An empirical analysis of Diaspora bonds

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Abstract. This study is the first to investigate theoretically and empirically the determinants of Diaspora Bonds for eight developing countries (Bangladesh, Ethiopia, Ghana, India, Lebanon, Pakistan, the Philippines, and Sri-Lanka) and one developed country - Israel for the period 1951 and 2008. Empirical results are consistent with the predictions of the theoretical model. The most robust variables are the closeness indicator and the sovereign rating, both on the demand-side. The spread is not significant, suggesting Diaspora Bonds differ from normal investments. Good governance and wars are also important demand-side determinants of Diaspora Bonds. Among the supply-side factors; FDI, ODA, foreign exchange, inflation, external debt and remittances significantly determine the issue of Diaspora Bonds. Most importantly, this study is able to make predictions of the most promising candidate countries in issuing Diaspora Bonds in the future.

Keywords. Diaspora Bonds, Supply-side, Demand-side.

JEL. F21, F24, F34, F35, G38, H62, H63.

1. Introduction

High budget deficit is a common challenge that many developing countries face. While developed countries can rely on perpetual tax revenue to finance their budget deficits, developing countries are not successful in collecting sufficient tax revenue due to weak economic power, capital flight, tax evasion, and malfunctioning financial and capital markets. Under these circumstances government of developing countries have four options to finance their budget deficit: domestic borrowing, money printing, foreign reserves and foreign borrowing. Domestic borrowing is almost impossible due to lack of capital. Money printing has undesired side effects, such as inflation. Foreign reserves are not sufficiently available. In addition, budget financing with foreign reserves will distort the exchange rates. Therefore, developing countries are left with the last option: external borrowing. However, developing countries do not have an easy access to the international debt markets and are considered to be unreliable debtors due to bad experiences that lending countries or institutions have had with developing countries` debt obligations, see Michaelowa (2003). When they have an access to the foreign financial assistance (grants and loans) from multi- or bilateral donors, then this assistance has strict conditionality that governments of developing countries can not meet. Therefore, developing countries` governments have to make a decision between high interests on international capital markets - if

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available at all - and conditions by bi- or multilateral donors. However, in times of economic and financial crises and also in the long run it is not wise for developing countries entirely to depend on external financing, as during these times external financing may not be readily available.

Although workers` remittances constitute an important share of foreign reserves for these countries, their effects on development and economic growth are not proved to be positive in several studies, see Abdih *et al.,* (2008), Chami *et al.,* (2008) and Adams *et al.,* (2008). Especially, when remittances are spent on consumption, they further increase financial outflows.

Therefore, the difficulties with borrowing from international capital markets and the adverse effects of remittances motivated governments to develop an alternative external borrowing instrument - Diaspora Bond.

Diaspora Bonds are debt securities issued by governments or government agencies and are explicitly target to their Diasporas, see Chander (2001). Diasporas are given the option to invest part of their wealth in their homeland in the form of Diaspora Bonds. As the issuing country may not able or willing to pay interests appropriate to its credit rating (if existent anyway) and market perception, it relies on some kind of patriotic discount offered by the buying Diasporas. The idea is that by offering Diaspora Bonds instead of asking for donations, the countries can leverage the Diaspora's charitable intention.[1] Chander (2001) depicts that a person who is willing to donate a 100 US$ to a country[2], should be ready to buy Diaspora Bonds, and, hence, lend its money to that country, to a much larger amount at a lower-than-market interest rate. In fact, the amount lent should exactly reach a level, where the interest forgone by not investing at a market interest rate investment equals US$ 100.

Indeed, so far, Diaspora Bonds have been issued by several developing countries including, most prominently, Israel and India, but also Bangladesh, the Lebanon, Pakistan, Sri Lanka, the Philippines, Ghana and Ethiopia. The last three countries only just started their Diaspora Bond very recently. South Africa and Kenya have planned to implement Diaspora Bonds. More strikingly, on September 2010 Greece announced to issue Diaspora Bonds.

Given the importance and already existence of Diaspora Bonds[3], rather little research has been devoted to understand the determinants of Diaspora bonds theoretically and also empirically. In this paper first we introduce a theoretical polito-economical model of supply and demand for Diaspora Bonds. Then we test this model for large sample countries that have issued Diaspora Bonds. Our empirical results are not only consistent with the predictions of our theoretical model, but also deliver important policy implications.

Section 2 introduces the theoretical model. Section 3 gives the results of the empirical analysis. Section 4 concludes and discusses the policy implications of our results.

2. The theoretical model

This Section analyses the incentives to issue and buy Diaspora Bonds for the issuer and the buyer, respectively. Hypotheses for the determinants of the supply and demand of these bonds are developed from the theoretical and empirical literature on development finance and on Diaspora Bonds. The issuer's motivations and trade-offs represent the supply determinants. The buyer's decision making process determines the demand factors. Merging supply and demand leads to a complete model. The complete model includes both supply- and demand side factors that determine Diaspora bonds.

2.1. Issuer incentives - supply side

The issuer of a Diaspora Bond is either the government or in some cases the central bank (or another public entity). In any case, the decision to issue such a bond will depend on the government's budget planning. The following simplified

model has the basic assumption is that the government finances its expenditure with tax income and deficit, see Fischer & Easterly (1990).

Expenditures = Tax Income + Deficit   (1)

The deficit can be financed through a mixture of money printing, the use of foreign reserves, foreign borrowing or domestic borrowing, Fischer & Easterly (1990):

Deficit = Money Printing + Foreign Reserve use + Foreign Borrowing
          + Domestic Borrowing   (2)

Diaspora Bonds are a part of foreign borrowing, and then the equation (2) can be refined into:

Foreign Borrowing = Deficit – Money Printing – Foreign Reserve use
          – Domestic Borrowing   (3)

The dependent variable - *foreign borrowing* - in equation (3) also includes the Diaspora Bond which is the variable of interest in our analysis. The right hand side variable, the deficit is positively correlated with foreign borrowing. This is logical, as the budget deficit is a basic precondition for the consideration of Diaspora Bonds as a source of funds for developing countries.

In order to understand the correlation between budget deficit and foreign borrowing better, we substitute the deficit with expenditures minus tax income (as defined in equation (1)):

Foreign Borrowing = (Expenditures – Tax Income) – Money Printing
          – Foreign Reserve use – Domestic Borrowing   (4)

The basic source of sovereign revenue is taxation. If a country can rely on a sufficiently high tax base and if the administration is capable of collecting these taxes, it will prefer this kind of funding, as with this instrument there is no need to repay the funds. Therefore, it is in general accepted that external borrowing and tax revenue are substitutes.

Money printing is another way to finance budget deficit. Money printing as a means to finance the budget deficit is usually directly associated with inflation.[4] Therefore, it is avoided in most of the time.

Foreign reserves can be utilized to finance the budget deficit, when they are available. However, when the foreign exchange reserves are expected to be exhausted, the currency will devaluate Krugman (1979). This can lead to a balance of payments crisis, which often is itself the very reason for issuing Diaspora Bonds. The example of India is consistent with this argument. Therefore, a measure of foreign reserves is included into the model for two reasons: It captures the substituting possibility (the running down of foreign exchange) and at the same time it captures one of the most named motives for issuing Diaspora Bonds.

The issue of domestic borrowing versus external borrowing is rather complex, and therefore, Panizza (2008) suggests that rather the characteristics of the debt should be analyzed. In addition, Drazen (1998) or Vasishtha (2007) argue that countries have different incentives to repay debt held by residents than by non-residents and the interest-differentials differ between foreign and domestically held debt. However, the effect of the domestic debt could not be analyzed empirically, due to lack of data for majority of countries in our sample.

