

IMF Working Paper

Islamic Banking: How Has it Diffused?

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Abstract

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This paper investigates the determinants of the pattern of Islamic bank diffusion around the world using country-level data for 1992–2006. The analysis illustrates that income per capita, share of Muslims in the population and status as an oil producer are linked to the development of Islamic banking, as are economic integration with Middle Eastern countries and proximity to Islamic financial centers. Interest rates have a negative impact on Islamic banking, reflecting the implicit benchmark for Islamic banks. The quality of institutions does not matter, probably because the often higher hurdle set by Shariah law trumps the quality of local institutions in most countries. The 9/11 attacks were not important to the diffusion of Islamic banking; but they coincided with rising oil prices, which are a significant factor in the diffusion of Islamic banking. Islamic banks also appear to be complements to, rather than substitutes for, conventional banks.

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I. INTRODUCTION

There is convincing evidence of a close correlation between financial sector development and growth. Countries with larger financial systems tend, all else being equal, to grow faster (King and Levine, 1993) because banks perform a fundamental economic role as financial intermediaries and as facilitators of payments. They help stimulate savings and allocate resources efficiently. Banks also allow for diversification of risk, monitor managers, and exert control (Levine, 1997). Moreover, even in a world of apparent capital mobility, the evidence suggests that domestic savings and investment rates are highly correlated (the so-called “Feldstein-Horioka paradox,” [Feldstein and Horioka, 1981]), which makes domestic saving and financial development a major driver of economic growth.

Studies assessing the impact of banking development on growth have, however, looked at “conventional” rather than Islamic banks because the importance of the latter has grown only in the last two decades. Islamic banking is now expanding out of its niche, becoming a market that could rival the conventional sector in many countries. It is an increasingly visible alternative to conventional banks in Islamic countries and in countries with large Muslim populations, such as the UK. Globally, the assets of these institutions have grown at double-digit rates for a decade, and some conventional banks have opened Islamic windows, with Shariah-compliant financial assets reaching an estimated \$509 billion at end-2007 (Moody’s, 2008). The International Organization of Securities Commissions predicts that as much as half of the savings of the world’s estimated 1.2-1.6 billion Muslims will be in Islamic financial institutions by 2015. Despite the rapid growth of Islamic banking in recent years, what drives its diffusion is still poorly understood.

This paper looks at Islamic banking around the world, identifying the sources of its expansion and formulating policy advice on how to stimulate its further growth. Knowing the factors that stimulate Islamic banking is crucial to helping Islamic countries—which have remained largely underbanked and therefore also underdeveloped—to catch up. These factors could also help developing countries with minority Muslim populations to benefit from an alternative source of financing and deepen their financial sectors.

To our knowledge, this is the first study that explicitly considers the diffusion of Islamic banking around the world. The paper is structured as follows: After a brief discussion of how the banking system has developed in Islamic countries, we delve into the growth of Islamic banks in recent decades. We then illustrate its geographical dispersion. In the subsequent section, we use Poisson and Tobit models to analyze how Islamic banks have diffused. Finally we draw policy implications.

II. WHAT IS ISLAMIC BANKING?

While Islamic banks respond to the needs of Muslim customers, they are not acting as religious institutions. Like other banks they are profit-maximizing entities. They act as intermediaries between savers and investors and offer custodial and other services found in traditional banking systems. The constraints facing Islamic banks are, however, different. They are based on prescriptions in Shariah law, which encompasses a set of duties that also apply to commercial transactions, and the hadith—the authentic traditions. Islamic law

affects how the banking system functions. Four factors in particular are unique to Islamic banking. We summarize them here briefly (for a good exposition, see El-Gamal (2006)).

Prohibition of interest (*Riba*). *Riba* is the major difference between Islamic and traditional banking. Islam prohibits all forms of *riba* (interest paid on loans) on the grounds that interest rates are a form of exploitation, inconsistent with the notion of fairness. Practically, this implies that Shariah law does not allow fixing in advance a positive return on a loan as a reward for waiting. The argument is that *riba* implies an improper appropriation of other people's property and is bad for growth. Islam does recognize the importance of the time value of money, but the time value is not realized as part of a loan contract; it can be realized only as part of a real transaction. For example, in a leasing agreement, the time value of money is an integral part of the rent to which the parties agree, with longer leases expected to yield higher returns.

Prohibition of *maysir* (games of chance) and of *gharar* (chance). Islamic banking bans speculation, which is increasing one's wealth by chance rather than productive effort. In practice, though, the distinction between speculation and productive effort is often blurred. While entrepreneurship itself could be interpreted as a form of gambling, *maysir* refers to unnecessary uncertainties not part of everyday life, such as going to a casino. Unavoidable risk is permitted.

A related concept is the prohibition of *gharar* contracts. It applies to doubtful or uncertain contracts, such as undertaking a business venture without sufficient information or taking excessive risk. It is similar to asymmetric information; the objective is to minimize possibilities of misunderstanding and conflicts between contracting parties.

Prohibition of *haram* (illegal) activities. The code of conduct for Islamic banks allows them to finance only *halal* (legal) activities. They are not supposed to lend to companies or individuals involved in activities deemed to have a negative impact on society (for example, gambling) or that are illegal under Islamic law (for example, financing construction of a plant to make alcoholic beverages).²

Payment of part of bank profits to benefit society (*zakat*). Muslims believe that justice and equality in opportunity (not outcome) are crucial for a society to function. One mechanism to achieve this goal is to redistribute income to provide a minimum standard of living for the poor. This form of giving, *zakat*, is also one of the five tenets of Islam. It is generally agreed that the amount of *zakat* is 2.5 percent of assets held. In countries where *zakat* is not collected by the state, Islamic banks establish a *zakat* fund for collecting money to be donated to religious institutions.

² As companies become increasingly complex, it is more and more difficult to find pure *halal* investments. Islamic scholars have found a way around this. Typically, when a small share of a company's business deals with *haram* activities, that part of the dividend that is deemed "tainted" should be donated to charity. So if 5 percent of the business of a company is deemed to be in activities not compatible with the Shariah, 5 percent of the dividend received should be given to charity.

Given these characteristics, would Islamic banking be good for growth? The analysis by Bhalla (2002) revealed that in comparison to the worldwide mean, Islamic countries are poor and not highly developed. Some scholars argue that Islam, by preaching fatalism, might negatively affect growth (Kuran, 1997). However, much of the evidence does not support this argument. First, the Golden Age of Islam between the 9th and 15th centuries, when advances were made in science, literature, navigation, law, and philosophy, illustrates that Islamic societies are capable of progress and innovation when the right environment is in place (Turner, 1997). More recently, Noland (2003), in an authoritative study, concludes that:

Predominantly Muslim countries are seldom outliers (either positively or negatively) in the cross-country regressions. In most cases, the coefficient on the Muslim population share is statistically insignificant. With one exception, where it is significant, it is always positive. The only case of a statistically significant negative coefficient is in the sub-national regression for Malaysia. Islam does not appear to be a drag on growth or an anchor on development as alleged. If anything, the opposite appears to be true. If one is concerned about economic performance in predominantly Muslim regions or countries, conventional economic analysis may yield greater insight than the sociology of religion.

In fact, not only does Islam not negatively impact growth, but Islamic banking could complement conventional banks and thereby help diversify systemic risk. In conventional banks, when a bank gives out a loan, the borrower bears all risks, except in the case of bankruptcy. In Islamic banking, both bank and entrepreneur share the rewards and failure. In many developing countries risk sharing might allow entrepreneurs with little savings to undertake projects they could not contemplate in an environment where all the risk lies on them. In conventional banking, the creditworthiness of the borrower is the main determinant of the lending decision, and banks are interested in the interest and principal on the loan. In Islamic banking, because profits and losses are shared, banks will receive a return only if a project is successful. Therefore, Islamic banks are more prone to finance sound projects, even if the entrepreneur has no credit history.³

III. DEVELOPMENT OF BANKING IN ISLAMIC COUNTRIES

A. Colonization, Independence, and Recent Times

The development of a modern banking system in Islamic countries occurred when their colonizers were interested in establishing banks that could support mining, agriculture, manufacturing, and financing of the public sector. After gaining independence, many Islamic countries nationalized banks, and development banks were created to spur industrialization (Chang, 2002). Governments used banks to finance expansion of the public sector, especially

³ However, Čihák and Hesse (2008) find that Islamic banks tend to be less stable when operating on a large scale, suggesting that under certain conditions, a growing Islamic banking sector might not be beneficial for economic growth if it weakens financial stability in countries where a proper prudential regulation is lacking. It is probably fair to say that the benefits in having banking systems that are diversified and include Islamic banks as a complement to conventional banks, is likely to be helpful for financial stability.

in the Middle East and Africa, or to expand certain favored industries, as in East Asia. Central banks were frequently tasked with assigning responsibility for credit allocation and economic development, rather than keeping inflation in check (see Epstein, 2006). In this situation, banks often could not be profitable, and banking systems remained underdeveloped. In Islamic countries, moreover, banks were not addressing the need of devout Muslims (Iqbal and Mirakhor, 1987). Devout Muslim individuals would not want to put their money into a financial system that was not based on religious principles. This underbanking of an important segment of the population meant that savings were not used efficiently.

