6 Conclusion

This work suggests that Islamic finance reduces the likelihood of financial crises by minimizing the debt-deflation channel. In examining the effect that Islamic finance has on the functioning of the financial accelerator theory, analysis shows that since the establishment of the secondary market in the early 2000s reduced the likelihood of both default and banking crises but had minimal impact on currency crises. The results suggest that implementing interest-free finance and financial contracts decreases the occurrence of debt-deflation crises. The implications for non-Muslim countries are that, by limiting leverage through regulation, countries may limit their crises. Moreover, regulations that cap firm leverage, particularly of non-bank financial institutions, may be effective at limiting crises. Ideally, future research may consider the cost of a crisis, not just the probability of one.

Table 1: Panel Logit Estimation: Emerging Market Economies. Sample 1973-2010
Occurrence of a Crisis within One-Three Years
Muslim Population $> 5\%$

		No Islamic Financing Presence		Islamic Financing Presence	
	SD(x)	$\partial p/\partial x$	$\triangle p$	$\partial p/\partial x$	$\triangle p$
Panel A. Default					
Public Debt/GDP	18.35889	-0.17167	-2.81803**	-0.14757	-2.4101
		(0.10456)	(1.53638)	(0.1086)	(1.64011)
Credit/GDP	7.619285	1.12703**	11.44984**	0.91659**	10.05072**
		(0.25383)	(2.99153)	(0.33632)	(4.21409)
Current Account/GDP	4.113477	0.2091	0.88655	0.17974	0.76331
		(0.5548)	(2.42381)	(0.48988)	(2.14428)
Reserves/GDP	5.041335	-1.31582**	-5.24047*	-1.13109**	-4.4624*
		(0.52386)	(1.61059)	(0.65573)	(2.28931)
Real Exchange Rate	20.49627	-0.26236**	-4.44168**	-0.22552**	-3.78763**
		(0.09497)	(1.40186)	(0.10503)	(1.66482)
Short Term Debt/GDP	5.237366	0.99899**	6.26461**	0.89411	5.44689**
		(0.29962)	(2.1025)	(0.92006)	(2.52181)
Output Gap	6.331653	2.36849	-0.0674	0.29779	2.04474
		(0.28871)	(2.12239)	(0.27374)	(0.200235)
Islamic Financing Presence				-1.93962	
				(5.27937)	
$p(percent)$		12.2010**		10.2613**	
$N: 17; N \times T: 364$					
Panel B. Banking Crisis					
Public Debt/GDP	22.36731	0.1791**	4.82814**	0.08853**	2.4563
		(0.07882)	(2.39985)	(0.0386)	(1.11955)
Credit/GDP	10.75805	0.48942**	6.87316*	0.33817**	3.5405
		(0.216581)	(3.60207)	(0.18223)	(2.38725)
Current Account/GDP	5.010465	0.25205	1.34	0.12459	0.66763
		(0.3402)	(1.91315)	(0.16061)	(0.91681)
Reserves/GDP	7.044688	-0.84401**	-4.50866**	-0.4172	-2.17111
		(0.35001)	(1.35193)	(0.34021)	(1.55253)
Real Exchange Rate	20.31478	-0.38441**	-5.44401**	-0.19002**	-2.60755**
		(0.10566)	(1.26127)	(0.08737)	(1.23504)
Short Term Debt/GDP	5.241479	0.19927	1.09697	0.14569	0.54576
		(0.23682)	(1.36729)	(0.29384)	(0.79635)
Output Gap	5.709788	1.55748**	13.28442**	0.76987**	7.12283**
		(0.50179)	(5.21938)	(0.3545)	(3.35214)
Islamic Financing Presence				-5.0646	
				(3.37676)	
$p(percent)$		9.52177**		4.45717*	
$N: 17; N \times T: 579$					

Notes: The table reports estimates of a panel logit with country fixed effects. All variables are in percent.
Real exchange rate-deviation from HP-trend. Credit/GDP: deviation from linear trend.
Output gap: deviation from HP-trend.
p: estimated probability of crisis, evaluated at the pre-crisis sample mean
SD(x): standard deviation of variable over tranquil periods. effect
$\partial p/\partial x$: marginal (in percentage) for variable x, evaluated at tranquil sample mean.
$\triangle p = p(x + SD(x))p(x)$ evaluated at tranquil sample mean.
Robust (White) standard errors evaluated by delta-method when necessary.
N: number of crisis events; $N \times T$: number of observations.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 2: Panel Logit Estimation: Emerging Market Economies. Sample 1973-2010
Occurrence of a Crisis within One-Three Years
Muslim Population $> 5\%$