Up to now, the left hand side variable - *Foreign Borrowing* remained aggregated. We separate *Diaspora Bonds* from other sovereign external debt by moving *Other External Borrowing* into the right-hand side of the equation:

Diaspora Bonds = (Expenditures – Tax Income) – Money Printing – Foreign Reserve use – Domestic Borrowing – Other External Borrowing (5)

Equation (5) suggests that other external debt can substitute Diaspora Bonds to finance the budget deficit. Although this is a rather simple assumption it is often argued that Diaspora Bonds are issued when ordinary external debt can not be issued on the international debt market or only at very high interest rates are available, see Fischer & Easterly (1990).[5]

An increased issuance of Diaspora Bonds would therefore allow a decrease in other external debt. In our analysis, ODA, Remittances, Trade and FDI are included in order to account for other external debt. These additional variables will also account for the political factors in government's finance decision. This extension is particularly important as Diaspora Bonds cannot be seen just as an ordinary monetary instrument. The political feature of issuing Diaspora Bonds is to target countries with large Diaspora population, and to attract Diasporas` savings and remittances and therefore to concentrate on more characteristics of sovereign finance than just expenditures, taxes, money printing, use of foreign reserves and debt.

The budgets of developing countries constitute a large amount of ODA lent by developed nations. The question of how ODA transfers and external borrowing are connected is subject to academic discussion since the pioneer work by Heller (1975). Feeny & McGillivray (2003) show that there is a positive correlation between aid and borrowing (net of aid loans). Consistent with their previous study (McGillivray & Morrissey, 2001) receiving governments have misperceptions and illusions about the real or nominal value of aid. Therefore, overspending leads to additional borrowing. However, Mavrotas & Ouattara (2003) show for Côte d'Ivoire that despite the importance of the aid type[6], sovereign borrowing is negatively correlated with aid. Also for Ghana there is evidence of (domestic) borrowing decreasing with aid, see Osei, Morrissey & Lloyd (2005). Finally, an Ouattara (2006) show with panel analysis is that aid and borrowing are substitutes for 20 years. Acknowledging the ongoing discussion on this issue[7], the hypotheses on the correlation between ODA and Diaspora Bonds supply is expected to be rather weak.

In addition, the type of aid has an important influence on its impact on fiscal policy, Mavrotas & Ouattara (2003). As shown in Gupta *et al.,* (2004), opposed to ODA grants, ODA loans do have an impact on domestic revenue. However, in the present case it would be too complex to include all the different types of aid into the empirical model. From a theoretical point of view, however, this differentiation certainly makes sense.

Even though FDI does not directly fund a country's government budget, it can stimulate the host country's economy and bring foreign currency into the country. Doing this, it will generate tax revenue for the government and income for the workers. Picht & Stüven (1991) touch the issue of FDI as a substitute for borrowing. Also, Agarwal, Gubitz & Nunnenkamp (1991) consider FDI as a possibility to substitute for other external (private) financing. These articles were published in light of the past debt crisis of the 1980s, which is especially interesting for the current financial crisis. Judging the effect of FDI on the government's decision whether to issue a Diaspora Bond or not still is difficult. However, the government will probably consider FDI as an alternative way to attract foreign capital as mentioned by the above cited authors.

There are some entry costs into the Diaspora Bond market. Different tolls, charges and fees might be required; for example to the commercial seller of the Bonds or for SEC registration. Therefore, a threshold number of potential investors are required for a successful launch of a Diaspora Bond. Many Diaspora Bonds explicitly target remittance senders, for example in the Gulf countries. The way, in which the Diaspora - as a possible source of external finance - is perceived by its home country governments crucially, depends on the impact it is expected to have.

Therefore, in estimating the impact the Diaspora could have on its home country, the amount of money remitted may well be a more accurate measure than the total number of emigrants of a country, see also Van Hear (1998) and Hirschman, Kasinitz & DeWind (1999). Consequently, the amount of remittances (in relation to the size of the home country economy) is expected to act as a signal for the home country government. A high ratio of remittances to the gross national income (GNI) indicates a large amount of Diaspora investments that could possibly be attracted via Diaspora Bonds.

By taking into the entire hypothesis mentioned above, the supply for Diaspora Bonds can now be modelled as:

$$B_s = (G – T) – INF – FX – EDT – ODA – FDI + REM \tag{6}$$

The abbreviations for the different variables are explained below:

B_s	denotes	Diaspora Bond supply
G	denotes	Government Spending
T	denotes	Tax Income
INF	denotes	Inflation
FX	denotes	Foreign Reserves
EDT	denotes	External Public Borrowing
ODA	denotes	Amount of ODA received
FDI	denotes	Foreign Direct Investments (inflow)
REM	denotes	Remittances

2.2. Buyer incentives - demand side

Although investment decision is based on the comparison of expected financial earnings, for Diaspora investments, the expected social and emotional returns are crucial, see Nielsen & Riddle (2007).

However, we start modelling the decision making process with purely economic assumptions: A Diaspora member compares the Diaspora Bond of her home country to an investment alternative. This is done in two ways:

- Ketkar & Ratha (2009a) compare the Diaspora Bond coupon to an equally rated
  U.S. corporate bond coupon.
- Chander (2001) compares the Diaspora Bond coupon to an average regional US$ sovereign bond coupon.

However, the comparison of Ketkar & Ratha (2009a) is not quite correct with regard to the public guarantee which sovereign bonds and Diaspora Bonds enjoy in contrast to corporate bonds. Concerning Israel, Ketkar & Ratha (2009a) somewhat inconsistently compare the coupons of DCI bonds with U.S. Treasury bills by ignoring the risk difference between the two countries. What seems to be the most interesting comparison is one that compares the Diaspora Bond coupons to the ordinary home-country treasury bills[8] (given, the latter is in foreign currency and of equal maturity). Using this comparison, the same investment risk can be assumed and the difference is only defined by the patriotic discount[9] (and, to some extent, the denomination, which is higher in all cases of Treasury bills). This approach is very similar to the one Chander (2001) follows.[10] However, data gathering on historical interest rates of exotic bonds from developing countries is not an easy task. In many cases, developing countries do neither have a very long, nor a very successful history of sovereign bond issues on the international market. As it was not possible to gather the data on coupons of the respective treasuries, the Diaspora Bond interest rates will all be compared to the U.S. Treasury bills of the same maturity. Hence, in the empirical analysis the Diaspora Bonds are compared to so-called Eurobonds.

However, Diaspora investors may not be interested in income from the interest, and therefore they may ignore the additional interest when buying Diaspora Bonds.

Many Diaspora Bonds under consideration come with a so-called patriotic discount. Altruism provides a possible explanation. As discussed for example by Akkoyunlu (2008), remittances are motivated by several motives such as altruism. This could also be the case for Diaspora Bonds. By lending money to the government of the home country, public goods for all citizens may be provided[11], and in the long run, the Diaspora investor could as well profit from this development when she/he faces a better investment climate in the home country. No matter, whether this consideration is labelled altruistic or egoistic in the long run, the pure fact that Diaspora investors are ready to buy bonds that require a patriotic discount already show - to a certain degree – a behaviour which is not completely led by a purely financial consideration. There are in fact studies that show how patriotism can influence investment decisions (Morse & Shive 2006). But even when this patriotism or altruism[12] is taken into consideration, it can be argued that the Diaspora favours a smaller patriotic discount. The spread measures the difference between the U.S. Treasury bill coupon and the Diaspora Bond coupon. Hence, the lower the value of the spread, the lower the patriotic discount. The spread turns negative as long as the Diaspora Bonds coupon is higher than the U.S. Treasury bill coupon, which should mostly be the case. The threshold value, where the patriotic discount disappears, cannot be determined, as comparing Diaspora Bonds coupons to the U.S. Treasury bills implies ignoring the risk differential.

For their investment decision, members of the Diaspora will assess the government's willingness to repay and its ability to repay the amount lent via Diaspora Bonds at maturity. The assessment of the ability to repay seems sensible, as it considers certain economic indicators that describe a government's capability of repaying outstanding debt. The term "willingness to repay" perhaps needs a closer look: As there is no mechanism to compensate lenders in case of a sovereign default, in theory the question arose, why governments have an incentive to repay their debts at all (willingness to repay). Two explanations are provided by the literature:

- The government cares about its reputation in order to take out loans in the future (Eaton & Gersowitz, 1981). This would imply that a country that has closer links to the world will repay its debts with higher probability, as it relies on perpetual lending.

- The government cares about possible sanctions in the event of debt repudiation (Bulow & Rogoff, 1989). This explanation would imply that countries with a higher output are more creditworthy as their economies are more vulnerable to sanctions in case of debt repudiation (Lane 2004).