Four decades ago, in a banking system not attuned to the needs of the devout, the Islamic banking industry emerged on a modest scale to fill the gap. Two factors were crucial to this development (Rivlin, 2008). First, bottom-up experiments in Egyptian rural villages illustrated the feasibility of Islamic banking. These small rural experiments have grown into a tremendous industry in many countries, spreading from the Middle East to Indonesia, Malaysia, sub-Saharan Africa, and Europe and the Americas.

Second, top-down support from the creation of the Islamic Development Bank (IDB) in 1975 in Jeddah gave impetus to the diffusion of Islamic banking by centralizing expertise. In its infancy, implementation of Islamic banking required a lot of interpretation of Shariah law. The demand for Islamic banking led Islamic scholars to address this problem. In the first few years, basic implementation tools were created and widely accepted; the last few years have seen rapid innovations, particularly of products like *sukuks* (Islamic bonds). Among other recent institutional developments that have helped Islamic banking diffusion, is the Islamic Financial Service Board (IFSB), established in 2002, with a mandate to set prudential standards for Islamic banks.

During its first three decades, Islamic finance focused on two core markets: Bahrain in the Middle East and Malaysia in South-East Asia. The two countries became pioneers, establishing the two leading financial centers for Islamic banking. By the early 1980s, Malaysia took the lead in the Islamic world thanks to official support that considered Islamic banking a pillar of development. The government was crucial to the establishment in 1983 of the country's first Islamic bank, the Bank Islam Malaysia Berhad. Similarly, Bahrain has pursued Islamic finance as a niche that could allow it to build on its strong banking sector and become a major financial center.

Government support in the Gulf and other regions was less evident. Gulf governments, unswayed by ideological commitment, mandated that financing be provided on the basis of conventional pricing and terms. Recently, this attitude has changed, especially in Saudi Arabia. Iran has taken steps to move their entire banking system toward Islamic finance, disallowing interest payments altogether (see Iqbal and Mirakhor, 1987). Pakistan and Sudan, while initially attempting to move their banking systems entirely to Islamic banking, have backed off recently and have mixed systems that include Islamic and conventional banks.

The expansion of Islamic banking has in the past few years accelerated, with the industry diversifying out of traditional territories into countries with large Islamic populations such as the United Kingdom. Africa in particular, with a Muslim population of more than 400

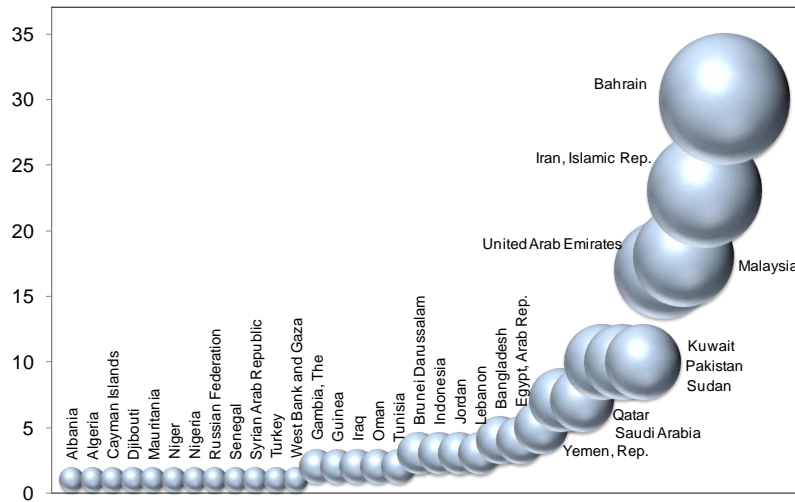
million, has seen an expansion in recent years (see Moody's, 2008). While estimates vary, Islamic finance has grown into a US\$1 trillion industry (see Banker, 2007).

Although Čihák and Hesse (2008) find that large Islamic banks appear more vulnerable to risks than large conventional banks, the former showed greater resilience during the recent financial crisis as they were not involved in trading “toxic assets” (see also Dridi and Hasan, 2010). One reason is that Islamic banks, in contrast to most conventional banks, tend to finance their activities out of deposits rather than from wholesale funding, and are thus less subject to the vagaries of the markets, adding another layer of stability. In addition, Shariah-compliant rules prohibited Islamic bankers from dealing in second-hand, interest-bearing mortgages—the financial assets at the root of the US subprime property market crisis that precipitated the worldwide crisis. Islamic banks favor investment in utilities, telecoms, health care, and high-tech sectors that were not hit as hard as sectors in which conventional banks were exposed (for example, casinos). Islamic banks have, however, not diversified out of their traditional niche markets, which are financing of trade, real estate, and infrastructural projects. The main focus has been on real estate, not only in the Middle East and Malaysia but also beyond. Thus, as the property boom around the world has collapsed, Islamic banks have been negatively impacted. Moreover, world trade collapse also affected Islamic banks, given their strong presence in trade finance.

B. The Diffusion of Islamic Banking

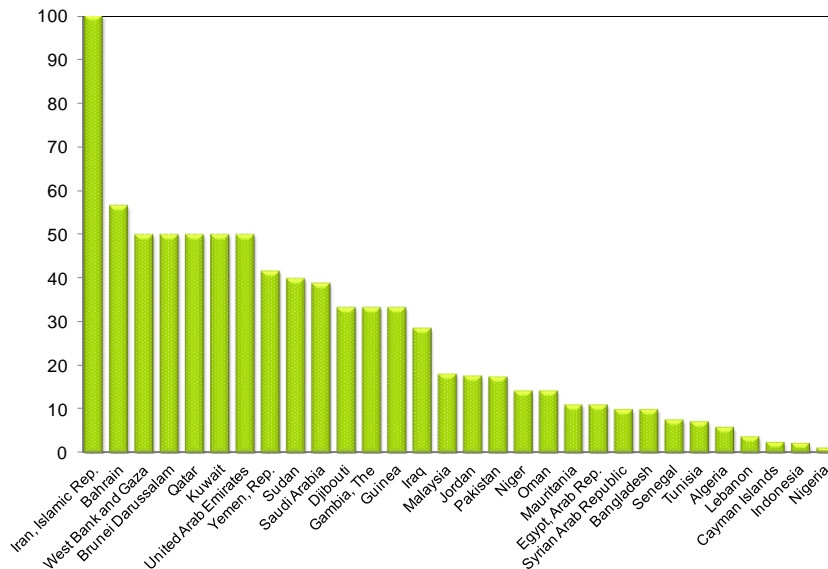
All bank-specific data used in this study are taken from Bankscope and aggregated by country (see Appendix 5, 6 for the summary statistics, and Appendix 7 for the source of the data). The period analyzed is from 1992-2006, the last complete year for which data is available at the time of writing the paper. This database provides us with useful information on assets, liabilities, and revenues with consistent and comparable standards. The database does have some limitations, however. First, it is difficult thus far to assess the size of Islamic banking accurately. Although most of the world's leading financial institutions have windows for Islamic banking, they rarely disclose the importance of Islamic banking in their business (Banker, 2007). Moreover, small rural cooperatives run on Islamic principles are not accounted for. Also, the definition of “Islamic banking” varies across countries, with an Islamic bank in Iran conducting its business differently from an Islamic bank in, say, Malaysia. Thus current databases almost certainly underestimate the importance of Islamic banking, though the underreporting may diminish over the time.

