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**Index of Financial Inclusion – A measure of financial
sector inclusiveness**

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Index of Financial Inclusion – A measure of financial sector inclusiveness¹

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Abstract

The promotion of an inclusive financial system is a policy priority in many countries. While the importance of financial inclusion is widely recognized, the literature lacks a comprehensive measure that can be used to measure the extent of financial inclusion across economies. This paper attempts to fill this gap by proposing an index of financial inclusion (IFI). The proposed IFI captures information on various dimensions of financial inclusion in a single number lying between 0 and 1, where 0 denotes complete financial exclusion and 1 indicates complete financial inclusion in an economy. The proposed index is easy to compute and is comparable across countries and over time. It also satisfies some important mathematical properties.

KEY WORDS: Financial inclusion, IFI, multi-dimensional index, normalized Euclidean distance, inverse Euclidean distance, financial exclusion

JEL Classification: G00, G21, O16

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1. Introduction

Academic literature has adequately discussed the close relation between financial development and economic growth.² However, the discussion on whether financial development implies financial inclusion is rather limited. It has been observed that even ‘well-developed’ financial systems have not succeeded to be ‘all-inclusive’ and certain segments of the population remain outside the formal financial systems. The importance of an inclusive financial system is widely recognized by policy makers and financial inclusion is seen as a policy priority in many countries.³ An inclusive financial system is desirable for many reasons. First, it facilitates efficient allocation of productive resources. Second, access to appropriate financial services can significantly improve the day-to-day management of finances. And third, an all-inclusive financial system can help reduce the growth of informal sources of credit (such as moneylenders) which often tend to be exploitative. Thus, an all-inclusive financial system enhances efficiency and welfare by providing avenues for secure and safe saving practices and by facilitating a whole range of efficient financial services. Through efficient allocation of productive resources, an inclusive financial system increases investment, raises economic growth and promotes capital formation.

Building an inclusive financial system is a complex process. The literature on financial exclusion identifies five major forms of exclusion – *access exclusion*, where segments of population remain excluded from the financial system either due to remoteness or due to the process of risk management of the financial system; *condition exclusion*, when exclusion occurs due to conditions that are inappropriate for some people; *price exclusion*, when the exclusion happens due to unaffordable prices of financial products; *marketing exclusion*, when exclusion occurs due to targeted marketing and sales of financial products and *self-exclusion*, that takes place when certain groups of people exclude themselves from the formal financial system owing to fear of refusal or due to other psychological barriers (Kempson and Whyley, 1999a, Kempson and Whyley, 1999b). Thus, financial inclusion is a multidimensional phenomenon.

While the importance of financial inclusion is widely recognized, the literature on financial inclusion still lacks a comprehensive measure that can be used to measure the extent of financial inclusion in an economy. Such a comprehensive measure of financial inclusion is

² See, for example, Levine (1997) for a survey of this literature.

³ For a review of policy level responses to financial exclusion in developed economies, see Kempson et. al. (2004).

important in order to take stock of the state of affairs with respect to financial inclusion in an economy and to monitor the progress of the policy initiatives undertaken to promote financial inclusion. A robust and comprehensive measure of financial inclusion is also of importance for the research community to investigate hypotheses relating to financial inclusion that have been raised in the academic literature.

There have been few attempts in the literature to measure the extent of financial inclusion that can be used for making cross country comparison. For example, Honohan (2008) has used an econometric approach to estimate the proportion of households having access to formal financial services for many countries. More recent attempts have employed this econometric approach to come up with a measure of financial inclusion (See eg., Ardic et al., 2011). Policy makers, on the other hand, use a variety of indicators of banking sector outreach to take stock of the status of financial inclusion (See eg., yearly report on the trend and progress of banking in India by Reserve Bank of India, and also the Financial Inclusion Indicators developed by Superintendency of Banking, Insurance Companies and AFPs (SBS) of Peru cited in Reyes et al., 2010).⁴ Both these approaches – the econometric approach of Honohan (2008) and the use of a variety of financial sector outreach indicators – provide valuable information on particular aspects of financial inclusion; however both the approaches suffer from certain shortcomings that will be discussed in a later section in detail.

In this paper, we propose an index of financial inclusion (IFI) as an alternative measure of financial inclusion.⁵ The proposed IFI is a multidimensional index based on macroeconomic data on banking sector outreach (as in the second approach mentioned above). This is an attempt to meaningfully combine various banking sector indicators so that the index incorporates information on various dimensions of an inclusive financial system such as accessibility, availability and usage of banking services. The IFI is computed in a manner that it captures information on these dimensions in a single number lying between 0 and 1, where 0 indicates complete financial exclusion and 1 indicates complete financial inclusion in an economy. Construction of the index is done by following a multidimensional approach of index construction similar to that used by United Nations Development Programme

⁴ Scholars like Beck et al. (2007) also used various banking sector indicators to indicate banking sector outreach.

⁵ The IFI was first proposed in Sarma (2008). Sarma (2010) modified the methodology. In Sarma and Pais (2011) the modified IFI was used to identify country specific factors associated with financial inclusion. Recently, the Central Bank of Brazil has adopted the methodology from Sarma and Pais (2011) to compute IFI for various regions of Brazil (Banco Central Do Brasil, 2011).

(UNDP) for computation of the well known Human Development Index (HDI); however, certain methodological improvements make IFI free from some of the widely criticized shortcomings of the HDI. Because it captures information on multiple aspects of financial inclusion in a single number, the IFI provides a more comprehensive measure of financial inclusiveness than individual indicators such as those used in Beck et al. (2007) and the measure estimated by Honohan (2008). Further, it can be easily computed on a periodic basis by using secondary data on banking sector outreach. The IFI proposed here also satisfies important mathematical properties.