		No Islamic Financing Presence		Islamic Financing Presence	
	SD(x)	$\partial p/\partial x$	$\triangle p$	$\partial p/\partial x$	$\triangle p$
Panel C. Currency crisis					
Public Debt/GDP	15.35437	0.01033	0.22718	0.01014	0.22302
		(0.00942)	(0.20996)	(0.2603)	(1.64011)
Credit/GDP	9.680686	0.02048	0.31259	0.15348	0.30688
		(0.01924)	(0.31123)	(0.19518)	(0.41028)
Current Account/GDP	4.237029	-0.00562	-0.02264	-0.00552	-0.02222
		(0.01213)	(0.04679)	(0.01464)	(0.05707)
Reserves/GDP	7.237998	-0.09066	-0.21839	-0.089	-0.21437
		(0.07642)	(0.20819)	(0.12139)	(0.30947)
Real Exchange Rate	15.85557	-0.02035	-0.17438	-0.01998	-0.17117
		(0.019417)	(0.16791)	(0.02912)	(0.24949)
Short Term Debt/GDP	4.037101	-0.01764	-0.06134	0.27865	-0.06021
		(0.01835)	(0.06161)	(0.38244)	(0.08629)
Output Gap	5.038428	0.03852	0.30294	0.03781	0.2974
		(0.03535)	(0.28102)	(0.05097)	(0.39169)
Islamic Financing Presence				-1.93962	
				(5.27937)	
$p(percent)$		0.23205		0.22778	
$N: 17; N \times T: 364$					

Notes: The table reports estimates of a panel logit with country fixed effects. All variables are in percent.
Real exchange rate-deviation from HP-trend. Credit/GDP: deviation from linear trend.
Output gap: deviation from HP-trend.
p: estimated probability of crisis, evaluated at the pre-crisis sample mean .
SD(x): standard deviation of variable over tranquil periods. effect
$\partial p/\partial x$: marginal (in percentage) for variable x, evaluated at tranquil sample mean.
$\triangle p = p(x + SD(x))p(x)$ evaluated at tranquil sample mean.
Robust (White) standard errors evaluated by delta-method when necessary.
N: number of crisis events; $N \times T$: number of observations.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 3: Panel Logit Estimation: Emerging Market Economies. Sample 1973-2010
Occurrence of a Crisis within One-Three Years
Muslim Population $> 80\%$

		No Islamic Financing Presence		Islamic Financing Presence	
	SD(x)	$\partial p/\partial x$	$\triangle p$	$\partial p/\partial x$	$\triangle p$
Panel A. Default					
Public Debt/GDP	18.35889	-0.17738	-2.91899*	-0.06272	-1.00911
		(0.10905)	(1.62027)	(0.05223)	(0.80221)
Credit/GDP	7.619285	1.1063**	11.00293***	0.60992*	4.25435
		(0.24679)	(2.8452)	(0.33801)	(3.04873)
Current Account/GDP	4.113477	0.20602	0.91524	0.07638	0.32591
		(0.56971)	(2.48515)	(0.2164)	(0.9541)
Reserves/GDP	5.041335	-1.30232**	-5.2626***	-0.46044	-1.78744
		(0.54006)	(1.66403)	(0.42394)	(1.52146)
Real Exchange Rate	20.49627	-0.26952**	-4.58622***	-0.09529	-1.56562
		(0.09501)	(1.41094)	(0.06975)	(1.12464)
Short Term Debt/GDP	5.237366	0.98428***	6.09444***	1.20866	2.26198
		(0.32658)	(2.2634)	(0.8539)	(1.63285)
Output Gap	6.331653	0.35905	2.45061	0.12694	0.88327
		(0.30797)	(2.2586)	(0.15201)	(1.11593)
Islamic Financing Presence				-8.68215*	
				(4.44807)	
$p(percent)$		12.7969***		4.11475	
$N: 17; N \times T: 364$					
Panel B. Banking Crisis					
Public Debt/GDP	22.36731	0.14501**	3.92724**	0.04165	1.16414
		(0.05571)	(1.7064)	(0.04161)	(1.16634)
Credit/GDP	10.75805	0.41394***	5.78648**	0.52514	1.7417
		(0.14448)	(2.41484)	(0.45819)	(1.88881)
Current Account/GDP	5.010465	0.22301	1.19355	0.12459	0.34608
		(0.25601)	(1.46232)	(0.10128)	(0.57085)
Reserves/GDP	7.044688	-0.66347**	-3.56627**	-0.19056	-0.9962
		(0.29473)	(1.20944)	(0.23449)	(1.15707)
Real Exchange Rate	20.31478	-4.48988***	-5.44401**	-1.24536	-2.60755**
		(0.09095)	(1.10049)	(0.09019)	(1.23985)
Short Term Debt/GDP	5.241479	0.09076	0.48923	1.86316	0.14106
		(0.18999)	(1.05269)	(2.03433)	(0.35643)
Output Gap	5.709788	1.26237***	10.95089**	0.36258	3.44354
		(0.38031)	(4.09787)	(0.36606)	(3.46152)
Islamic Financing Presence				-5.0668*	
				(2.89481)	
$p(percent)$		7.77078***		2.10269	
$N: 17; N \times T: 579$					