Currently concentrated in the Middle East, North Africa, and Southeast Asia, Islamic banking is spreading to Sub-Saharan Africa, Central Asia, and Western Europe. Of the 176 Islamic banks in the Bankscope database for 2006, 70 percent are in Middle Eastern countries, 14 percent in Southeast Asia, and 15 percent in Sub-Saharan Africa. Figure 1 shows that the number of Islamic banks is highest in the Islamic financial centers Bahrain and Malaysia, in Islamic republics—Iran and Sudan for instance—and in the Gulf region more generally. The number is very low in other predominantly Arab and Muslim countries, where there are often fewer than three.

Figure 1. Number of Islamic Banks in Selected Countries, 2006

Source: Bankscope, 2009.

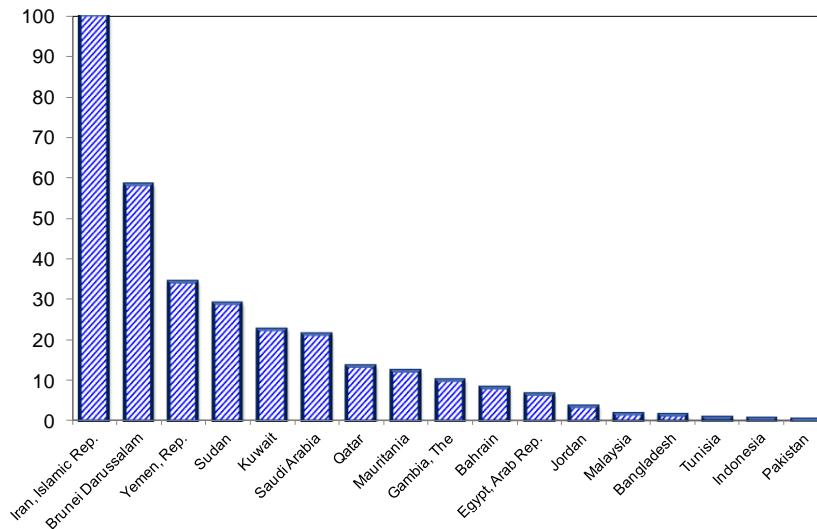
Because the number of banks alone does not give a full picture of how important Islamic banks are, we compare the number of Islamic banks with the total number of banks across countries (Figure 2). Even in countries with only a few Islamic institutions, such as Brunei, Islamic banks have a strong presence. What we see is that in the Gulf region in general and in some African countries with sizeable Muslim population, the number of Islamic banks is relatively large. In other regions, the share of Islamic banks is in the single digits, indicating less importance.

Figure 2. Share of Islamic Banks in Total Banking System in Selected Countries, 2006 (Percent)

Sources: Bankscope and authors' calculations

If we compare credit by Islamic banks to the depth of the financial system, even in countries like Malaysia where Islamic banking is well-developed, it is dwarfed by conventional banks (Figure 3).

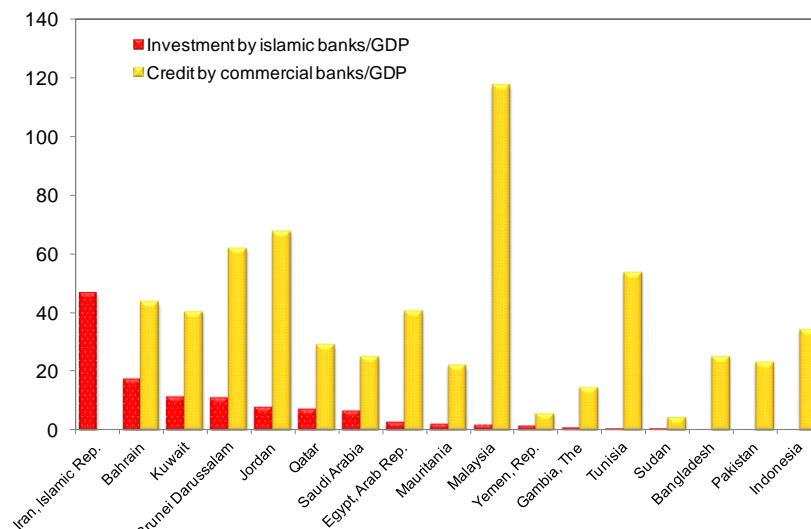
Figure 3. Share of Credit by Islamic Banks in Total Banking Credit in Selected Countries (average 1992-2006)



Sources: Bankscope, Financial Development and Structure Database, and authors' calculations.

If we now measure the importance of Islamic banks in the economy by assets, we see that in almost all countries, except Iran, the ratio of credit of conventional banks to GDP is substantially higher than the investment to GDP ratio of Islamic banks, which accounts for less than 20 percent of GDP in most countries (Figure 4).

Figure 4. Comparing Investment by Islamic Banks with Credit by Conventional Banks in Selected Countries (average 1992-2006, percent of GDP)



Sources: Bankscope, Financial Development and Structure Database, and authors' calculations.

Therefore, the importance of Islamic banking varies, being high in the Gulf and East Asia in absolute numbers though relatively small in comparison with how much investment they

finance as a share of GDP compared to conventional banks. In other regions, the importance of Islamic banking is even lower.

IV. ECONOMETRIC ESTIMATION OF THE DIFFUSION OF ISLAMIC BANKS

A. The Data and Model

To evaluate the diffusion of Islamic banks, we use two main proxies: (i) the number of Islamic banks and (ii) the share of the assets of Islamic banks in the entire banking system. The model specification is as follows:

$$Isl = \gamma_0 + \sum_{i=1}^k \gamma_i X_i + \varepsilon$$

where Isl represents an indicator of the diffusion of Islamic banking, X is a set of factors that could explain the diffusion of Islamic banking, and ε is the error term.

We hypothesize that the following factors are likely to influence Islamic banking diffusion (all data-sources are reported in Appendix 7):

Islamic Population: All else being equal, we expect that the higher the percentage of Muslims in a country, the faster the diffusion of Islamic banking. Current estimates suggest there are an estimated 1.2–1.6 billion Muslims worldwide, with high concentrations in the Middle East, North Africa, and South-East Asia but otherwise spread across the globe. The data was obtained from Alesina, et al. (2003).

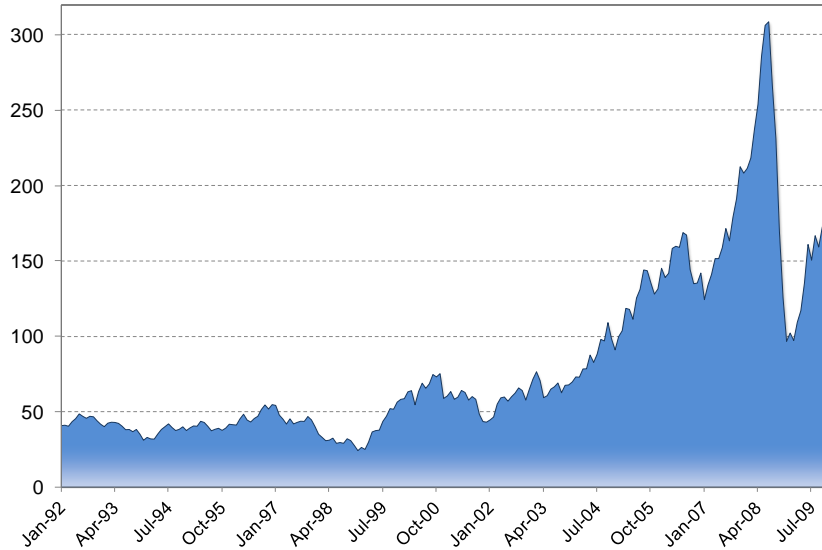
Interest Rates: Although Islamic banks are not allowed to charge interest, they compete with traditional banks and have to offer competitive products. While devout Muslim individuals will put their money only in Islamic banks, less devout Muslims, and non-Muslims, see the opportunity cost of putting their money with Islamic banks as the current prevailing interest rate. If it is low, the opportunity cost foregone is low, and Islamic banking should be stimulated. We use both real and nominal interest rate variables, with the data obtained from *International Financial Statistics* (IFS).

Income per capita: We expect that higher income per capita should result in greater demand for Islamic services. As income rises, savings tend to rise and the need for financial activities—lending, trade credit and other activities—similarly grows. The data is from the IFS.