Besides presenting the index of financial inclusion (IFI), this paper presents the computed values of the IFI for several countries on a yearly basis, depending on available data, for the period 2004 – 2010. Section 2 of this paper defines financial inclusion; Section 3 presents the index of financial inclusion (IFI); Section 4 presents the IFI measures for various countries for the years 2004-2010. Section 5 concludes this paper.

2. Defining Financial Inclusion (Exclusion)

Financial inclusion (or, alternatively, financial exclusion) has been defined in the literature in the context of a larger issue of social inclusion (or exclusion) in a society. One of the early attempts to define financial exclusion was by Leyshon and Thrift (1995) who defined it as referring to those processes that serve to prevent certain social groups and individuals from gaining access to the formal financial system. According to Sinclair (2001), financial exclusion means the inability to access necessary financial services in an appropriate form. Exclusion can come about as a result of problems with access, conditions, prices, marketing or self-exclusion in response to negative experiences or perceptions. Carbo et al. (2005) have defined financial exclusion as broadly the inability of some societal groups to access the financial system. The Government of India's 'Committee on Financial Inclusion in India' begins its report by defining financial inclusion '*as the process of ensuring access to financial services and timely and adequate credit where needed by vulnerable groups such as the weaker sections and low income groups at an affordable cost*' (Rangarajan Committee 2008).

Thus, most definitions indicate that financial exclusion is the manifestation of a much broader question of social exclusion of certain disadvantaged groups including the economically poor. For the purpose of this paper, we define financial inclusion *as a process that ensures the ease of access, availability and usage of the formal financial system for all members of an economy*. This definition emphasizes several dimensions of financial inclusion, viz., accessibility, availability

and usage of the formal financial system. These dimensions together build an inclusive financial system. As banks are the gateway to the most basic forms of financial services, banking inclusion/exclusion is often used as analogous to financial inclusion/exclusion. Similarly, in this paper, we consider banking inclusion as being analogous to financial inclusion.

3. Index of Financial Inclusion (IFI): a new measure of financial sector inclusiveness

3.1 Review of literature

The literature on measuring financial inclusion is new but growing. A measure of financial inclusion depends precisely on the way financial inclusion is defined. Some studies have attempted to measure financial inclusion by simply measuring the proportion of adult population or proportion of households (of an economy) having access to formal financial services (i.e., having a bank account). Since such a measure can be obtained only through country-wide primary surveys, and since such surveys on access to financial services are conducted only in a limited number of countries, it is difficult to obtain such a measure of financial inclusion for countries where such surveys are not conducted.⁶ Country-wide surveys are not conducted at regular intervals, as they involve substantial cost in addition to being time-consuming. Therefore a measure of financial inclusion that is based on country wide surveys may not be easily available at a regular and periodic basis. Even if the surveys could be conducted at regular intervals, the dates and methodologies of the surveys in all countries cannot be made identical, thus leading to inconsistencies in the measure across countries.⁷ For countries where such surveys are not conducted, a measure of financial inclusion has to be obtained from the available data on banking sector outreach from secondary sources. Honohan (2008) has attempted to combine survey based information and secondary data on the number of bank accounts to econometrically estimate the proportion of households/adults having access to financial services for as many as 160 countries.

⁶ Some of the country wide surveys of access to financial systems are the Finscope surveys for African and some Latin American countries and the Eurobarometer surveys for the European countries. Honohan (2008) gives a list of the countries for which such surveys are conducted.

⁷ A recent attempt by World Bank Development Research Group to create a database from 148 countries on financial inclusion is expected to reduce many such inconsistencies relating to survey-based data. Named the Global Financial Inclusion (Global Findex) database, these data are collected through sample surveys of adults in 148 countries during the calendar year 2011. While its worldwide coverage is impressive, the sample for individual countries is small; for e.g., the sample for India and China are only about 0.0004 per cent of their respective adult populations. For more on this database, see Demirguc-Kunt and Klapper (2012).

Despite several limitations, these estimates provide interesting information; however, they provide only a one-time measure of financial inclusion and are not useful for understanding the changes over time and across countries.⁸

Further, a measure of financial inclusion that is based on the proportion of adults/households with a bank account ignores some other important aspects of an inclusive financial system. These relate to quality and usage of the financial services. Literature has pointed out that merely having a bank account may not imply that the account is utilized adequately (see, eg., Kempson, 2004). In many countries, people having a bank account do not use them enough due to remoteness of bank branches, or other physical or psychological barriers. In this context, Diniz et al. (2011) presents an interesting case study of how the ‘banked people’ (i.e., people having a checking or savings account) of Autazes (an Amazon county) found it extremely expensive and time consuming to use their bank facilities before 2002 when banking facilities were not locally available. This case study is a peculiar case where the people of Autazes were financially included while Autazes, as a region itself, was financially excluded as there were no banking outlets there prior to 2002. A measure of financial inclusion that only counts number of people having a bank account will not reflect the lack of adequate financial services as in the case of Autazes before 2002. Further, adequate utilization of financial services is also an important aspect of financial inclusion. Kempson et al. (2004) defined the notion of “underbanked” or “marginally banked” people as those who do not make adequate use of their bank accounts, despite having bank ac-