Notes: The table reports estimates of a panel logit with country fixed effects. All variables are in percent.
Real exchange rate-deviation from HP-trend. Credit/GDP: deviation from linear trend.
Output gap: deviation from HP-trend.
p: estimated probability of crisis, evaluated at the pre-crisis sample mean .
SD(x): standard deviation of variable over tranquil periods. effect
$\partial p/\partial x$: marginal (in percentage) for variable x, evaluated at tranquil sample mean.
$\triangle p = p(x + SD(x))p(x)$ evaluated at tranquil sample mean.
Robust (White) standard errors evaluated by delta-method when necessary.
N: number of crisis events; $N \times T$: number of observations.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table 4: Panel Logit Estimation: Emerging Market Economies. Sample 1973-2010
Occurrence of a Crisis within One-Three Years
Muslim Population $> 80\%$

		No Islamic Financing Presence		Islamic Financing Presence	
	SD(x)	$\partial p/\partial x$	$\triangle p$	$\partial p/\partial x$	$\triangle p$
Panel C. Currency crisis					
Public Debt/GDP	15.35437	0.07406	1.34462	0.27661	4.80821
		(0.05018)	(1.00915)	(0.23655)	(4.21514)
Credit/GDP	9.680686	0.3937**	6.78103**	3.67716	20.68622*
		(0.15734)	(2.63307)	(2.65857)	(12.36514)
Current Account/GDP	4.237029	-0.02668	-0.11121	-0.09964	-0.41688
		(0.15572)	(0.63882)	(0.57239)	(2.36508)
Reserves/GDP	7.237998	-2.9821**	-0.21839	-3.79027	-12.35712
		(0.30083)	(1.4064)	(2.93514)	(9.88178)
Real Exchange Rate	15.85557	-0.2768*	-2.45885*	-1.03452	-9.99692
		(0.14587)	(1.29708)	(0.69571)	(7.51439)
Short Term Debt/GDP	4.037101	-0.14835	-0.05464	5.14727	-2.09091
		(0.17696)	(0.061006)	(5.21319)	(2.41412)
Output Gap	5.038428	0.45479*	3.22751*	1.69864	10.89165
		(0.25147)	(1.93005)	(1.22729)	(7.33963)
Islamic Financing Presence				10.66181	
				(11.68234)	
$p(percent)$		3.33393*		13.99574	
$N: 17; N \times T: 364$					

Notes: The table reports estimates of a panel logit with country fixed effects. All variables are in percent.
Real exchange rate-deviation from HP-trend. Credit/GDP: deviation from linear trend.
Output gap: deviation from HP-trend.
p: estimated probability of crisis, evaluated at the pre-crisis sample mean .
SD(x): standard deviation of variable over tranquil periods. effect
$\partial p/\partial x$: marginal (in percentage) for variable x, evaluated at tranquil sample mean.
$\triangle p = p(x + SD(x))p(x)$ evaluated at tranquil sample mean.
Robust (White) standard errors evaluated by delta-method when necessary.
N: number of crisis events; $N \times T$: number of observations.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

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