September 11, 2001: It has been suggested that an important driver of Islamic banking was the terrorist attacks of 9/11 (Rivlin, 2008). Following that event, money coming out of Islamic countries was viewed with suspicion in Western countries. The risk of funds being seized by Western governments made it more appealing for Islamic investors, who traditionally had exported their savings to the West, to keep their money in their own region. A step-dummy variable after 9/11 should therefore show a positive effect on the diffusion of Islamic banks.

Petroleum Exporters: Islamic countries, particularly in the Middle East, depend on extraction of petroleum products. Since 2000, oil prices have risen substantially (see Figure 5). Positive improvements in the terms of trade for these countries should therefore increase purchasing power, which raises incomes and should stimulate the diffusion of Islamic banking. Positive terms of trade shocks have a positive effect on income not only in oil-exporting countries but also in countries where a large share of the population works as migrants in oil exporting countries, for instance Egypt, Pakistan, and Yemen. While many oil-producing countries have created sovereign wealth funds that invest much of their assets overseas, we expect enough money is entering the economy and spilling over to the domestic sector to have a noticeable impact on growth. To capture this effect, we used both a dummy variable for net oil-exporter countries and the oil price index (based on average oil price in dollars per barrel).

Figure 5. Oil Price Index (Jan 92 – Dec 09)
(Jan 2005=100)



Source: International Financial Statistics.

Economic Integration with the Middle East: How much a country's economy is integrated with the Middle East—as proxied by the share of exports and imports to that region—is also likely to be a crucial factor in determining Islamic banking diffusion. Countries with closer trade ties to the Middle East are more exposed to businesses dealing with Islamic banking systems, and will be more likely to develop their own Islamic banking back home. We use the share of a country's exports and share of its imports to the Middle East,⁴ as provided by the IMF Direction of Trade Database.

⁴ The Middle East country group consists of Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen.

Distance from Islamic Centers: Bahrain and Malaysia are the two major Islamic finance centers. We expect that the closer a country is to one of them, the higher the familiarity with Islamic finance concepts tends to be and the more likely Islamic banks are to develop. The data is derived from Gleditsch and Ward (2001).

Financial System Development: The effect of a country's current banking system on Islamic banking is ambiguous. On the one hand, a more sophisticated banking system could act as a substitute for Islamic banks, making their diffusion more difficult. At the same time, a sophisticated banking system, by providing infrastructure (for example, human capital) on which Islamic banks can build, could promote the diffusion of Islamic banking. In this latter scenario, Islamic banks would act as a complement to conventional banks. To measure the size of conventional banks, we use two variables: credit to the private sector as a share of GDP and the number of non-Islamic banks. The data are from the IFS and Bankscope respectively.

Macroeconomic Stability: A key determinant of the size of the banking system is macroeconomic stability (Kaminsky and Reinhart, 1996). We use two standard proxies, inflation and the budget balance as a share of GDP (see Boyd, Levine and Smith, 2001). Typically, as an economy becomes less stable, we can expect disintermediation. Also, because their basic principle is to share risk with investors, lower investment returns from higher macroeconomic risk should negatively affect diffusion of Islamic banks. The data were obtained from the IFS.

Institutions: Most Islamic countries were colonized and inherited the institutions of their colonizers. For Muslim countries, this means either English common law or French civil law. Some scholars (for instance La Porta et al., 1998; Beck, Demirguc-Kunt, and Levine, et al., 2003) have argued that English common law has a more positive effect on financial and economic development than civil law, on the grounds that the latter tends to place less emphasis on protecting private property rights. We use a dummy variable taken from La Porta et al. (1998) to capture the legal origin. We also use two indicators compiled by Kaufmann, Kraay, and Mastruzzi (2007): the index of rule of law, which captures the quality of contract enforcement, and the index of regulatory quality, which measures the ability of the government to formulate and apply sound policies for regulation. We expect that Islamic banks, like conventional banks, are more likely to grow in environments where the regulatory system is built on a solid foundation. Individuals trusting the banking system are more likely to put their money in banks and use banking services.⁵

We do not use bank profitability as an independent variable. The profitability of Islamic banks cannot easily be compared to that of conventional banks because of different accounting methods (for example, Islamic banks tend to keep nonperforming loans on their

⁵ When they were first established, Shariah Supervisory Boards were extremely cautious in their advice, and sometimes even obstructive. In the last few years, they appear, according to some experts, to have become less cautious in their interpretations.

books). Other reasons are structural: for instance, Islamic banks are by definition not leveraged, and we would need to adjust for this risk factor in any profitability comparison.

B. Regression Analysis

Below we use various econometric estimation techniques to model how Islamic banking is diffusing around the world. We first estimate a model where we look at what determines the number of Islamic banks in various countries. Because the dependent variable—number of Islamic banks—is a count variable, we use a Poisson distribution method. The sample consists of 117 countries, and the data are averaged during 1992–2006, as the number of Islamic banks varies little during the period. The disadvantage of this method is that it is a cross-country rather than a panel estimation technique, meaning it ignores changes over time. Therefore, as a consistency check, we also use the share of assets of Islamic banks in total banking assets as a dependent variable to account for the size and importance of Islamic banks in each country. Since this is a continuous variable, we use a Tobit model, which also has the advantage of allowing us to do the estimation in panels and therefore take account of country-specific effects.

Determinants of the Number of Islamic Banks in a Country

We start by using the number of Islamic banks as a dependent variable in measuring Islamic bank diffusion. As it can lead to negative predicted values, ordinary least square (OLS) regression is not an appropriate model to explain variation when the dependent variable takes on values of zero or more. Therefore, we have to use a Poisson distribution model, which is more suitable for discrete non-negative variables (see Appendix 1). We do not normalize by total number of banks because we will first study what explains the absolute size of the Islamic banking sector across countries. Note that the ratio of the number of Islamic banks to total banks is “noisy.” If the ratio drops for a country, it could mean the number of Islamic banks either declines or increases less than the number of conventional banks. We do, however, include the number of conventional banks as an explanatory variable to control for the size of the conventional financial system.

The Results

Table 1 sets out the results related to determinants of the number of Islamic banks. Overall, the pseudo R-squared,⁶ which measures the goodness of fit, is relatively high—between 0.4 and 0.6—suggesting that much of the variation in the dependent variable data is driven by explanatory variables, and that the model is relatively well specified.

⁶ The pseudo R squared is given by the following formula: $Pseudo R^2 = 1 - \frac{L(\hat{\lambda}_i, y_i)}{L(\bar{y}, y_i)}$, where $L(\hat{\lambda}_i, y_i)$

is the log-likelihood for the Poisson model fit by Maximum likelihood estimation, and $L(\bar{y}, y_i)$ is log-likelihood of the model with only a constant term.

Income per capita is in all specifications strongly significant and has the correct sign. As with conventional banking, rising income per capita tends to raise the number of Islamic banks in a country. Similarly, as the share of Muslims in the population rises, the number of Islamic banks also rises. The coefficient is positive and significant at the 1 percent level regardless of the specification.

Islamic banking diffusion tends to be higher in net oil exporting countries, though this is not statistically significant under every specification, suggesting that being a net oil exporter per se is not as important as often thought.

The distance to the two main Islamic financial centers, Bahrain and Malaysia, does matter for the diffusion of Islamic banks across countries. Islamic banks diffuse faster when a country is closer to one of the two centers. However, the importance of being close to one of the centers might fade with time because banks in major financial centers from London to Singapore are all introducing Islamic banking units.

The existence of a developed banking system has a positive impact on Islamic banking. Given the dominance of conventional banks, one can conclude that the more sophisticated or competitive a banking system is, the more accommodative it is to Islamic banking. More importantly, this implies that Islamic banking acts as a complement to, rather than a substitute for the conventional banking system and is covering a niche that had so far not been served.

Owing to a period of great moderation (see, for instance, Bernanke, 2004) interest rates have been declining in most countries, including those in our sample.⁷ With falling interest rates, the opportunity cost of putting one's money into Islamic banking has therefore declined because the risk-adjusted relative return in conventional banks has come down. Our results imply that the effect is nonlinear. Real low interest rates do indeed help Islamic banking, but as the rates rise and pass a threshold value estimated at 3.5 percent, the diffusion of Islamic banking starts to slow down.