⁸ Honohan (2008) uses a regression based method to estimate these measures for countries where survey-based information is not available; in countries where survey-based information on percentage of adults/households with access to financial services is available, that information is taken directly. These estimates suffer from several limitations some of which are mentioned by the author himself. First limitation is regarding the inconsistencies of the survey dates and survey units. The country surveys used in the estimation pertain to different points of time, so there is an inconsistency regarding the date. Further, some of these surveys have adult individuals as the unit (such as the Eurobarometer surveys) while others have households as their unit (like the Finscope surveys). Honohan (2008) uses both interchangeably, simply by stating that “*the difference may not be all that great*”, although there are reasons to believe otherwise. While estimating the proportion of adults/households with access to financial services, the author uses a log-linear relationship between proportion of financially included adults/households and the number of bank accounts (including number of micro finance accounts). This log-linear relationship is justified by a good fit of this relationship for only 13 countries for which both survey based proportion of financially included adults/households and number of accounts (bank and microfinance institutions) data are available. However, as in any econometric exercise, such a relationship may not hold true if the data set changes due to a change in the period and/or a change in the number of countries. Thus, these estimates are not easily amenable for computing on a periodic basis in order to compare financial inclusion over time and across countries.

counts. In a large household level survey of low-income households of Washington D.C., Los Angeles and Chicago in the United States of America, Seidman et al. (2005) reported that two-thirds of the 'banked population' were using informal non-bank services, ranging from "*buying money orders and sending remittances from other than a bank to using payday lenders, pawn shops and auto title lenders as primary sources of credit.*" Thus, in spite of having a bank account, these households were not using the banking facilities and were in fact using informal financial services. These households form a part of so-called 'underbanked' or 'marginally banked' households, which has been discussed in the literature as equivalent to being financially excluded households. This emphasizes "usage" as another dimension of financial inclusion.

A measure of financial inclusion based on proportion of "banked" adults, thus measures only one aspect of financial inclusion, viz., access to financial system, and ignores other important aspects, such as availability and usage of financial system. While access to financial institutions is the primary dimension of financial inclusion, an inclusive financial system is also the one in which financial services are adequately available and are adequately utilized.

An alternate approach, as used by policy makers of different countries, is to use a variety of indicators of financial sector outreach to take stock of the state of financial inclusion. The most commonly used indicators are number of bank accounts (per 1000 adult persons), number of bank branches (per million people), number of ATMs (per million people), amount of bank credit and amount of bank deposit. In Beck et al. (2007), other indicators of banking sector outreach have been used – geographic branch penetration, loan and deposit accounts per capita, loan-income and deposit-income ratios and so on.⁹

A recent initiative by World Bank, the Global Findex database (Demirguc-Kunt and Klapper, 2012) provide interesting indicators of financial inclusion from a micro (adult individuals) perspectives, based on primary surveys of 150,000 adults in 148 countries during 2011. These indicators include share of adults having an account with a formal financial institution, of adults who saved and borrowed using a formal account, of adults who used informal

⁹ The Reserve Bank of India reports population per bank branch, population per ATM, percentage of population having bank deposit accounts, credit to GDP ratio etc. to report on the progress of financial inclusion in India. In 2010, the Superintendence of Banking, Insurance Companies and Private Pension Funds of Peru (SBS) began to develop a set of financial inclusion indicators, with an objective of providing information on access and use of financial products and services. These indicators include number of branches, ATMs and agents per 100,000 adults and per 1000 sq. km., number of depositors and borrowers per 100000 adults, average size of deposit and credit as a ratio of GDP per capita etc.

method to save and informal sources to borrow and shares of adults with credit/debit cards, with mortgage and with a health insurance. These indicators are also provided by income group, gender and education levels of the respondents.

These indicators, either at macro level or at the micro level, do provide interesting and useful information on the nature of inclusiveness of a financial system. However, when used individually, they may provide partial and incomplete information on the inclusiveness of the financial system. Using individual indicators may also lead to a misinterpretation of the extent of financial inclusion in an economy as seen from the example in Table 1.

Table 1: Indicators of Financial Inclusion for select countries

Panel 1: Macro level data, 2010 (Sources: FAS, 2012, IMF and Central Banks)				
Country	No. of bank A/C (per 1000 adults)	No. of Bank Branches (per 100,000 adults)	Domestic credit (as % of GDP)	Domestic deposit (as % of GDP)
Czech Republic	1141.6	22.5	84.7	91.4
India	1066.0	22.5	43.4	58.4
Lebanon	916.5	31.6	79.9	281.4
Malaysia	2275.7	22.2	114.9	149.5
Qatar	769.8	23.4	67.5	64.3
Romania	1324.2	33.9	40.7	34.5
Thailand	1802.2	19.2	125.1	106.0
Panel 2: Micro level data, 2011 (Source: Global Findex Database, World Bank (Deriguc-Kunt and Klapper, 2012)				
Country	Share of adults with an account at formal institutions (%)	Share of adults using a formal A/C to save (%)	Share of adults using a formal A/C to bor- row (%)	Share of adults using an informal source to borrow (%)
Czech Republic	81	35	9	18
India	35	12	8	20

Table continued in next page

Table 1: Indicators of Financial Inclusion for select countries (contd.)