Gelos *et al.,* (2004) argue that in fact there is no clear-cut distinction between a sovereign government's ability and willingness to repay. For example, while a government may in principle repay because a country's net worth is greater than its debt, repayment may not be feasible because it may either imply strong political opposition or severe humanitarian consequences such as starvation. When assessing countries' willingness and ability to repay, investors rely heavily on standard indicators such as credit ratings to monitor the borrower (Ratha *et al.,* 2009). A country's sovereign rating by one of the big rating agencies, Fitch Ratings (Fitch), Moody's Investors Service, and Standard and Poor's (S&P) is therefore the key for access to the international credit market. As mentioned above, many developing countries - 70, to be exact - do not even have a sovereign credit rating. Of the 86 developing countries that do have such a rating, only 15 have one longer than 5 years (Ratha *et al.,* 2009). Ratha *et al.,* (2009) provide an overview over models which allow to determine sovereign ratings of unrated countries (so-called shadow-ratings) and they also provide an own model, which seems to correlate heavily with the sovereign ratings by the big rating agencies. Most of the countries in the dataset, however, do have a sovereign rating, at least for most of the time they are issuing Diaspora Bonds. Hence, for the empirical analysis, an index with 22 categories is constructed to convert Standard and Poor's sovereign long-term

rating for foreign currency credit (Standard and Poor's, 2007) into a categorical variable.

Until now, we have concentrated on purely economic factors. However, the home country's government policy or governance is also assessed by Diasporas when making the investment decision. Good governance is a concept which is used very differently and the definitions and measures in the literature will probably again differ from the very subjective view of a Diaspora member on its home country. There are many indicators which attempt to measure good governance at least to some extent. A good overview is given by Kaufmann *et al.,* (2008). In our empirical section, we use Freedom House's "Freedom in the World" (Freedom House, 2009) to measure good governance for several reasons. Firstly it has a very individual-based approach: "The survey does not rate governments or government performance per se, but rather the real-world rights and social freedoms enjoyed by individuals" (Freedom House, 2009). This approach makes it valuable for the investment decision, as Diaspora investors will probably consider the experience they or their families make regularly in the home countries. They will assess their own and their family's freedom inside the home country. Secondly, the database is very comprehensive, providing annual data since 1972 and for 193 countries. Thirdly, it has an easy access.

The connection between the Diaspora and its home country certainly affects the Diasporas investment decision should be included in our theoretical model. This connection is clearly not directly observable, but there are certain indicators for it. The sending of remittances is 13 certainly a good indicator for a connection, especially with regard to Diaspora Bonds. By sending remittances, members of the Diaspora stay in touch with their families, but also with authorities and even financial institutions of their home countries. Many Diaspora Bonds are directly targeted at wage earners that send remittances home. The bonds are sometimes also explicitly labelled an instrument to channel remittances and make them more efficient. Although remittances tap the emigrant's wages and Diaspora Bonds the emigrant's savings (Ketkar & Ratha 2009a) the targeted emigrant is the same. Therefore, it can be expected that a Diaspora that sends a large amount of remittances through formal channels[13] is better connected to its home country and more aware of the financial products it offers. The higher the extent each migrant is involved in this connecting act of sending remittances, the closer the Diaspora is considered to be to its home country. The closeness will thus be measured in remittances per migrant. Several studies can support this measure of closeness by showing that emigrants with relatives in the home country generally send more remittances per capita or are more likely to send remittances, see Menjivar *et al.,* (1998) and Blue (2004).

One of the most important motives for the Diaspora Bonds demand is an ideological one. As most Diaspora Bonds relies on a patriotic discount, the investor must be willing to provide this discount. A country that is shaken by civil war may have a large number of emigrants. But these emigrants probably have been displaced or expelled by the enemy population group and are therefore assumedly not ready to give them a patriotic discount. Here, we rather expect a patriotic surcharge, if any lending takes place at all.

Having described the determinants for bond demand, we can write it as follows:

$$B_D = (i_E - i_D) + RAT + GOV + CLO - WAR \tag{7}$$

Where;

B_D denotes		Diaspora Bond Demand
i_E denotes		Interest Rate of Equivalent Investment
i_D denotes		Interest Rate of Diaspora Bond
RAT denotes		Sovereign Rating
GOV denotes		Governance

CLO denotes   Diaspora Closeness
WAR denotes   Civil War

2.3. The complete model - supply and demand sides

As we have shown buyers' and sellers' incentives determine the supply and demand for Diaspora Bonds. However, these two decisions are simultaneous and determine the equilibrating level of Diaspora Bonds:

$$B_S = (G - T) - INF - FX - EDT - ODA - FDI + REM \qquad (8)$$

$$B_D = (i_E - i_D) + RAT + GOV + CLO - WAR \qquad (9)$$

One question that might arise is whether the model needs to be specified as a simultaneous equation model. The fact that it is a supply/demand model which is supposed to be estimated, suggests a simultaneous equation, as in general such a model is specified in the following way:

$$\text{Demand Function: } Q_d = \beta_0 + \beta_1 * P + e \qquad (10)$$

$$\text{Supply Function: } Q_s = \beta_0 + \beta_1 * P + e \qquad (11)$$

$$\text{Equilibrum Condition: } Q_d = Q_s \qquad (12)$$

where Q_d stands for quantity demanded and Q_s for quantity supplied. Insertion results in a supply function that is dependent on the quantity demanded and vice versa. Price (P) and Quantity are jointly determined. Due to the endogenity in this model, a simultaneous equation[14] (12) would be required. However, in the Diaspora Bonds model set up above, there are no two variables that are jointly determined (like the price (P) in equations (10) and (11)). The quantity of Diaspora Bonds sold does not affect any of the independent variables. They are all considered being exogenous.[15] The only variable that could perhaps be somehow determined by the quantity of Diaspora Bonds sold might be the spread $((i_E - i_D))$. This could be the case, if it is assumed that the issuer adjusts the coupon of the Diaspora Bond depending on the amount demanded (or, in a second period, the amount sold). But looking at the data, this is in fact hardly ever done.[16] In the context of Diaspora Bonds, the issuing countries seem not to necessarily seek to minimize the interest rates of the Diaspora Bonds. Diaspora Bond investors serve as a lender of last resort, when the international market perception of investment risk is substantially different from the Diaspora's perception of that risk. The market power of the issuing countries is by nature quite low. This leads to a model, where different exogenous independent variables influence the equilibrium quantity on demand- and supply-side. The supply side offers a bond at a certain interest rate, while the quantity to be sold is mostly flexible. Thus, supply and demand curves of an abstract model would look like the ones in Figure 1.
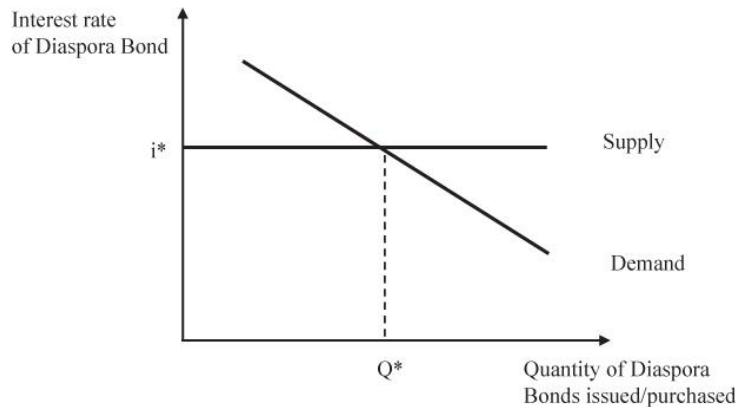
Figure 1. *Supply- and Demand-Curves for Diaspora Bonds*
Note: that moving up the Y-Axis means lowering the interest rate

Consequently, these two equations are aggregated into a single one, which gives the equilibrium level of Diaspora Bonds (BE) as a dependent variable. Additionally, some control variables will be included into the model. Eichengreen & Mody (2000) suggest including the bond characteristics when analyzing the determinants of the spread for an emerging market debt. To account for that, currency, maturity and denomination of the bonds are also integrated into the full model (not that, as control variables, they are not explicitly stated in the following equation):

$$B_s = (G - T) - INF - FX - EDT - ODA - FDI + REM + (i_E - i_D) + RAT + GOV + CLO - WAR \qquad (13)$$

Another refinement of the model, which is not explicitly stated in the model above, is that the supply-side variables are lagged for two years in our empirical analysis. This lag structure stems from the assumption that the process of designing and placing of the Diaspora Bond with the Diaspora abroad takes at least one year. During the period of designing the bonds, the economists in charge, in particular those in developing countries do hardly have access to data that is newer than one year. This implies that at the time the Diaspora investors make their investment decision, the data for the home country's supply decision already lies (at least) two years in the past.