While we found that Islamic banks and conventional banks appear to be complementary, results also suggest that interest rates matter. This supports the view that less devout or nonreligious consumers view traditional and Islamic banks as substitutes, and they put more money into Islamic banks when opportunity costs fall and move money into conventional banks when the opportunity cost rises.

⁷ In our sample, real interest rates declined by about 10 percentage points on average for 1992–2006.

Table 1. Determinants of Islamic Banking Diffusion: Number of Islamic Banks, Poisson Model, Cross-country, 1992–2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GDP per capita (log)	0.491 [0.00]***	0.377 [0.00]***	0.291 [0.00]***	0.466 [0.00]***	0.557 [0.00]***	0.384 [0.00]***	0.350 [0.00]***	0.485 [0.00]***	0.436 [0.00]***	0.238 [0.10]	0.243 [0.04]**
Population share of Muslims	0.031 [0.00]***	0.035 [0.00]***	0.025 [0.00]***	0.037 [0.00]***	0.039 [0.00]***	0.031 [0.00]***	0.034 [0.00]***	0.029 [0.00]***	0.026 [0.00]***	0.034 [0.00]***	0.034 [0.00]***
Dummy for net oil exporters	0.503 [0.01]**	0.944 [0.00]***	0.052 [0.83]	0.569 [0.01]**	-0.116 [0.66]	0.640 [0.00]***	0.600 [0.01]***	0.512 [0.01]**	0.297 [0.15]	0.626 [0.02]**	0.637 [0.02]**
Distance from Malaysia (log)		-0.338 [0.03]**									
Distance from Bahrain (log)			-0.440 [0.00]***								
Number of conventional banks				0.007 [0.00]***							
Real interest rate					0.092 [0.01]**						
Square real interest rate					-0.013 [0.00]***						
Inflation (log)						2.881 [0.04]**					
Square inflation (log)						-4.020 [0.06]*					
Budget balance							0.087 [0.00]***				
Share of exports to Middle East								0.011 [0.13]			
Share of imports from Middle East									0.038 [0.00]***		
British legal origin										1.482 [0.00]***	1.463 [0.00]***
Rule of law										0.124 [0.62]	
Regulatory quality											0.112 [0.52]
Constant	-5.494 [0.00]***	-2.522 [0.10]*	-0.272 [0.86]	-5.977 [0.00]***	-6.036 [0.00]***	-4.916 [0.00]***	-4.313 [0.00]***	-5.418 [0.00]***	-5.068 [0.00]***	-4.517 [0.00]***	-4.584 [0.00]***
Observations	117	115	115	114	107	108	87	110	110	113	113
Pseudo R2	0.46	0.54	0.42	0.49	0.58	0.47	0.54	0.46	0.50	0.57	0.57

Notes: p value in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Inflation, a proxy for economic instability, has (as in most studies on conventional banking diffusion) a negative impact on the diffusion of Islamic banks beyond a certain threshold. With rising inflation the intermediation effect of Islamic banking breaks down, and people invest (save) by transforming their banking assets into hard assets, from housing to foreign exchange. In this way, the diffusion of Islamic banking is like that of conventional banking.⁸ Similarly, our second indicator of economic stability, the government budget balance as a share of GDP has a positive coefficient and is significant at the 1 percent level, suggesting that sound fiscal policies matter for the development of financial systems, including Islamic banks.

The share of exports to and imports from the Middle East does raise the probability that Islamic banks will develop, though the share of exports to the Middle East are only marginally statistically significant. The reason trade with the Middle East matters may be both because of demand-pull or a supply-push factor. If a country deals more with the Middle East, customers there might request that the trade transaction go through an Islamic bank. This could stimulate Islamic banking in the exporting country. Similarly, as exporters or importers get more accustomed to dealing with Islamic banks in the Middle East, a demand for Islamic banks at home might arise, which would stimulate their diffusion.

The quality of institutions as measured by rule of law or regulatory quality does not statistically influence the diffusion of Islamic banks. Unlike studies that have found that institutions matter for financial development (see Beck and Levine, 2003, for a survey), we find that diffusion of Islamic banks appears impervious to quality of the institutional environment. It may be that regardless of the institutional environment, the way Islamic banks are permitted to behave is driven by relatively strict Shariah law, making the institutional environment less important than for conventional banks. An attempt is often made to settle disputes in the first instance through using Islamic scholars for instance, and only if this is unfruitful do the parties settle disputes in courts. The one exception is countries that had common law tradition. As illustrated by La Porta et al. (1998), common law countries generally have stronger legal protections of investors than French civil law countries.

Of all the institutional variables, the legal origin therefore appears to be the only one that matters for the diffusion of Islamic banks.⁹ Note that for the Poisson distribution, we are not

⁸ In fact, the impact of inflation on banking system activity is far more complex, and has been studied by, among others, Wachtel and Rousseau (2000) and Boyd, Levine, and Smith (2001).

⁹ One problem Islamic banks face is that there is not a single set of rules that governs Islamic banking. Like Shariah law, the rules are subject to interpretation and tend to change over time. Some conservative Islamic scholars have concluded that investing in stock markets is a form of gambling prohibited by the Koran. But others interpret the Koran to mean that they should not get involved in day trading with the intention of selling the equity soon after for a profit. Another issue is the guarantee of savings deposits. Instead of collecting interest on savings, a person who deposits money into an Islamic bank collects a fee based upon a contractual profit-and-loss sharing agreement with the Islamic bank. This makes savings accounts at Islamic banks much riskier than a guaranteed savings account at a conventional Western bank that also is backed by government insurance plans. If an Islamic bank invests money from savings accounts into a firm that fails, the holders of the savings accounts can actually lose their money.

able to assess the impact of the September 11th attack because we use a cross-section methodology. Its impact is estimated in the next section.

We also refine our analysis using techniques appropriate for count data: a zero inflated Poisson model and a negative binomial model (see appendix tables 3 and 4). The first corrects for the excessive number of zeros arising from underreporting and the fact that Islamic banks have begun to diffuse only in recent years. The second allows for overdispersion, relaxing the Poisson model assumption of equal mean and variance. Overall, the results are similar to those of the Poisson model.

Determinants of the Share of Islamic Bank Assets in Total Banking Assets

So far, we have looked only at how the numbers of Islamic banks varies across countries, without taking into account their relative share in the banking system. In this section, we use as a dependent variable the assets of Islamic banks as a share of total banking assets to account for relative size, and test whether the factors determining Islamic bank diffusion shape financial sector assets toward more Islamic finance.

We will use a Tobit model, which is useful when the data are continuous and censored, that is, when the zeros are actual observations (see Appendix 2).¹⁰ In addition, in many countries, Islamic banking is only reported separately once a minimum number of banks are in place; therefore the dependent variable is censored below a value. OLS is again not appropriate because it can lead to negative predicted values, and a linear model may not fit a population distribution over positive values, when there is a clustering at the value zero.

The Results

What do the results suggest for our Tobit model? Essentially they confirm the findings of the Poisson model, suggesting that both the number of Islamic banks and the share of Islamic bank assets in total banking assets are positively determined by income per capita¹¹ and the share of Muslims in the population. As we found in our earlier regressions, distance to Malaysia matters for the diffusion of Islamic banking, though the coefficient is less significant. Distance to Bahrain, however, appears not significant at conventional levels (the result is not reported). The Tobit model confirms the finding that real interest rates have a negative impact on the diffusion of the number of banks above a certain threshold.

Our results suggest that the September 11th attack on the United States had a positive impact on assets of Islamic banks, perhaps because Muslim investors, who have traditionally

¹⁰ Wooldridge (2001) suggests using the term "corner solution zeros" when the dependent variable takes the value zero with positive probability but is a continuous random variable over strictly positive values. These zeros are the result of a utility maximization problem by economic agents: they are real values, real observations.

¹¹ It is only significant in one-third of regressions, probably because we are estimating the impact on the relative share of Islamic banks in total assets.

invested in the West, were compelled to keep more money at home for fear of expropriation, for instance. However, because 9/11 and oil price increases happened at about the same time, we regress them together to see if they have different effects on the diffusion of Islamic banking. The result is that the significance of the coefficient on 9/11 vanishes once oil prices are accounted for. This implies, contrary to conventional wisdom, that 9/11 did not affect the diffusion of Islamic banking; rather that it coincides with rising oil prices, which are a major cause of the diffusion of Islamic banking. While oil prices have a positive and statistically significant impact on the diffusion of Islamic banking, the effect is likely to be asymmetric. We would not expect a large fall in oil prices to lead to a large decline in the diffusion of Islamic banking, though diffusion rates would certainly decline. Unfortunately, the use of annual data over a relatively short period (1992-2006) prevents us from testing robustly for asymmetric effects.