Panel 2: Micro level data, 2011 (Source: Global Findex Database, World Bank (Derirguc-Kunt and Klapper, 2012))				
Country	Share of adults with an account at formal institutions (%)	Share of adults using a formal A/C to save (%)	Share of adults using a formal A/C to borrow (%)	Share of adults using an informal source to borrow (%)
Paraguay	22	10	13	15
Serbia	62	3	12	29
Thailand	73	43	19	8
United Kingdom	97	44	12	14
Uruguay	24	6	15	6

In panel 1 of Table 1, macro level indicators of financial inclusion are provided for a select group of countries, while in Panel 2, micro level indicators are presented. Among the countries shown in Panel 1, Malaysia has the highest number of bank accounts per 1000 adults, followed by Thailand, Romania, Czech Republic, India, Lebanon and Qatar. However, if we look at the number of bank branches per 100,000 adult people, Malaysia and Thailand rank much lower than Romania, Lebanon, Qatar, Czech Republic and India. Looking at another dimension of an inclusive banking system, that is, usage of the banking system in terms of the volume of credit and deposit, Romania seems to be having very low credit to GDP and deposit to GDP ratios in spite of moderate density of bank accounts and high density of bank branches.

Looking at the micro level indicators presented for the group of countries in Panel 2 of Table 1, we see that 97 per cent of adults in United Kingdom have an account with a formal financial institution, followed by Czech Republic (81 per cent), Thailand (73 per cent), Serbia (62 per cent), India (35 per cent), Uruguay (24 per cent) and Paraguay (22 per cent). If we focus on the share of adults saving with a formal institution, it is only 44 per cent United Kingdom, quite similar to 43 per cent in Thailand, although Thailand is reported to have a much lower percentage of adults with a formal A/C than United Kingdom. The share of adults using a formal institution to save is reported to be 35 per cent for Czech Republic, 12 per cent for India, 10 per cent for Paraguay, 6 per cent for Uruguay and 3 per cent for Serbia. This shows that while Serbia has a much higher share of adults with a formal A/C than India, in terms of the second indicator, i.e., share of adults using a formal method to save,

Serbia stands way below India. Looking at another indicator, viz., share of adults borrowing from a formal source, Uruguay had a much higher share (15 per cent) than Czech Republic (9 per cent), India (8 per cent) and even the United Kingdom (12 per cent) although in terms of the first indicator, Uruguay had a much lower share of adults with a formal A/C (24 per cent) compared to Czech Republic (81 per cent), India (35 per cent) and United Kingdom (97 per cent). The fourth column of Panel 2 of Table 1 presents share of adults using an informal source to borrow (family and friends) for these countries. As shown here, although United Kingdom had the highest share of adults with a formal A/C (97 per cent) and Paraguay the lowest (22 per cent), the share of adults borrowing from informal sources was similar in both these countries – 14 per cent in United Kingdom and 15 per cent in Paraguay. Similarly, Uruguay had a much lower share of adults using informal sources of credit (6 per cent) than United Kingdom (14 per cent) although the share of banked adults is much higher in United Kingdom than in Uruguay.

As evident from these examples, any one single indicator fails to adequately capture the extent of financial inclusion. Thus, a comprehensive measure, such as the IFI proposed in this paper, is required. A comprehensive measure of financial inclusion should be able to incorporate information on several aspects (dimensions) of financial inclusion preferably in one single number. Such a measure can be used to compare the levels of financial inclusion across economies and across states/provinces within countries at a particular time point. It can be used to monitor the progress of policy initiatives for financial inclusion in an economy over a period of time. Further, such a measure would be of academic interest to address issues put forward in the growing literature on financial inclusion. For example, scholars have attempted to investigate whether economic development leads to an all-inclusive financial system and whether low financial inclusion is associated with high income inequality (Kempson et al., 2004). In order to investigate such questions empirically, a robust and comprehensive measure of financial inclusion is required. A good measure of financial inclusion, in our view, should be constructed based on the following criteria: it should incorporate information on as many aspects (dimensions) of financial inclusion as possible; it should be easy and simple to compute and it should be comparable across countries over time. From a theoretical point of view, such an index should also satisfy some important mathematical properties, viz., boundedness, unit-free property, homogeneity and monotonicity. We propose an index of financial inclusion (IFI), which satisfies these criteria. The proposed IFI is elaborated below.

3.2 Methodology for designing a comprehensive indicator

As the inclusiveness of a financial system should be evaluated along several dimensions, we follow a multidimensional approach while constructing our index of financial inclusion (IFI). Our approach is similar to that used by UNDP for computation of some well known development indexes such as the HDI, the HPI, the GDI and so on. As in the case of these indexes, our proposed IFI is computed by first computing a dimension index for each dimension of financial inclusion. The dimension index d_i , as computed by the formula **(1)**, measures the country's achievement in the i^{th} dimension of financial inclusion. A weight w_i such that $0 \leq w_i \leq 1$ is attached to the dimension i , indicating the relative importance of the dimension i in quantifying the inclusiveness of a financial system.

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i} \quad (1)$$

where

w_i = weight attached to the dimension i , $0 \leq w_i \leq 1$

A_i = actual value of dimension i

m_i = lower limit on the value of dimension i , fixed by some pre-specified rule.

M_i = upper limit on the value of dimension i , fixed by some pre-specified rule.

The choice of m_i and M_i used in this paper is discussed in Section 3.4.

Formula **(1)** ensures that $0 \leq d_i \leq w_i$. The higher the value of d_i , the higher the country's achievement in dimension i . If n dimensions of financial inclusion are considered, then, a country's achievements in these dimensions will be represented by a point $X = (d_1, d_2, d_3, \dots, d_n)$ on the n -dimensional space. In the n -dimensional space, the point $O = (0, 0, 0, \dots, 0)$ represents the point indicating the worst situation while the point $W = (w_1, w_2, \dots, w_n)$ represents an ideal situation indicating the highest achievement in all dimensions.