3. Empirical Analyses
3.1. The salient feature of the data on Diaspora Bonds
The data on Diaspora Bonds is not very rich, as only recently it was considered an interesting tool for development finance. For Israel, a comprehensive dataset for more than fifty years is available (Rehavi & Weingarten, 2004). India, being the second most important issuer of Diaspora Bonds, has only fifteen years of experience with this instrument. Additionally, there is data for Bangladesh since 2001. For all the other countries, the experience is very limited. For some of them, only the amount offered by the issuing entity is known, together with the terms and conditions (coupon, maturity, currency, minimum amount). Our sample consists of nine countries Bangladesh, Ethiopia, Ghana, India, Israel, Lebanon, Pakistan, the Philippines and Sri Lanka. Data has been compiled starting from 1951 (the first issuance of Israeli Diaspora Bonds) up to 2008 (the most recent available data).

An overview of the data is given in Appendix – Table 1. The dependent variable, which is Diaspora Bonds balance (i.e. the debt liabilities on the respective accounts in the balance of payments) has 493 observations, 39 are missing. Clearly, a majority of observations (388) take a value of zero whenever there is no Diaspora Bond issued. This leaves 104 observations above zero. The fact that the dataset is

left-censored requires special attention. The most common way to solve the problem is the estimation of a Tobit-regression. However, also other estimation techniques are dealt with in the following section. The budget deficit (G - T) and the spread $(i_E - i_D)$ do only have quite few observations. The effect of this lack of data point will be seen in the regressions, where in fact, only one or mostly even neither of the two variables could be included in the same regression. All the other variables have sufficient 17 amount of observations, however, the control variables maturity, denomination and currency are either dummies or discrete variables, which cause problems, especially in fixed effects regressions. Again emphasized here should be at this point the characteristics of the spread variable: The difference in coupons rate between U.S. Treasury Bills and the Diaspora Bond does not measure the "true" patriotic discount, but it still captures the profit-lead investment decision of the Diaspora. However, the negative values of the spread (where the Diaspora Bond coupon is higher than the U.S. Treasury Bill) can still incorporate a patriotic discount compared to normal sovereign bond coupons of that country. Still, the more negative the spread, the lower the patriotic discount by trend, at some threshold turning into an unpatriotic surplus.

3.2. Panel data analysis

The panel data analysis section is divided into several steps, where with each step, the estimation method applied is more sophisticated. Respecting the panel form of the data, ordinary least square (OLS) with fixed effects (FE) or, where applicable, random effects (RE) general least square (GLS) method was applied first. The Hausman test was performed to see whether country fixed effects were necessary or not. The estimations results can be seen in Table 2. First of all, as already mentioned above, there are many variables and also some correlations between independent variables are high, which makes it impossible to include all variables into the model. This is true in particular for the bond characteristics, which were supposed to be included as control variables. However, the currency variable is a dummy, meaning that if fixed effects are applied, the currency variable has to be dropped. If integrated into a random effects model it does not have any significant impact. A longer maturity seems to have a negative impact on the attractiveness of Diaspora Bonds. However, there is not much variation in the maturity variable, which ranges only from three to fifteen years with a mean of around six years. Also denomination seems to have a narrow positive impact. However, in general, it seems that we can not rely too much on the bond characteristic variables for a serious judgement.

First regressions deliver some quite interesting results. Two variables - *the closeness indicator* (which is remittances per member of the Diaspora) and *remittances* (as % of GNI) are significant throughout all specifications, see Table 2. The closeness indicator, which is supposed to be a demand-side factor, has the expected sign. As argued above, Diasporas who are sending more remittances per member are much more closely connected to their home countries and subsequently ready to buy more Diaspora Bonds. The coefficient size is very small compared to the other coefficients, but this variable is measured in US$ per emigrant, which makes it quite important.[17] Remittances were expected to be some kind of signal for the issuing countries. This signal was expected to be interpreted as a positive one for the Diaspora's demand for Diaspora Bonds. However, obviously, remittances are rather seen as an alternative source for foreign exchange, serving as a substitute for Diaspora Bonds.

Table 2. *Coefficients of Random- and Fixed-Effects Regressions*

Variable	RE GLS (1)	OLS FE (2)	RE GLS (3)	OLS FE (4)
CLO	.1182647***	.3335076***	.1782234***	.2689294***
GOV	-581.9917***	70.21327	-508.4668**	83.36054
RAT	143.6284*	171.0205***	60.07854	261.2009***
WAR	999.0417	839.8334***		797.2302***
EDT	-102.5931***	2.606518		
FDI	13701.61	8090.845	24208.68	18849.45**
FX	429.1838	-2092.611***		
ODA	21191.39	-146.95	-27465.96**	-3004.881
REM	-29489.25**	-11742.12***	-42840.79***	-7069.946***
(G-T)	76.17883			
INF	28.1545	2.503772		.5358545
$(^iE - {}^iD)$			99.1751	
MAT			-543.1946***	
DEN			.7291391*	
CUR			1581.638	
Constant	9848.138***	-172.9236	7835.188***	-614.6252
R^2 (overall)	0.9406	0.3370	0.9107	0.6112
Obs.	52	181	66	206

Note: significant at the * 10%, ** 5%, *** 1% level.

Rating is also significant with an expected sign. However, rating might represent other factors such as the shadow ratings (Ketkar & Ratha 2009a). In addition it may also correlate with some other exogenous variables in our model. However, our initial investigation shows that the correlations are not high. Therefore, we can still argue that Diasporas, although wanting to support their home country, try to minimize the investment risk.

Speaking of risk, the FDI variable is positive throughout the regressions as opposed to the predictions of our theoretical model. In our theoretical model FDI was considered as a supply-side factor to substitute for Diaspora Bonds by providing foreign currency inflows. However, the positive sign in empirical results can reflect two effects: Firstly, it could serve as a signal for Diaspora Bond investors who are looking for some first-mover investors who are paving the ground for further investment and therewith making investments safer (*risk effect*). Secondly, if the Diaspora investor is, himself, an FDI source (an FDI investor), he may see Diaspora Bonds as a mean to support the country which – in return - provides public goods whereof her FDI investments may benefit (*externality effect*). The fact that FDI turns significant only in the fixed-effects regression makes country characteristics - for example different tax structures - reasonable in explaining a share of this variable.

It seems that Diaspora Bonds are not associated with the common risk perception pattern as in other types of investment. This becomes obvious when having a look at the civil war variable, which shows a strong and significant positive coefficient on Diaspora Bonds. This connection is unexpected by the theoretical model, yet it is consistent with the findings of Ketkar & Ratha (2009a) that particularly in times of crises the Diaspora Bonds serve as a stable source of external finance. During the 6-Days war for Israel and in the aftermath of the nuclear testing of India, both countries were able to raise an extra ordinary amount of foreign exchange. It must be noted, though, that the civil war variable is so far significant only in the fixed-effects model, which is critical, as we do not have much variation in this variable.

External debt, foreign exchange and ODA show, when significant, the expected negative signs. This result is consistent with our theoretical model that is to raise foreign exchange is one of the main reasons for countries to issue Diaspora Bonds.

As for governance, the regression results show the expected correlation too.[18] Good governance is indeed an important factor for the Diaspora's investment decision. It seems that the Diaspora's perception of good governance could be measured quite well with this index. The rather time-invariant variable governance

is not significant in the fixed-effects model and this can be explained by the inserted country dummies that control for country characteristics.

Three variables show no significance at all: The budget deficit, inflation, and the spread. For the budget deficit the insufficient amount of observations might be the reason. The inflation may indeed have no influence on Diaspora Bonds, thereby pointing to altruistic motives of Diasporas (Akkoyunlu, 2008), rather than to the money printing incentive by the issuing country, as theoretically modelled. However, it must be kept in mind that there is a certain correlation between inflation and the rating. And although it is not significant, a measure of inflation is probably integrated in the rating variable.