As expected, terms of trade changes, especially the evolution of oil prices, have a statistically significant impact on the diffusion of Islamic banks, which tends to increase when oil prices rise. This is to be expected: whether the extra income is treated as permanent or as a transitory windfall, it will stimulate savings and demand for banking services ranging from mortgages to savings products.

Financial development—measured by private credit to GDP—is not statistically significantly correlated with a higher share of Islamic bank assets, though its coefficient is positive. This suggests that better financial intermediation, while not hampering the growth of Islamic banking, does not stimulate it, in contrast to our earlier finding in the Poisson model.

Inflation, one of the proxies for macroeconomic instability, is negative but not significant at conventional levels. The other indicator, budget balance, has the right sign and is consistent with expectations that economic instability reduces investment demand. This confirms that uncertainty raises the threshold for an individual to invest and use banking services (Dixit, 1992).

Trading with the Middle East, as proxied by the share of imports and exports from that region, has a positive and statistically significant impact on Islamic bank assets, which confirms our earlier results. Given that Islamic banks are involved in trade finance, this is expected. Interestingly, the impact of imports from the Middle East is larger—as tested by an F-test¹²—than the impact of exports to the Middle East. This may suggest that Middle Eastern exporters favor the use of Islamic banking more than Middle Eastern importers.

¹² The difference between the two coefficients is significant at 5 percent.

Table 2. Determinants of Islamic Banking Diffusion: Share of Islamic Bank Assets in Total Banking Assets, Tobit model, Panel, 1992-2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
GDP per capita (log)	0.056 [0.10]	0.064 [0.08]*	0.019 [0.63]	-0.036 [0.33]	0.003 [0.94]	0.056 [0.07]*	0.027 [0.43]	0.031 [0.37]	0.053 [0.09]*	0.035 [0.27]	0.069 [0.04]**	0.040 [0.13]
Population share of Muslims	0.009 [0.00]***	0.010 [0.00]***	0.008 [0.00]***	0.009 [0.00]***	0.009 [0.01]***	0.009 [0.01]***	0.009 [0.00]***	0.006 [0.00]***	0.008 [0.00]***	0.008 [0.00]***	0.008 [0.00]***	0.008 [0.00]***
Dummy for net oil exporters	0.162 [0.13]	0.185 [0.09]*	0.207 [0.15]	0.356 [0.00]***	0.279 [0.03]**	0.026 [0.80]	0.167 [0.14]	0.250 [0.11]	0.195 [0.03]**	0.151 [0.10]	0.069 [0.39]	0.155 [0.03]**
Dummy for Sep 11			0.045 [0.00]***	0.021 [0.10]*	0.022 [0.18]	0.047 [0.00]***	0.037 [0.00]***	0.018 [0.12]	0.035 [0.00]***	0.012 [0.32]	0.005 [0.66]	0.009 [0.42]
Distance from Malaysia (log)		-0.125 [0.06]*										
Private sector credit to GDP (log)				0.023 [0.29]								
Oil price index					0.001 [0.03]**							
Real interest rate						-0.001 [0.09]*						
Square real interest rate						0.000 [0.27]						
Inflation (log)							0.321 [0.00]***					
Square inflation (log)							-0.074 [0.15]					
Budget balance								0.005 [0.00]***				
Share of exports to Middle East									0.003 [0.02]**			
Share of imports from Middle East										0.007 [0.00]***		
British legal origin											0.286 [0.00]***	0.247 [0.00]***
Rule of law											-0.035 [0.34]	
Regulatory quality												0.012 [0.43]
Constant	-1.403 [0.00]***	-0.545 [0.40]	-1.155 [0.00]***	-0.737 [0.02]**	-1.094 [0.00]***	-1.275 [0.00]***	-1.224 [0.00]***	-0.852 [0.00]***	-1.455 [0.00]***	-1.317 [0.00]***	-1.498 [0.00]***	-1.198 [0.00]***
Observations	1520	1494	1520	1289	1520	1206	1354	577	1421	1421	821	824
Number of id	113	111	113	97	113	99	104	83	106	106	109	109
Wald test	23.79	28.63	38.33	53.15	46.10	42.86	36.35	57.31	47.86	80.57	48.96	70.25

Notes: p value in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Finally, if we look at institutional variables, the findings from the Poisson regressions on determinants of the diffusion of banks by country are confirmed in Tobit regressions. Having a British colonial heritage favors development of Islamic banking in a positive and statistically significant way more than other colonial heritages do. Other forms of institutional variables are not significant. As argued earlier, this reflects the fact that enforcement mechanisms in Shariah compliant banks are stronger than the laws prevailing in most countries we cover, so the impact of the prevailing laws is marginal.

V. CONCLUSION

In this paper we investigated the determinants of the diffusion of Islamic banking across the world. We showed that Islamic banking has, in a few decades, moved from a niche market into the mainstream. Because Muslim populations are underbanked, and given the tremendous need for infrastructure projects like roads and housing across the Muslim world, development of Islamic banking can spur growth in these regions and can be part of the solution to the slow development process.

We found that the probability for Islamic banking to develop in a given country rises with the share of the Muslim population, income per capita, and whether the country is a net exporter of oil. Trading with the Middle East and economic stability also are conducive to diffusion of Islamic banking. Proximity to Malaysia and Bahrain, the two Islamic financial centers, also matters. We found that rising interest rates hinder the diffusion of Islamic banking because they raise the opportunity cost for less devout individuals or non Muslims to put their money with an Islamic bank.

Several findings must be highlighted:

Contrary to what many observers say, our results suggest that the attacks of 9/11 were not crucial to the diffusion of Islamic banking. Instead, the attacks coincided with rising oil prices, which appear to overshadow the significance of 9/11.

The Islamic world is often considered stifled by a lack of well-functioning institutions (Kuran, 1997). Our results demonstrate that the quality of institutions, which traditionally matters for conventional banking, is not important for the diffusion of Islamic banking. Because Islamic banking is guided by Shariah law, it is largely immune to poorly functioning institutions—from the judiciary to the bureaucracy—because there is little resort to them; disputes are instead settled within Islamic jurisprudence. Therefore, Islamic countries can build up the banking system even if a country makes little progress at reforming institutions. This is different from conventional banking systems, which are inherently intertwined with the domestic institutional environment.

Finally, Islamic banking appears to be a complement to conventional banks, not a substitute. Devout Muslims want Islamic banking products which conventional banks are not supplying, and having a well-functioning conventional banking system already in place—through sharing of common platform and human capital, helps spread Islamic banking.

REFERENCES

- Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat, and Romain Wacziarg, 2003, "Fractionalization," *Journal of Economic Growth*, Vol. 8, No. 2, pp. 155–94.
- Banker, 2007, "Top 500 Islamic Institutions," available via the Internet: <http://www.thebanker.com>
- Beck, Thorsten, Asli Demirguc-Kunt, and Ross Levine, 2003, "Law and Finance: Why Does Legal Origin Matter?" *Journal of Comparative Economics*, Vol. 31, No. 4, pp. 653–75.
- Beck, Thorsten, and Ross Levine, 2003, "Legal Institutions and Financial Development," NBER Working Papers 10126 (Cambridge, MA: National Bureau of Economic Research).
- Bernanke, Ben, 2004, "The Great Moderation," remarks at the meetings of the Eastern Economic Association, Washington, DC, February 20.
- Bhalla, Surjit, 2002, *Imagine There's No Country: Poverty, Inequality, and Growth in the Era of Globalization* (Washington: Institute for International Economics).
- Boyd, John, Ross Levine, and Bruce Smith, 2001, "The Impact of Inflation on Financial Sector Performance," *Journal of Monetary Economics*, Vol. 47, No. 2, pp. 221–48.
- Chang, Ha-Joon, 2002, *Kicking Away the Ladder: Development Strategy in Historical Perspective* (London: Anthem Press).
- Čihák, Martin and Heiko Hesse, 2008, "Islamic Banks and Financial Stability: An Empirical Analysis," IMF Working Paper 08/16 (Washington: International Monetary Fund).
- Dixit, Avinash, 1992, "Investment and Hysteresis," *Journal of Economic Perspectives*, Vol. 6, pp. 107–32.
- Dridi, Jemma and Maher Hasan, 2010, "Have Islamic Banks Been Impacted Differently than Conventional Banks During the Recent Global Crisis?" IMF Working Paper (*forthcoming*)
- El-Gamal, Mahmoud, 2006, *Islamic Finance: Law, Economics and Practice* (Cambridge, UK: Cambridge University Press).
- Epstein, Gerald, 2006, "Central Banks as Agents of Economic Development," WIDER Working Paper No. 54.
- Feldstein, Martin, and Charles Horioka, 1981, "Domestic Saving and International Capital Flows," *Economic Journal*, Vol. 90, pp. 314–29.