The location of the achievement point X vis-à-vis the worst point O and the ideal point W is the crucial factor in measuring a country's level of financial inclusion. Larger distance between X and O would indicate higher financial inclusion. And, smaller distance between X and W would indicate higher financial inclusion. In the n -dimensional space, it is possible to

have two points having same distance from W but different distances from O and vice versa. Thus, two countries can have their achievement points at the same distance from one of these points but having different distances from the other point. If two countries have their achievement points at same distance from W but different distances from O, then the country with higher distance from O should be considered more financially inclusive while if they have the same distance from O but different distances from W, then the country with less distance from W should be considered more financially inclusive. Thus, while developing a measure of financial inclusion, both these distances should be taken into account. In our proposed IFI, we use a simple average of the Euclidian distance between X and O and the inverse Euclidian distance between X and W. Both these distances are normalized by the distance between O and W, to make them lie between 0 and 1. In computing the simple average between the distances, the inverse distance between D and W is considered. This ensures that the IFI is a number that lies between 0 and 1 (i.e., the index has well defined bounds) and is monotonically increasing, i.e., higher level of financial inclusion indicates higher value of the index. Thus, to compute IFI, first we compute X_1 (distance between X and O) and X_2 (inverse distance between X and W) and then take a simple average of X_1 and X_2 to compute IFI, the final index. The exact formulae are given below

$$X_1 = \frac{\sqrt{d_1^2 + d_2^2 + \dots + d_n^2}}{\sqrt{(w_1^2 + w_2^2 + \dots + w_n^2)}} \quad (2)$$

$$X_2 = 1 - \frac{\sqrt{(w_1 - d_1)^2 + (w_2 - d_2)^2 + \dots + (w_n - d_n)^2}}{\sqrt{(w_1^2 + w_2^2 + \dots + w_n^2)}} \quad (3)$$

$$IFI = \frac{1}{2} [X_1 + X_2] \quad (4)$$

The formula (2) for X_1 gives the normalized Euclidean distance of X from the worst point O, normalized by the distance between the worst point O and the ideal point W. The normalization is done to make the value of X_1 lie between 0 and 1. Higher value of X_1 implies more financial inclusion.

The formula (3) for X_2 gives the inverse normalized Euclidean distance of X from the ideal point W. In this, the numerator of the second component is the Euclidean distance of X from the ideal point W, normalizing it by the denominator and subtracting by 1 gives the

inverse normalized distance. The normalization is done in order to make the value of X_2 lie between 0 and 1 and the inverse distance is considered so that higher value of X_2 corresponds to higher financial inclusion.

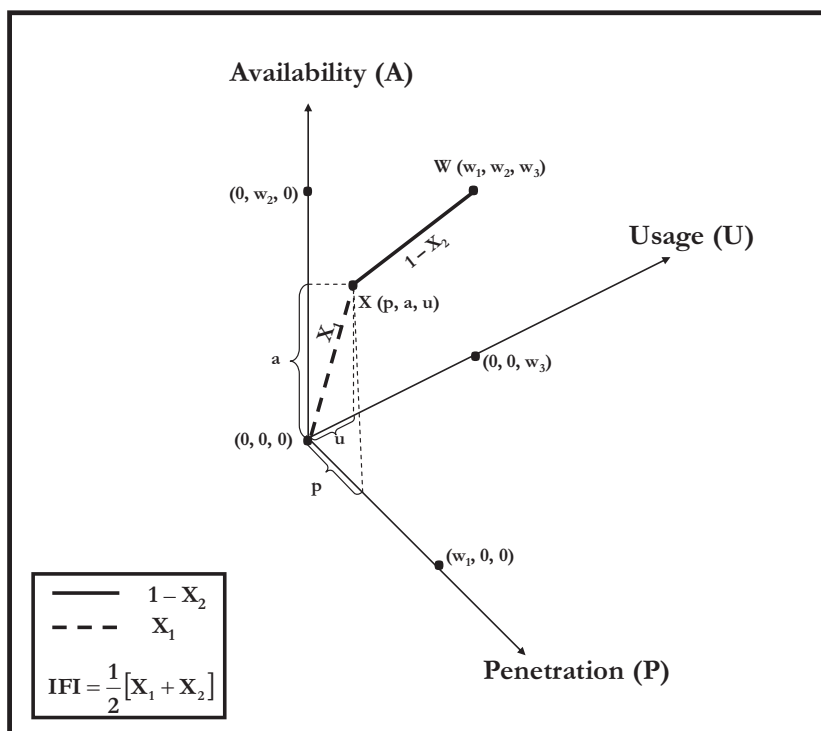
The IFI formula (4) is a simple average of X_1 and X_2 , thus incorporating distances from both the worst point and the ideal point.

For simplification, if we consider all dimensions to be equally important in measuring the inclusiveness of a financial system, then $w_i = 1$ for all i . In this case, the ideal situation will be represented by the point $W = (1,1,1,\dots,1)$ in the n -dimensional space and the formula for IFI will be

$$IFI = \frac{1}{2} \left[\frac{\sqrt{d_1^2 + d_2^2 + \dots + d_n^2}}{\sqrt{n}} + \left(1 - \frac{\sqrt{(1-d_1)^2 + (1-d_2)^2 + \dots + (1-d_n)^2}}{\sqrt{n}} \right) \right] \quad (5)$$