Finally, what is interesting in terms of patriotism in the investment decision is the fact that the spread seems to be completely insignificant. It must be kept in mind that there is quite some correlation with other explanatory variables. But, there was no combination of variables that lead to a significance of the spread variable. Indeed, this may point once again to the fact that the investment decision on Diaspora Bonds is very different from a common investment decision. It happens to be that the Diaspora does not really compare different investment options (at least for that amount of money for which they consider an investment in Diaspora Bonds).[19]

So far, it seems that the investment decision for the Diaspora strongly depends on its closeness to the home country, on the good governance of the home country, on the alternative external financing (remittances) and on the rating of the home country, which indicates the latter's willingness and ability to repay the debt.

The analysis has so far ignored the fact that a large amount of the observed values is zero (388 out of 493). The zeros are "true" zeros, meaning that there was no wrong data coding or errors.[20] The zeros simply state that the country did not issue a Diaspora Bond at that point of time. This large amount of zeros in the dependent variable may skew the distribution which then can bias an OLS regression. The fact that the dependent variable is by definition limited at zero and we can observe those zeros make it censored.[21] The simplest way - and one that is often pursued (see Frankel, 1997) - to solve the problem is to drop all zero observations. However, this of course can also bias the results, especially in a case like the present one where a large amount of dependent variable values are zero. If the zero values should be kept in the model, the standard way to handle the problem of a censored dependent variable is to apply Tobit model. This is done in the following. There is a number of ways to deal with large amounts of zero-values however; they are mostly designed for discrete dependent variables.[22]

In gravity models for trade or migration such as in Santos Silva & Tenreyro (2006), Flowerdew & Aitkin (1982), and Frankel (1997), the zero values are handled by adding small values (mostly 1) to them and then transforming all values into logarithmic form in order to avoid negative predicted values for the dependent value (when estimating OLS). Yet this does not solve the problem of the model at hand, as the log of 1 is, again, zero, which solves the gravity model problem but not the zero problem in general.[23] Additionally, all above cited authors mention certain problems with this transformation, especially in the presence of heteroscedasticity which is very likely, again, due to the zero values. Another option, suggested by Wooldridge (2002) is to use the exponential function of the independent variables (exp(x)) and then estimate beta using nonlinear least squares (NLS), but this has the same limitations due to heteroscedasticity and will also lead to inconsistent estimates (like all nonlinear transformations), see Santos Silva & Tenreyro (2006). To avoid these problems, Santos Silva & Tenreyro (2006) and subsequently also Desbordes & Vicard (2009) apply a Poisson pseudo maximum likelihood model (PPML), also called Poisson quasi maximum likelihood model (PQML). Although mostly used for count data, Poisson regressions may also be used for continuous data, see Ancelet *et al.,* (2009) and Flowerdew & Aitkin (1982).

The application of the PPML in a (aid or) trade context is a relatively new way to account for the problem of many zeros in gravity models of bilateral trade or bilateral FDI (see Desbordes & Vicard, 2009 and Nowak-Lehmann *et al.*, 2009). However, while Desbordes & Vicard (2009) apply PPML and are therefore able to include the zero observations into the model, Nowak-Lehmann *et al.*, (2009) are sceptic concerning the model's ability to deal with heteroscedasticity.

In our empirical analysis, some Tobit regressions are first performed, before testing the results by applying a PPML model.[24] In Table 3 the results of the Tobit equations and the PPML equation will be compared.

Table 3. *Coefficients of the Tobit and PPML Regressions*

Variable	Tobit (5)	Tobit (6)	Tobit (7)	PPML (8)
CLO	.3026319***	.2300348***	.4336496***	.0000159
GOV	-573.312	10.33388	-83.02589	-.1130795*
RAT	379.1032***	351.9593***	374.7693***	.1932058***
WAR	2001.04	2970.393***	1158.931*	20.59266***
EDT	117.822**		28.86037	.0481961***
INF	3.939373		-78.80666	.0072874
FX	-7281.555**		-8621.037***	-1.072178
ODA	-131533.1***	-39638.4***	-82664.87***	-20.37624
FDI	2497.544	51692.61**	-11882.73	7.076343***
REM	93515.42**	47017.67***	-18111.85	69.23729***
MAT	-2143.041	-197.1134		-.4393598**
DEN	4.633997**	2.043002***		(dropped)
CUR	-9571.406*	-6101.541***		(dropped)
Constant	9119.129	-1088.622	925.5356	
Obs.	135	164	181	85
Censored Obs.	95	99	139	

Note: significant at the * 10%, ** 5%, *** 1% level.

The Tobit regressions largely support the findings from the OLS and GLS regressions. Most importantly, the closeness variable keeps its sign and stays significant. Also, the rating stays significant and positive throughout regressions (5) to (7), further supporting this variable's importance. Civil war keeps being an important factor with significant positive values in regressions (6) and (7).

Inflation, as well as the spread and the budget deficit (not showed), stay insignificant. The foreign reserves variable underlines significantly that it is one of the main reasons for countries to issue Diaspora Bonds. ODA, on the other hand, stays a fundraising alternative to Diaspora Bonds. Where significant (in regression (6)), FDI can be interpreted as in the OLS regressions although contradicting the theoretical model: Firstly, high FDI investments could serve the investor as a signal for the trustworthiness of the country. And secondly, Diaspora Bond investments could be a complement to FDI investments.

However, the variables for governance, external debt and remittances do show other results: Governance is no longer significant in the Tobit regressions; however, it shows the expected sign and turns significant again in the PPML regression (8). External debt changes the signs and is positively correlated with Diaspora Bonds in one of the regressions. This should not be over-interpreted as the external debt variable is correlated not only with ODA, but also with denomination, closeness, FDI and foreign reserves. Dropping the control variables also turns external debt insignificant. Far more important, the remittances variable turns sings and now is positive, at least in regressions (5) and (6). This would be consistent with the model and attribute the remittances again a signal function for the issuing country. This is the most striking change when moving from simple OLS to Tobit regression.

Now moving on to the comparison of the Tobit results to the PPML results, which should be correcting for a disputed amount of heteroscedasticity, the coefficients for closeness, foreign exchange and ODA are now found insignificant. On the other hand, also the values for governance and maturity changed and

became, like in the OLS regressions, significant in the expected way. So if indeed, the PPML model is able to correct the heteroscedasticity which is certainly also caused by the large amount of zero values in the sample, closeness, foreign exchange, and ODA do not have the expected effect on Diaspora Bonds. For ODA and foreign exchange, there were already mixed results in the OLS regressions. Far more surprising is the fact that closeness is no longer significant, although it prove significant in all OLS and Tobit regressions. The other variables, rating, civil war, external debt, inflation, FDI and remittances, show results comparable to the Tobit regressions. Rating, civil war, inflation and FDI are consistent also with the OLS regressions, further underlining their robustness. The spread and budget deficit variables again reduced the regressions to very small samples. Nevertheless, the variables were tested (not shown in the results tables) but not found significant.

The Tobit model (and also the PPML model), however, has some weaknesses if applied to the data at hand. The Tobit model assumes that the same independent variables determine if there is investment in Diaspora Bonds at all and if yes, then how much. In the present case, it might be argued that the selection of which countries do have a positive value of Diaspora Bonds is determined rather by supply factors than by demand factors. This assumption stems from the fact that the issuer offers Diaspora Bonds in the first place, without complete information on the demand for these bonds. In a second step, the buyers demand a certain amount of Diaspora Bonds, depending on the offer already made by the issuer. As argued before, the model incorporates the assumption that once the offer is made, the amount sold rather depends on the demand than on supply (also compare Figure 1). This would imply that the allocation equation is dominated by the demand-side coefficients. The observation that for all countries in the sample, there is no zero value due to a lack of demand[25] underlines the argument just made.