- Gleditsch, Kristian, and Michael Ward, 2001, "Measuring Space: A Minimum Distance Database," *Journal of Peace Research*, Vol. 38, pp. 749–68.
- Iqbal, Zubair, and Abbas Mirakhor, 1987, "Islamic Banking," IMF Occasional Paper No. 49 (Washington: International Monetary Fund).
- Kaminsky, Graciela L., and Carman M. Reinhart, 1996, "The Twin Crises: The Causes of Banking and Balance-of-Payments Problem" International Finance Discussion Paper No. 544 (Washington: World Bank).
- Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi (2007) "Governance Matters VI: Governance Indicators for 1996–2006," World Bank Policy Research Working Paper No. 4280 (Washington: World Bank).
- King, Robert G., and Ross Levine, 1993, "Finance and Growth: Schumpeter Might Be Right," *Quarterly Journal of Economics*, Vol. 108, pp. 717–38.
- Kuran, Timur, 1997, "Islam and Underdevelopment: An Old Puzzle Revisited," *Journal of Institutional and Theoretical Economics*, Vol. 153, pp. 41–71.
- La Porta, Rafael, Florencio López de Silanes, Andrei Shleifer, and Robert Vishny, 1998, "Law and Finance," *Journal of Political Economy*, Vol. 106, pp.1113–55.
- Levine, Ross, 1997, "Financial Development and Economic Growth: Views and Agenda," *Journal of Economic Literature*, Vol. 35, pp. 688–726.
- Moody's, 2008, "Islamic Finance Explores New Horizons in Africa," available via the Internet: <http://www.moody.com>
- Noland, Marcus, 2003, "Religion, Culture, and Economic Performance," Institute for International Economics Working Paper No. 3 (Washington: IIE).
- Rivlin, Paul, 2008, "The Development of Islamic Banking" *Orient*, pp.4–11.
- Turner, Howard, 1997, *Science in Medieval Islam: An Illustrated Introduction* (Austin: University of Texas Press).
- Wachtel, Paul, and Peter Rousseau, 2000, "Inflation, Financial Development and Growth," Working Papers 00-10 (New York: New York University Department of Economics).
- Winkelmann, Rainer, 2003, *Econometric Analysis of Count Data*, 4th edition (Heidelberg: Springer Verlag).
- Wooldridge, Jeffrey, 2001, "Econometric Analysis of Cross Section and Panel Data," (Cambridge: MA, MIT Press).

Appendix 1. Poisson Model

The Poisson distribution is a discrete probability distribution that expresses the probability of a number of events occurring in a fixed period, if the events occur at a known average rate and independent of the time since the last event (see Winkelmann, 2003). The Poisson, which is a one-parameter distribution, finds a probability distribution of Islamic banking by

$$\Pr(Y = y|\lambda) = \frac{\exp(-\lambda)\lambda^y}{y!} \text{ for } y = 0,1,2 \dots \quad (1)$$

where λ , the parameter, must be positive and is the mean and the variance of the Poisson. It is assumed that λ is a log-linear function of the explanatory variables x_i that account for observed sample heterogeneity as follows:

$$\lambda_i = \exp\left(\beta_0 + \sum_j x_{ij}\beta_j\right) \quad (2)$$

where β_j is the relative change in $E(y|x)$ associated with a small change in x_j . However, the marginal effect differs between individuals.

The likelihood function for the Poisson model is given by

$$L(\beta|y, X) = \ln \prod_{i=1}^N \Pr(y_i|\lambda_i) = \ln \prod_{i=1}^N \frac{\exp(-\lambda_i)\lambda_i^{y_i}}{y_i!} \quad (3)$$

where $\lambda_i = E(y_i|x_i) = \exp(x_i\beta)$

Appendix 2. Tobit Model

Let Y be the proportion of Islamic banks (by assets) in each country, given their characteristics X . Then $Y > 0$ if the country has Islamic banks, and $Y = 0$ if not. We assume that the latent variable Y^* is only observed if $Y^* > 0$; the actual dependent variable is $Y = \max(0, Y^*)$.

The Tobit model is a convenient way of modeling this type of data (see Winkelmann, 2003). In our case, we have “left-censoring” because countries have no Islamic banks. With $y_i \geq 0$, some countries have Islamic banks and some do not; the latent model is given by

$$y_i^* = X_i\beta + \varepsilon_i \quad (1)$$

where X is a k -vector of regressors, and the error term ε_i is $N(0, \sigma^2)$ distributed, conditionally on X ; y_i^* is unobservable, and:

$$y_i = 0 \text{ if } y_i^* = X_i\beta + \varepsilon_i < 0 \quad (2)$$

$$y_i = X_i\beta + \varepsilon_i \text{ if } y_i^* = X_i\beta + \varepsilon_i \geq 0 \quad (3)$$

The unconditional expectation of y given X is:

$$E(y_i | X) = (1 - \Phi(-X_i\beta / \sigma))X_i\beta + \sigma\phi(-X_i\beta / \sigma) \quad (4)$$

The marginal effect of a change in the k -th explanatory variable $x_{k,i}$ on the expectation of y_i is

$$\frac{\partial E[y_i | X_i]}{\partial x_{k,i}} = (1 - \Phi(-X_i\beta / \sigma))\beta_k \quad (5)$$

Appendix Table 3. Determinants of Islamic Banking Diffusion: Number of Islamic Banks, Negative Binomial Model, Cross-country, 1992-2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GDP per capita (log)	0.505 [0.00]***	0.218 [0.16]	0.499 [0.01]***	0.385 [0.03]**	0.572 [0.00]***	0.628 [0.01]***	0.455 [0.04]**	0.496 [0.00]***	0.508 [0.00]***	0.649 [0.06]*	0.400 [0.16]
Population share of Muslims	0.048 [0.00]***	0.050 [0.00]***	0.050 [0.00]***	0.058 [0.00]***	0.053 [0.00]***	0.053 [0.00]***	0.055 [0.00]***	0.046 [0.00]***	0.043 [0.00]***	0.053 [0.00]***	0.052 [0.00]***
Dummy for net oil exporters	0.723 [0.13]	1.507 [0.00]***	0.774 [0.22]	1.073 [0.05]*	-0.196 [0.75]	0.314 [0.62]	0.643 [0.31]	0.598 [0.23]	0.362 [0.49]	0.259 [0.64]	0.549 [0.38]
Distance from Malaysia (log)		-0.395 [0.28]									
Distance from Bahrain (log)			0.147 [0.74]								
Number of conventional banks				0.016 [0.05]**							
Real interest rate					0.111 [0.21]						
Square real interest rate					-0.011 [0.04]**						
Inflation (log)						6.073 [0.12]					
Square inflation (log)						-6.183 [0.09]*					
Budget balance							0.100 [0.17]				
Share of exports to Middle East								0.017 [0.51]			
Share of imports from Middle East									0.031 [0.22]		
British legal origin										1.966 [0.00]***	1.850 [0.00]***
Rule of law										-0.457 [0.43]	
Regulatory quality											0.036 [0.95]
Constant	-6.814 [0.00]***	-2.280 [0.52]	-8.063 [0.09]*	-7.401 [0.00]***	-7.376 [0.00]***	-8.305 [0.00]***	-6.450 [0.00]***	-6.687 [0.00]***	-6.717 [0.00]***	-9.181 [0.00]***	-7.187 [0.00]***
Observations	117	115	115	114	107	108	87	110	110	113	113
Pseudo R2	0.22	0.29	0.21	0.25	0.29	0.25	0.24	0.22	0.22	0.28	0.28