In Figure 1, a graphical explanation of the IFI is provided with the help of the three dimensions used to construct the index in this paper. As discussed in the next section, we consider three dimensions of financial inclusion in this paper – accessibility (or financial sector penetration), availability and usage of the financial system. In Figure 1, each of these dimensions is represented by an axis in the three-dimensional space. The point $W = (w_1, w_2, w_3)$ represents the ideal point and a particular country's achievements in these dimensions is depicted by the point $X = (p, a, u)$. A country that has an inclusive financial system should be closer to the ideal point W than a country that is less financially included. Similarly, a country with a more financially inclusive system should be farther away from the point O than a less inclusive country. In other words, less distance between the points X and W and more distance between X and O will together indicate high financial inclusion in country X . In the IFI formula, the normalized distance between X and O is given by the X_1 in formula (2) and that between X and W is given by the second component in formula (3). The normalized distance between X and W is a number that lies between 0 and 1 and if X has a highly financially inclusive system, then this normalized distance will be close to 0. While computing the IFI, the inverse normalized distance between X and W , computed as 1 minus the normalized distance is considered. This is given by X_2 in formula (3) and this ensures that less distance between X and W imply high financial inclusion. The final index is computed by taking an average of X_1 and X_2 .

Figure 1: Graphical Explanation of a 3-dimensional IFI



Although the IFI proposed here follows a multidimensional approach of index construction similar to the UNDP approach, there is a major difference in the manner in which dimension indexes are combined to compute the final index. Unlike the UNDP’s methodology of using an average of the dimension indexes¹⁰, our index is based on a notion of distance from a worst and an ideal situations.¹¹ UNDP’s methodology of using an average of dimension indexes suffers from the criticism that such averaging implies ‘perfect substitutability’ across

¹⁰ Until 2011, UNDP used a simple arithmetic average to compute Human Development Index (HDI), Gender-related Development Index (GDI) and Gender Empowerment Measure (GEM) and a geometric average for computing Human Poverty Index (HPI). In 2011, it revised the methodology for HDI by using geometric mean instead of an arithmetic mean. The Human Development Report (2011) also computes other indices like Inequality-adjusted HDI (IHDI), Gender Inequality Index (GII) and Multidimensional Poverty Index (MPI) that adopt combinations of arithmetic and geometric averages (see, eg., UNDP 2011)

¹¹ This is similar to the “method of displaced ideal” of Zeleny (1974) in the context of multi objective optimization programming. In the method of displaced ideal, only the displacement from the ideal point is considered. However, we consider displacement from both the ideal and worst points to compute our IFI, and this makes it somewhat different from the “method of displaced ideal”. The IFI presented in Sarma (2008), Sarma (2010) and Sarma and Pais (2011) was based on the distance from the ideal only. Here we incorporate the distance from both the ideal and worst points; thus the present IFI is an improvement over the earlier one. The author thanks Ashish Das for suggesting this improvement.

dimensions; i.e., an increase in one dimension can be compensated for by a decrease of equal (in case of arithmetic average) or proportional (in case of geometric average) magnitude in another dimension. As all dimensions are assumed to be equally important for the overall index value, the perfect substitutability can hardly be appropriate (Desai, 1991; Trabold-Nubler, 1991; Luchters and Menkhoff, 1996; Sagar and Najam, 1998). The distance based approach does not suffer from this shortcoming.

It is easy to verify that the distance based IFI proposed here satisfies following mathematical properties:

1. Boundedness: The IFI has well defined and meaningful bounds. It is bounded below by 0 and bounded above by 1.
2. Unit free measure: As each dimension index is unit free, hence the overall IFI is also a unit free measure.
3. Homogeneity: Each dimension index $d_i(A_i, m_i, M_i)$, considered as a function of A_i , m_i and M_i is such that $d_i(A_i, m_i, M_i) = d_i(\lambda A_i, \lambda m_i, \lambda M_i)$, for any scalar $\lambda > 0$. Thus, the dimension indexes are homonegeous functions (of degree zero). It follows that the overall index IFI is also homogeneous of degree 0; i.e., $IFI(d_1(A_1, m_1, M_1), d_2(A_2, m_2, M_2), \dots, d_n(A_n, m_n, M_n)) = IFI(d_1(\lambda_1 A_1, \lambda_1 m_1, \lambda_1 M_1), d_2(\lambda_2 A_2, \lambda_2 m_2, \lambda_2 M_2), \dots, d_n(\lambda_n A_n, \lambda_n m_n, \lambda_n M_n))$. The homogeneity property of the IFI implies that if the arguments of a dimension index are changed by the same constant, it does not change the value of the dimension index or the overall IFI.
4. Monotonicity: The IFI is a monotonous function of the dimension indexes. This means that higher values in the dimension indexes (i.e., higher levels of financial inclusion) will give rise to higher values of the IFI.

The IFI so defined, can be used to measure financial inclusion at different time points and at different levels of economic aggregation (village, province, state, nation and so on). It can be constructed at a macro level as well as at micro level, depending on the availability of data and the purpose of the research.

3.3 An illustration of the IFI

As an illustration of the concepts elaborated in the earlier sections, here we attempt to implement these concepts by developing an IFI based on macro level data and by computing

the IFI for as many countries as possible. In the index presented in this paper, we consider three basic dimensions of an inclusive financial system: banking penetration (BP), availability of the banking services (BS) and usage of the banking system (BU). These dimensions are largely motivated by availability of relevant and consistent data for a large number of countries to compute comparable IFI.¹²

Banking penetration (dimension 1): An inclusive financial system should have as many users as possible, that is, an inclusive financial system should penetrate widely amongst its users. The size of the ‘banked’ population, i.e. the proportion of people having a bank account is a measure of the banking penetration of the system. Thus, if every person in an economy has a bank account, then the value of this measure would be 1. However, data on the number of ‘banked’ people is not readily available and in the absence of such data, we use number of deposit bank accounts per 1000 adult population as an indicator of this dimension.¹³ Number of deposit bank accounts per adult and the proportion of banked adults can be expected to be positively correlated and that can justify using number of deposit accounts per 1000 adults as a proxy for the number of banked adults.¹⁴ We assign a weight 1 to this dimension, as banking penetration is the primary indicator of financial inclusion.