There are two basic ways to deal with this sample selection: The first one is a model with two steps, including a Probit regression for the selection equation and an OLS regression for the allocation equation. The other model is a Heckman regression, which performs both regressions but connects the error terms of the first (Probit) regression to the second one by adding the inverse Mill's ratio (Heckman, 1976). Note that for the Probit equation, a dummy variable for Diaspora Bonds is created, turning 1 whenever a Diaspora Bond is observed and 0 if no Diaspora Bonds is observed. Missing values are coded 1, as they reflect observations where a Diaspora Bond was in fact issued, but the exact value is unknown. The results of the two methods are presented in Table 4:

Table 4. *Coefficients of the Heckman and Probit/OLS two-step Regressions*

Variable	Heckman (9)	Heckman (10)	Probit/FE OLS (11)
selection equation			
(G-T)			
INF	-.0496216**	-.0478287**	-.0245269
FX	-.5675685	-.5819957	-.4310428
EDT	-.0366973***	-.0354886***	-.0199307*
ODA	-22.7988***	-22.07604***	-28.61789***
FDI	52.9276***	48.31401***	110.2031***
REM	8.09376*	8.137258*	12.80658***
allocation equation			
$(i_E - i_D)$		370.175	81.61118
RAT	283.8864***	324.6199***	320.541***
GOV	-716.6568***	-1007.895*	-944.8357***
CLO	.1268759***	.0472823	.1708758***
WAR	1639.2**	3219.715*	784.9321
Number of Observations	217	212	249
Number of censored Obs.	173	173	287

Note: significant at the * 10%, ** 5%, *** 1% level.

Starting with the supply-side variables in the selection equations, it can be observed that external debt, ODA and remittances are significant and consistent

with the model. The FDI is again positive and significant. A plausible explanation for this has already been provided. Foreign exchange is not significant in the Heckman and Probit/OLS regressions, but negative throughout all regressions but one (1), also including the Tobit, PPML and OLS regressions. This certainly indicates that a negative correlation is highly probable. Inflation is significant only in Heckman regressions, which makes it not very plausible. Though, in the selection process, it could still play the role of money printing as a substitute for the issuance of Diaspora Bonds. Such a correlation was expected from the theoretical model. The budget deficit variable (G - T) is excluded in the regressions presented, again, due to a lack of observations. Incorporating it into the model did not yield a significant result.

Moving on, to the allocation equation and the demand-side variables, the spread variable is once more insignificant. This again confirms our argument that the investment decision does not seem to be a trade-off between investment alternatives (at least not one to the U.S. Treasury bills), but rather a calculation of risk and some feelings of connection and ties to the home country. In line with this argumentation, the rating and the closeness variables are again (mostly) significant (note that closeness and spread are correlated, which is perhaps why the former turns insignificant, when the latter is integrated into the regression). Governance and civil war also keep the signs that are consistent with the model expectations.

Summing up, given the results of the different panel estimation models, presented in regressions (1) to (11), some overall statements can be made. Beginning with those demand-side variables that are the most robust to changes in the estimation technique, the sovereign rating and the closeness variables do show the significant results and consistent with the theoretical model. The war variable has a consistently positive effect on Diaspora Bonds, which was not expected by the theoretical model, but can be explained by patriotic motives of solidarity in times of crises. Still, it is surprising that intrastate wars do have such an effect that would rather be attributed to natural disasters or interstate wars. Governance is not significant in the Tobit regressions, but apart from those, it always has the expected impact on Diaspora Bonds. Good governance in the home country is a factor which is certainly decisive for the Diaspora investors. As for the spread variable, no significant effect could be observed. It must be accounted for the few observations available on this variable. Still, this result of an insignificance of the spread is consistent with other empirical studies on the behaviour of Diasporas (Akkoyunlu, 2008). Moving on to the supply-side, it is certainly the remittances that are very consistent in the expected way throughout estimations (5) to (11). In the OLS they have a negative sign, indicating that the OLS regressions might be biased in the present case. Inflation is not significant in regressions (1) to (8), then it turns to a negative value in the selection equations, as the theoretically expected substituting effect suggests. Obviously, this variable does only have an impact on Diaspora Bonds via the selection mechanism.

The foreign exchange variable, which is seen as one of the main reasons for issuing Diaspora Bonds by the theoretical model, has the expected negative sign, when significant. Yet it is only significant in regressions (3), (5), and (7). The budget deficit variable has been excluded from all regressions, except (1), due to insufficient data. However, it never yielded a significant effect if included.

The external debt variable is negative and significant as expected in the selection equations (7), (8), and (9) and also in regression (1). However, in the Tobit regressions it has a significant positive effect, which is unexpected. This makes the external debt variable rather unreliable. ODA further strengthens the theoretical model by having the expected negative sign and being significant through all regressions apart from the OLS and PPML regressions. Finally, FDI consistently has a significant positive influence on Diaspora Bonds, as opposed to the theoretical model, yet an explanation in which this variable acts rather on the demand side, could be provided.

3.3. Time-series analysis for Israel

After having analysed the complete dataset for all countries at all points of time, this section provides a close insight on the case of Israel, which has the longest experience of Diaspora Bonds. Israel's non-negotiable bonds are clearly a success story of integrating a Diaspora into the development process. This could be a role model for other developing countries. Additionally, the data on Israel's Diaspora Bonds is more comprehensive than for any other country in the complete dataset. This is why a time-series analysis on this single country is important. It should also be investigated, whether Israel is a different case than the other countries and if the determinants of success of the Israeli Diaspora Bonds are different ones. The results of the time-series analysis will highlight, whether the results are consistent with the panel analysis and further strengthen the model hypotheses. Finally, the time-series analysis for Israel allows controlling for the income of the Diaspora. As nearly 70% of the Jewish Diaspora lives in the United States of America (Jewish Agency for Israel 2009), it is reasonable to take the U.S. GDP per capita as an indicator for the income if the Israeli Diaspora Bonds target group. Two restrictions needed to be made for the present case of Israel. Firstly, there is hardly any or no data at all for the following variables: Domestic debt, external debt and (G - T). Some variables are time-invariant or show very little variation: Rating, Governance, Maturity, Denomination, Currency and Civil War. Also, there are again heavy pair wise correlations between the independent variables, in particular for the newly introduced explanatory variable YUS, the U.S. GDP per capita. Secondly, there is only a quite short time-series of 34 observations available. Consequently, only a very limited model can be estimated.[26]

As a first step, the unrestricted model for the three explanatory variables log U.S. GDP per capita, Remittances and ODA is estimated.[27] The dependent variable is the log of BE. The log form of BE and YUS was applied for smoothing the data. The data covers the time span between 1973 and 2006. The Dickey-Fuller unit root test for all three variables was performed subsequently. This test could not reject the null hypothesis that there is a unit root, consequently the series are non-stationary. The lag-order statistics suggested a one-year lag for all variables (in contrast to what has been assumed in the panel-model).

As a second step, the long-run relationship is calculated from the unrestricted model. This is presented in the following equation:

$$\log (BE) = 8.149 + 1.65 \log (YUS) + 27.31 \, REM - 6.797 \, ODA \qquad (14)$$

In the long run, US per capita income and remittances have a positive impact on Diaspora Bonds but ODAs have a negative impact.

According to the Wald-test, the variables jointly have the assumed significant long-run relationship, supporting the model previously set up (The Wald test rejects the null hypothesis of no long-run correlation). Consequently, this is a cointegrating set of variables:

$$WALD \text{ test: } Chi2 \, (3) = 45.3687 \, [0.0000]^{***} \qquad (15)$$

Using the results of this long-term equation as error correction term[28] and plugging it in into a second equation, allows us to estimate a conditional model. In this conditional model, short run and long run effects can be separated. The conditional model consists of one-year lagged ECM from Regression (14) and first difference of the log U.S. GDP per capita. The dependent variable is now the first difference in log of Diaspora Bond balance (first differences are required for estimating the short-run model). The first difference of U.S. GDP per capita is significantly positive in the short run, indicating that investments in Diaspora Bonds increase with a higher income of the Diaspora in the host country. The ECM-term, which stands for the long-run effects of the U.S. GDP per capita, ODA and remittances, is also significant (see Table 5).

Table 4. *Coefficients of the unrestricted equation for Israel*

Dependent Variable: $\Delta log(D_E)$	
Variable	Coefficient
ECM_{-1}	-0.1027***
$\Delta log(Y_{US})$	0.7019**
Constant	0.0017

Note: significant at the * 10%, ** 5%, *** 1% level.