Notes: p value in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 4. Determinants of Islamic Banking Diffusion: Number of Islamic Banks, Zero-Inflated Poisson Model, Cross-country, 1992-2006

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
GDP per capita (log)	0.435 [0.00]***	0.307 [0.00]***	0.124 [0.22]	0.467 [0.00]***	0.666 [0.00]***	0.302 [0.00]***	0.311 [0.00]***	0.435 [0.00]***	0.379 [0.00]***	0.344 [0.05]**	0.383 [0.02]**
Population share of Muslims	0.026 [0.00]***	0.034 [0.00]***	-0.011 [0.03]**	0.029 [0.00]***	0.036 [0.00]***	-0.012 [0.04]**	0.003 [0.59]	0.024 [0.00]***	-0.011 [0.03]**	0.032 [0.00]***	0.031 [0.00]***
Dummy for net oil exporters	0.474 [0.03]**	0.961 [0.00]***	-0.307 [0.21]	0.715 [0.00]***	-0.442 [0.15]	0.321 [0.11]	0.240 [0.31]	0.418 [0.07]*	-0.126 [0.55]	0.204 [0.53]	0.128 [0.71]
Distance from Malaysia (log)		-0.293 [0.07]*									
Distance from Bahrain (log)			-0.500 [0.01]***								
Number of conventional banks				0.016 [0.00]***							
Real interest rate					0.031 [0.59]						
Square real interest rate					-0.006 [0.15]						
Inflation (log)						1.025 [0.56]					
Square inflation (log)						-5.154 [0.08]*					
Budget balance							0.054 [0.04]**				
Share of exports to Middle East								-0.001 [0.95]			
Share of imports from Middle East									0.037 [0.00]***		
British legal origin										1.461 [0.00]***	1.481 [0.00]***
Rule of law										-0.086 [0.75]	
Regulatory quality											-0.147 [0.52]
Constant	-4.419 [0.00]***	-2.108 [0.19]	5.231 [0.02]**	-5.358 [0.00]***	-6.333 [0.00]***	0.177 [0.85]	-0.891 [0.24]	-4.190 [0.00]***	-0.823 [0.23]	-4.740 [0.00]***	-4.922 [0.00]***
Observations	117	115	115	114	107	108	87	110	110	113	113
Vuong test	1.31	1.38	0.39	1.35	0.89	0.31	0.52	1.25	0.48	1.27	1.18

Notes: p value in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%. The Vuong test has a standard normal distribution, with large positive values favoring the Zero-Inflated Poisson model, and large negative values favoring the Poisson model.

Appendix Table 5. Summary Statistics

Variables	Observations	Mean	Std. Dev.	Min	Max
Number of Islamic banks	1520	1.4	4.1	0.0	30.0
GDP per capita (log)	1520	7.1	1.4	4.1	10.6
Population share of Muslims	1520	31.5	38.2	0.0	100.0
Distance from Malaysia (log)	1494	8.5	0.7	5.3	9.4
Distance from Bahrain (log)	1494	8.1	0.8	5.5	9.1
Number of conventional banks	1520	36.8	52.3	1.0	336.0
Real interest rate	1206	8.8	14.0	-98.1	84.0
Inflation (log)	1354	0.1	0.3	-0.1	5.5
Budget balance/GDP	577	-1.8	4.7	-22.5	21.2
Share of exports to Middle East	1421	4.4	8.5	0.0	62.0
Share of imports from Middle East	1421	6.0	8.8	0.0	64.7
British legal origin	1470	0.4	0.5	0.0	1.0
Rule of law	848	-0.4	0.8	-2.3	2.0
Regulatory quality	851	-0.2	0.8	-3.2	3.5
Share of islamic bank assets in total banking assets	1520	0.02	0.1	0.0	1.0
Private sector credit to GDP (log)	1289	-1.6	1.0	-5.5	0.7
Oil price index	1520	27.2	14.2	13.1	64.3

Appendix Table 6. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	
Number of Islamic banks	(1)	1.00																
GDP per capita (log)	(2)	0.25	1.00															
Population share of Muslims	(3)	0.43	-0.09	1.00														
Distance from Malaysia (log)	(4)	-0.12	-0.01	-0.14	1.00													
Distance from Bahrain (log)	(5)	-0.50	0.08	-0.62	0.37	1.00												
Number of conventional banks	(6)	-0.04	0.38	-0.24	-0.01	0.27	1.00											
Real interest rate	(7)	-0.06	0.01	-0.07	0.13	0.11	0.11	1.00										
Inflation (log)	(8)	-0.05	-0.14	-0.10	0.10	0.04	0.04	-0.56	1.00									
Budget balance/GDP	(9)	0.11	0.35	-0.11	-0.19	0.16	0.14	-0.13	-0.05	1.00								
Share of exports to Middle East	(10)	0.24	0.06	0.41	-0.12	-0.50	-0.01	0.00	-0.02	-0.10	1.00							
Share of imports from Middle East	(11)	0.45	0.06	0.40	-0.27	-0.55	-0.01	-0.06	-0.05	-0.10	0.55	1.00						
British legal origin	(12)	0.23	0.07	-0.08	-0.23	-0.07	-0.14	-0.08	-0.07	0.08	-0.03	0.12	1.00					
Rule of law	(13)	0.16	0.73	-0.06	-0.19	0.03	0.25	0.01	-0.25	0.20	0.09	0.13	0.22	1.00				
Regulatory quality	(14)	0.09	0.67	-0.19	-0.09	0.24	0.30	0.15	-0.28	0.28	0.00	0.00	0.19	0.82	1.00			
Share of islamic bank assets in total banking ass	(15)	0.39	0.10	0.32	-0.12	-0.30	-0.11	-0.07	0.01	0.13	0.11	0.22	0.10	0.00	-0.07	1.00		
Private sector credit to GDP (log)	(16)	0.15	0.67	-0.06	-0.13	0.20	0.40	0.04	-0.24	0.28	0.04	0.07	0.07	0.70	0.66	-0.05	1.00	
Oil price index	(17)	-0.03	0.00	0.01	0.00	0.01	-0.02	-0.07	-0.12	-0.01	-0.01	0.06	-0.02	-0.07	-0.10	0.02	0.04	1.00

Appendix Table 7. Variable Definition and Sources

Variables	Definitions	Sources
Number of Islamic banks	Number of Islamic banks in a given country. Subsidiaries in foreign countries are treated as separate, and branches are consolidated. Only fully-fledged Islamic banks are considered.	
Share of Islamic bank assets in total banking assets	Assets of Islamic banks divided by total assets of the banking system.	Bankscope and various sources
Number of conventional banks	Number of commercial banks in a given country. Subsidiaries in foreign countries are treated as separate, and branches are consolidated. Banks that are not classified as Islamic are considered as conventional.	
GDP per capita (log)	Nominal Gross Domestic Product (GDP) divided by the size of the population.	
Real interest rate	Nominal interest rate adjusted for inflation.	
Inflation (log)	Change in consumer price index (CPI).	International Financial Statistics
Budget balance/GDP	Government revenue minus government expenditure, divided by GDP.	
Private sector credit to GDP (log)	Private credit by deposit money banks relative to GDP.	
Oil price index	Index of the average crude oil price (January 2005=100).	
Share of exports to Middle East	Exports to Middle Eastern countries as share of total exports of a given country.	Direction of Trade Database (IMF)
Share of imports from Middle East	Imports from Middle Eastern countries as share of total imports of a given country.	
Share of Muslims in the population	Numbers of Muslims divided by the size of the population.	Alesina, et al. (2003)
Distance from Bahrain or Malaysia (log)	Minimum distance between Bahrain or Malaysia and a given country (in km) as estimated by Gleditsch and Ward (2001).	Gleditsch and Ward (2001)
British legal origin	A dummy variable taking 1 if a country's commercial/company law is based on British legal origin, and 0 otherwise.	Porta et al. (1998)
Rule of law	The confidence of citizens in law, and the extent that they abide by the rules of the society, such as contract enforcement, property rights, police, and courts.	Kaufmann, Kraay, and Mastruzzi (2007)
Regulatory quality	The capacity of a government to provide sound policies and regulations which would promote private sector development.	