Availability of banking services (dimension 2): In an inclusive financial system, banking services should be easily available to the users. Indicators of availability are banking outlets (offices, branches, ATMs and so on). Thus, availability of services can be indicated by the number of bank outlets (per 1000 population) and/or by the number of ATM per 1000

¹² Apart from these three dimensions, one can think of many other dimensions of an inclusive financial system. For example, “Affordability” and “Timeliness” can be very important aspects of an inclusive financial system, particularly for developing countries, as pointed out by Rangarajan Committee Report on Financial Inclusion in India (Rangarajan Committee, 2008). However, data for measuring such dimensions, such as “transaction cost” and “time taken” for a bank transaction, or, “number of bank employees per 1000 clients” etc. are not readily available for a large number of countries. Therefore these dimensions have not been incorporated in the present index. In countries where such data are available, one can construct more detailed country specific index using the methodology proposed here.

¹³ There may be persons having more than one bank account co-existing with others who may have none. Therefore, number of accounts per capita, is likely to actually provide an overestimation of the proportion of the “banked” population. For example, in 2010, number of bank accounts per 1000 adult people is 2276 in Malaysia, 1324 in Romania and 1066 in India; this is despite the fact that a significant proportion of population is without bank accounts in these countries.

¹⁴ In this context, it may be noted that Honohan (2008) found a positive and significant association between proportion of banked adults/households and number of bank accounts per 100 adults.

people. In the present day banking system in many countries, ATMs play an important role. Besides giving customers their bank account details and allowing the deposit and withdrawal of cash and cheques (traditional teller services), ATMs in some instances also perform other functions such as providing bill payment services, credit card related services. Thus the importance of ATMs in providing improved access to banking services is undeniable. However, the spread of ATM network varies from bank to bank and from country to country and the role of a bank branch remains. Hence both are included in this dimension index. The number of bank employees per customer can also be used as another indicator of the availability of banking services. Further, keeping in view the move towards electronic banking in many countries, data on availability of electronic/internet based banking services should also be incorporated in this dimension. However, due to lack of consistent data on no. of bank employees and volume/no. of electronic banking for all countries, we do not use these indicators in the quantification of the availability dimension. In the present index, we use data on the number of bank branches and the number of ATMs per 100,000 adults to measure the availability dimension. Two separate indexes are calculated for bank branches and ATMs. Then, a weighted average of these two indexes, using $2/3^{\text{rd}}$ weight for bank branch index and $1/3^{\text{rd}}$ weight for ATM index is considered as the index for the availability dimension.¹⁵

Usage (dimension 3): This dimension is motivated by the notion of ‘underbanked’ or ‘marginally banked’ people, as observed by Kempson et al. (2004). They have observed that *‘in some apparently very highly-banked countries, a number of people with bank account are nonetheless making very little use of the services on offer...’*. These people are termed ‘under-banked’ or ‘marginally banked’. These underbanked people, despite having access to the formal financial services, are unable to use the financial services, due to various reasons such as remoteness of banking outlets, unaffordable conditions attached to financial services or simply due to negative experiences with the service provider. These factors reflect negatively on the inclusiveness of a financial system. Thus, merely having a bank account is not enough for an inclusive financial system; it is also imperative that the banking services are adequately

¹⁵ The choice of these weights is motivated by an empirical observation of our data set. In our data set covering the years 2004-2010, the average ratio of ATM-to-branch per 100000 adults is found to be 2.13. Thus, on an average, there are 2 ATMs per bank branch, implying that a bank branch, on an average, is equivalent to 2 ATMs. Thus, branch index gets a weightage of 2/3 and the ATM index gets a weightage of 1/3 in the availability index.

utilized. The utilization can be in many forms – for credit, deposit, payments, remittances, transfer etc. So, the usage dimension should include measures on all these different forms. However, cross country comparable data on payments, remittances and transfers are not available till date. Hence, in incorporating the usage dimension in the present index, we consider two basic services of the banking system – credit and deposit. The appropriate indicators for these would be the volume of credit and deposit to adult individuals as a proportion of GDP. Such data are, however, currently not available. Data on credit and deposit to the household sector are available for a few countries. Relying on them would greatly reduce the coverage of the present study. Hence we use the data on volume of credit to the private sector and deposit mobilized from the private sector as proportion of the country's GDP to measure this dimension.¹⁶

3.4 Choice of upper and lower limits for dimensions

Computation of the IFI requires a-priori fixing the value of M_i (upper limit) and m_i (lower limit) for each dimension, so that the dimension indexes are normalized to have values between 0 and w_i . Further, it is necessary to keep the values of M_i and m_i fixed for different years so that IFI computed for different years and different countries are compared with respect to the same benchmarks on various dimensions. While one can safely choose 0 as the lower bound for all the dimensions discussed above, it is not so easy to fix the upper bound of a dimension, since theoretically it is not possible to arrive at a 'maximum' or even an 'optimum' level of achievement for a dimension of financial inclusion. Analytically, and using an objective and straightforward methodology, the empirically observed highest value of a dimension can be considered as the upper limit for it.¹⁷ However, this may cause two problems. First, if the empirically observed highest value happens to be 'an outlier', then it will distort the scale of the index, driving the IFI values of all other countries down, even though their performance may be reasonable. This is because all countries will be compared vis-à-vis the outlier country. The second problem caused by using the empirically observed highest value as the upper bound is that this value may be different for different years, and

¹⁶ In the literature on the role of finance in economic development, the credit to GDP and deposit to GDP ratios indicate what is known as "financial depth". In this literature, indicators of financial depth provide a measure of the contribution of the financial system in economic activities. Here, however, we are using these ratios to indicate the volume of credit and deposit generated by the banking system as a measure of the extent of the usage of the banking system due to lack of data on more appropriate measure on this.