The results from this Error-Corrected Model indicate that the GDP per capita in the host country has a significant and strong effect on Diaspora Bonds in the short- and long-run. A decrease in host country GDP of 10% results in a decrease in Diaspora Bonds balance of 7%. Such host country macroeconomic determinants are also found for remittances sending, this supports the findings at hand (Vargas-Silva & Huang 2006). Especially having in mind the current financial crisis, where not only the GDP of many host countries, but also remittances and ODA have decreased; this effect should not be neglected.

The time-series analysis of the Israeli experience with Diaspora Bond was restrained by the rather short period of analysis of only 34 years. Still, for the available data on ODA, remittances and the U.S. GDP per capita it could be showed that long term effects can be differentiated from short-term effects. Doing so, three innovative statements as compared to the panel models can be made. Firstly, the long-run determinants for Israel are consistent with the model and the panel data analysis. ODA and Remittances do have the expected signs in the long-run and are jointly significant. Secondly, extending the panel model, it could be showed that also the U.S. GDP per capita, as the host country income, has effects in the long run and in the short run. This is an important insight, as up to now, global macroeconomic mechanisms have been ignored by the model.[29] It should not be neglected, though, that the concept of Diaspora Bonds also depends on the income of the Diaspora in their respective host countries. Diaspora members whose income rises are consequently more interested in investing their funds in Diaspora Bonds. Thirdly, it could also be showed that the long-run determinants do have a joint significant impact on the short run, too (this is shown via the ECM-term). This implies that policy makers will need to consider all variables together. Receiving more ODA could be an alternative to Diaspora Bonds, however, the costs of ODA, especially when containing a large share of ODA loans, must not be ignored.

Remittances do have the expected positive impact on Diaspora Bonds, which supports the theoretical model that suggests remittances (as % of GNI) are an indicator that home countries use for their decision on issuing a Diaspora Bond.

4. Conclusions and policy implications

This study investigates the theoretical and empirical determinants of Diaspora Bonds. Empirical results are consistent with the predictions of the theoretical model. The most robust variables are the closeness indicator and the sovereign rating, both on the demand-side. With high confidence, it can be said that the closer in terms of remittances per migrant a Diaspora is to its home country, the more successful will Diaspora Bonds be. And also the better a country's sovereign rating, the more Diaspora investment into this instrument will be made. Robust to all specifications, the spread of the Diaspora Bonds never showed significant correlation to the dependent variable. This implies that the Diaspora does not base its investment decision in Diaspora Bonds on the ground of pure profit-maximisation. But the variable also does not indicate a constant patriotic discount. It seems therefore that the patriotic discount is not per se an element of a Diaspora Bond. This is an important feature of Diaspora Bonds relative to normal investments. Good governance mostly has a positive effect as suggested by the

theoretical model. Civil war, however, contradicting the model, mostly yields more investments into Diaspora Bonds. Ketkar & Ratha (2009b) suggest that the Diaspora may feel obliged to support the home country in particular in times of turmoil. This mechanism can be understood analogous with the case of remittances during natural disasters in the home country, Yang (2007) and Yang & Choi (2007).

The supply-side factors are far more sensitive to the model specification. FDI is, in contrast to the predictions of the theoretical model, positive if it is significant. It was expected that Diaspora Bonds and FDI have substituting effects in attracting foreign currency. The empirically estimated effect, though, points towards first-mover effects, which play rather on demand-side. In the eyes of the Diaspora investors, high FDI may be a signal for a government's trustworthiness in the handling of financial investments and hence, also for Diaspora Bonds. ODA has, in accordance with the theoretical model, a negative effect where significant, thus supporting the view of it as a "cheaper" alternative to all other kinds of external borrowing. Also foreign exchange, when significant, has the expected negative influence on (the countries supply of) Diaspora Bonds. This underlines the countries primary aim in issuing Diaspora Bonds, to raise foreign exchange. As for the government's budget deficit, probably the lack of data was responsible, that this variable never turned significant. Inflation turned significant and negative (the expected correlation) only in the Heckman regressions. Reliable statements on the role of inflation, which was supposed to measure money printing as a substitute for Diaspora Bonds, can therefore not be made. External debt, though, seems to be such a substitute. Finally, remittances proved to be negative only in the OLS regressions. In the other models, they had a positive sign when significant. This would be in line with the model, which suggested that remittances are a signal for the funds the Diaspora has at it's disposal and therewith providing the issuing government an indicator for the Diaspora Bond's success.

Moving on to the time-series analysis for the Israeli case, notwithstanding the limitations in data for this particular country, an error-corrected model could be applied to investigate the influence of remittances, ODA and U.S. GDP per capita on Israeli Diaspora Bonds over 34 years. It could be shown that remittances as well as ODA do have the same influence on Diaspora Bonds as expected from the theoretical model and as proven in the panel data analysis. Additionally, including the U.S. GDP per capita, the theoretical model could even be enhanced. The U.S. being the main host country for the Israeli Diaspora, this variable is able to control for macroeconomic effects in the host country and their impact on Diaspora Bonds. Applying an error-corrected model allowed to differentiate short-term effects from long-term effects. This model showed that in the long term, remittances, ODA and the U.S. GDP per capita are jointly significantly related to Diaspora Bonds. In the short run, the host country GDP per capita again has a very strong influence on Diaspora Bonds. A higher economic growth in the host country hence yields a higher increase of the Diaspora Bond balance in the home country. This result confirms the importance of host country economic factors that have been largely ignored in the panel analysis. And it also has implications for the current financial crisis, where the U.S. GDP per capita growth is slowing down.

Now the task is inferring for which countries it could be an interesting option to issue Diaspora Bonds, additional to those that are already covered in this analysis. Supply factors are not considered here, in line with the Heckman regression applied. This model suggested that those factors rather have an impact on the decision whether to issue a Diaspora Bond in the first place, but not on the amount sold. Consequently, in table 6, countries are listed with respect to their closeness, remittances, governance, sovereign rating (those are the variables found to have a significant effects on Diaspora Bond demand) and total migrants (to demonstrate the scale a Diaspora Bond might have for these countries).

Table 6 presents those countries that fit best into the characteristics a country that wants to use the instrument of Diaspora Bonds should provide. Romania in

Europe, El Salvador in Central America, Nigeria in Africa and Indonesia in Asia could be the most promising candidates. Not only judging from the closeness indicator, but also concerning rating and governance they would fit the model quite well. Those countries without rating (Algeria and Azerbaijan), those with low closeness (Georgia and Azerbaijan) and those with bad governance (Vietnam, Bosnia and Herzegovina, Egypt, Algeria and Azerbaijan) may be among those who could encounter problems in issuing Diaspora Bonds.

Table 5. *Countries that might consider issuing Diaspora Bonds*
(World Bank 2007) (Standart & Poor's 2007) (Freedom House 2009)

Country	Closeness	Remittances	Governance	Rating	No. of Migrants
Romania	6349.535	6.72E+09	4	BBB-	1057974
El Salvador	3332.943	3.33E+09	5	BB+	998934
Nigeria	3197.014	3.33E+09	8	BB-	1041284
Indonesia	3121.949	5.72E+09	5	BB-	1832945
Serbia	2796.919	4.7E+09	5	BB-	1681493
Mexico	2470.386	2.51E+10	5	BBB	10140846
Egypt, Arab Rep.	2451.085	5.33E+09	14	BB+	2174343
Vietnam	2391.074	4.8E+09	12	BB	2007466
Colombia	2385.198	3.93E+09	6	BB	1646937
Morocco	2105.108	5.45E+09	9	BB+	2590960
Bosna and Herzegovina	1632.244	2.07E+09	6	none	1266784
Algeria	1219.888	2.53E+09	11	none	2071502
Azerbaijan	592.6939	8.13E+08	11	none	1370927
Georgia	468.6242	4.85E+08	6	B+	1035670
Turkey	368.0707	1.11E+09	6	BB-	3018442
Belarus	187.3303	3.34E+08	13	none	1784015
Ukraine	141.0389	8.29E+08	5	BB-	5877810
Mali	112.2256	1.77E+08	5	B	1578695
Kazakhstan	52.1024	1.87E+08	11	BBB	3598107
Burkina Faso	37.07395	50000000	8	B	1348656

A final remark should be made concerning the final purpose of the funds raised by Diaspora Bonds. As already mentioned above, not much is known about the utilisation of these funds. The World Bank has a focus on Diaspora-for-Development issues (World Bank, 2006). But also the British Department for International Development (DFID) and later even the German Federal Ministry for Economic Cooperation and Development (BMZ) have recognised the potential of migrants beyond remittances, Weitzenegger (2008). The DFID even considered a project which intended to initiate a Diaspora Bond in Bangladesh targeting explicitly non-resident Bangladeshi in the United Kingdom. The project was turned down, however, due to the fact that already a Diaspora Bond instrument (the Wage Earner's Development Bonds, WEDB) existed. The DFID decided that it was easier to work towards an issue of the WEDB in British Pound than to promote another Diaspora Bond (Department for International Development (UK) (2008). Hence, a clear declaration of the purpose of Diaspora Bond funds, perhaps integrated in general guidelines for such bonds provided by an international agency such as the World Bank or the International Monetary Fund (IMF) would make the bonds far more transparent and the issuing governments accountable.

Notes

1   This is based on the assumption that migrants are more loyal than the financial investors in times of stress and interested in financing infrastructure, housing, health and education projects.

2   The issuers of Diaspora Bonds by retailing small denominations ranging from $100-$10,000 can target relatively poor migrants.

3   Indeed, the governments of India and Israel have raised about $40 billion through Diaspora Bonds, and preliminary estimates suggest that Sub Saharan African countries have potential to raise $5-10 billion per year by issuing Diaspora Bonds, see Ketkar & Ratha (2010) and Ratha (2010a). Furthermore, if each 200,000 Haitians in abroad invest $1,000 in Diaspora Bonds, this would raise $200 million, see Ratha (2010b). His preliminary calculations even suggest that a $100 million grant from official (or private) donors to guarantee such bonds on an annual rolling basis for 10 years could actually generate $600 million of additional funding for Haiti.

4   Inflation as a measure for excessive money printing is used in our empirical study.

5   This was indeed the case for India.

6   While borrowing decreases with programme aid, there is no effect on borrowing with technical assistance and food aid.

7   And also the fact that the articles cited above have the general assumption that countries do not have the access to non-concessional external borrowing.

8   The term Treasury bill is used here as a synonym for a sovereign bond with maturity longer than one year.

9   This is also consistent with Jewish Diaspora investors who paid a steep price premium which characterizes a large patriotic yield discount see Ketkar & Ratha (2009b).

10 The difference to the usually analyzed "spread" of a bond is that the "spread" normally measures the interest difference between two bonds with different risk ratings. What is been looked at here is the interest difference of two bonds with the same risk rating.

11 If a certain degree of good governance is hypothesized. In the worst case of a dictatorial government, it may have as well the adverse effect.

12 The altruism that has been described here is maybe not even a true one. Firstly, it is limited to the Diaspora's home country. And secondly, the reason for lending money to the home country can be the expectation of a better investment climate or better living standards for the family in the future. Whether this intention is to be labeled "egoism" or "altruism" is questionable and a question certainly not easy to answer.

13 Although remittances are observable and measurable; there is a large amount of money remitted through informal channels. Freund & Spatafora (2008) report that estimates for informal flows range from 50-250 % of recorded flows globally.

14 Extensive discussions of applications of the simultaneous equation model can be found in Greene (2002, p.393) and Gujarati (2003, p.717).

15 Note that, Greene (2002, p.381) mentions that in the macroeconomic context the definition of endogenous and exogenous "is of fairly limited use in macroeconomics, where almost no variable can be said to be truly exogenous".

16 The fact that Israel has adjusted its Diaspora Bonds often in the last decade certainly conflicts with this assumption. However, in the dataset covered, this seems to be rather the exception.

17 The coefficient of regression (1) suggests that an increase in remittances per migrant of one US$, increases Diaspora Bonds balance by a 118'000 US$.

18 The Freedom House governance index increases with worse governance.

19 Akkoyunlu (2008) makes similar findings when analysing remittances from Turkish workers in Germany.

20 "False" zeros can for example occur, when missing values are coded 0.

21 Note that Wooldridge (2002, p.518) calls such a model a "corner solution model".

22 The Zero Inflated Poisson and Negative Binomial regression.

23 Note that in gravity models, the dependent variable (trade) needs to be in the log-linear form and the log of zero is not defined, while the log of 1 equals zero.

24 The xtpqml Stata package (http://www.rotman.utoronto.ca/timothy.simcoe/xtpqml.txt is used, as suggested by Desbordes & Vicard (2009) to use fixed effects and compute robust standard errors.

25 It could theoretically be argued that the inclusion of countries like Kenya or South Africa would have changed the situation at hand. In those cases, a lack of demand could have been a reason for abandoning the projects. Perhaps, an "unofficial" offer already existed but was retired when observing insufficient demand.

26 Econometric methodology in this Section closely follows Akkoyunlu (2008).

27 Time-series regressions and tests were all calculated using Pc-Give 10.2, see Doornik & Hendry (2001).

28 For the use of Error Corrected Models (ECM) in political science, see Keele & Boef (2004).

29 Vargas-Silva & Huang (2006) accounted for this effect indirectly.

Appendix

Table 1. *Data Overview*

Variable	Obs	Mean	Std. Dev.	Min	Max
(G-T)	85	2.739696	4.806087	-16.9825	14.85686
clo	265	2044.966	4896.918	1	38362
country	531	5	2.584424	1	9
cur	472	0.752119	0.432241	0	1
den	354	1400.708	1728.018	35	5000
B_E	493	794.2781	2524.007	0	20600
edt	277	47.32711	26.38713	6.154826	148.0763
fdi	360	0.009384	0.019004	-0.00665	0.155564
fx	306	1.621237	7.272452	0.006395	65.17145
gov	333	7.885886	2.923556	3	14
inf	357	17.45408	41.00422	-9.80877	487.5782
mat	412	5.881068	2.724661	3	15
oda	360	0.038275	0.036465	0	0.200159
rat	531	1.753296	3.994024	0	15
rem	360	0.029426	0.054559	0	0.525315
$(^{i}E - {}^{i}D)$	117	1.879009	4.443576	-9.986	12.7
war	531	0.246704	0.4315	0	1
year	531	1979	17.04544	1951	2008

Table 7. *Pair-wise correlations*

Independent Variable	(G-T)	CLO	CUR	DEN	EDT	FDI	FX	GOV	INF	MAT	ODA	RAT	REM	$i_E - i_D$	WAR
(G-T)	1														
CLO	0.0436	1													
CUR	0.7080*	0.1632	1												
DEN	0.4008*	0.0461	0.4886*	1											
EDT	-0.0961	-0.3254*	-0.0097	-0.4212*	1										
FDI	0.3824*	0.1192	0.1064	0.112	0.3250*	1									
FX	0.3903*	-0.1115	0.129	0.5242*	-0.2050*	0.1863*	1								
GOV	-0.1122	-0.1271	-0.0799	-0.5966*	0.1503	0.0149	-0.0656	1							
INF	-0.5310*	-0.2511*	0.2039*	-0.2153*	0.1386	-0.0724	0.0675	-0.0135	1						
MAT	0.153	-0.3000*	-0.2185*	0.7501*	0.5141*	0.0855	0.3027*	-0.2592*	0.1939*	1					
ODA	-0.4650*	0.2701*	0.1796*	0.4328*	-0.1364	0.0322	-0.1975*	0.2031*	0.1159	-0.0091	1				
RAT	0.2856*	0.037	0.1547*	-0.1441	0.1327	0.3654*	-0.0815	-0.3899*	-0.1092	-0.0069	-0.3236*	1			
REM	0.3898*	0.3215*	-0.6398*	-0.7514*	-0.0636	0.3728*	0.5430*	0.1238	0.0444	-0.2512*	-0.1117	0.1206	1		
$i_E - i_D$	-0.8148*					-0.0678	-0.0475	0.3925*	-0.5752*	-0.6374*	-0.1646	-0.0493	0.3302*	1	
WAR	0.1691	0.1602*	0.3108*	0.0801	0.0568	-0.1223	0.1254	0.0452	0.1993*	0.0145	-0.052	0.0365	0.032	-0.3482*	1

Note: * indicates a significance level of 1%.

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