¹⁷ For example, the UNDP uses the empirically observed highest observed value as the maximum while computing dimension indexes for the Human Development Index (HDI) (UNDP 2011)

hence comparing the index across time will be difficult. In view of these observations, we consider the following upper bounds to be reasonable for different dimensions:

M_p = upper limit for computing dimension index for penetration dimension = 2500 (indicating on an average of at least 2 deposit accounts per adult).¹⁸

M_{a1} = upper limit for computing 1st index of availability dimension = 60 (indicating about 1667 clients per bank branch).¹⁹

M_{a2} = upper limit for computing 2nd index of availability dimension = 120 (indicating 1 ATM per 833 adults).²⁰

M_p = upper limit for computing dimension index for usage dimension = 300 (indicating a credit+deposit to GDP ratio of 3).²¹

If a country has a dimension value higher than these upper bounds, then it is set equal to the upper bound. By setting the upper limits as above, we avoid comparing countries against excessively high benchmarks and thus remove outliers and smoothen the value of the index at the upper level.

3.5 Weights assigned to the dimensions

Assigning appropriate weights to the dimension indexes is a difficult task. While all the three dimensions considered here are equally important for an inclusive financial system, the lack of adequate data on important indicators that completely characterize the availability and usage dimensions renders us to give relatively less weight to these dimensions in the present index. As far as availability of banking services is concerned, it may be noted that many countries have moved towards internet banking, thus reducing the importance of physical bank outlets. Some countries also offer banking services through telephones. Thus, using data only on physical outlets (such as bank branches and ATMs) can give an incomplete

¹⁸ Ardic et al. (2011) estimated that on average, an individual has 3 deposit accounts in the world. Our choice of M_p is informed both by our data set and the estimates from Ardic et al. (2011). In our dataset, this represents the 90th percentile on the distribution for this dimension.

¹⁹ In our data set this again represents about 90th percentile on the distribution for this dimension.

²⁰ In our dataset for the period from 2004 to 2010, we find that the average number of ATMs per bank branch is about 2.13. Our choice of a maximum for ATM (120) being twice the maximum for bank branches (60) is motivated by the above empirical observation. This is about the 92nd percentile observed in the distribution for the ATM dimension.

²¹ This represents about 90th percentile observed in the distribution for the usage dimension.

picture of the availability of banking services. Similarly, data on credit and deposit can only partially depict the usage of the financial system as other services of the banking system, such as payments, transfers and remittances are not included. In the absence of such data, a complete characterization of these dimensions is not possible.

In the present index, we have provided the following weights: 1 for the index of banking penetration, 0.5 for the index of availability and 0.5 for the index of usage. Given these weights, we can represent a country K by a point (p_k, a_k, u_k) in the three dimensional space, such that $0 \leq p_k \leq 1$, $0 \leq a_k \leq 0.5$, $0 \leq u_k \leq 0.5$, where p_k , a_k and u_k are the dimension indexes for country k computed using formula (1). In the three dimensional space, the point $(0,0,0)$ will indicate the worst situation (complete financial exclusion) and the point $(1,0.5,0.5)$ will indicate the best or ideal situation (complete financial inclusion) in the present context.

The IFI_k for the country k is measured by the simple average of normalized Euclidean distance of the point (p_k, a_k, u_k) from the point $(0,0,0)$ and its normalized inverse Euclidian distance the ideal point $(1, 0.5, 0.5)$. Algebraically,

$$IFI_k = \frac{1}{2} \left[\frac{\sqrt{p_k^2 + a_k^2 + u_k^2}}{\sqrt{1.5}} + \left(1 - \frac{\sqrt{(1-p_k)^2 + (0.5-a_k)^2 + (0.5-u_k)^2}}{\sqrt{1.5}} \right) \right] \quad (6)$$

4. Computation of IFI for countries around the world for the years 2004 – 2010

We now present the computed values of the IFI elaborated in Sections 3.3, 3.4 and 3.5 on a yearly basis for as many countries as possible, for the years 2004 - 2010. First we describe the data used for the computation of our IFI and then proceed to present the IFI values with some discussion.

4.1 Data

As discussed in Section 3.3, we use the data on deposit accounts per 1000 adults as a measure of banking penetration, data on number of (deposit) bank branches and ATMs per 100,000 adults as an indicator of availability of banking services and the total deposit and credit from deposit banks as percentage of the GDP of a country as an indicator of the usage of banking services. Deposit banks include commercial banks and other deposit-takers. These are defined as *'all resident financial corporations and quasi-corporations (except the central bank) that are mainly engaged in financial intermediation and that issue liabilities included in the national*

definition of broad money. These institutions have varying names in different countries, such as savings and loan associations, building societies, credit unions and credit cooperatives, post office giro institutions, post office savings banks, savings banks, microfinance institutions, etc.’ (IMF 2011).

The main source of the data used here is the Financial Access Survey (FAS) database of the International Monetary Fund (IMF). This is a new database, disseminating annual data on indicators of geographic and demographic outreach of financial services for 160 respondent countries for the period 2004 — 2010. The FAS database released its first set of data in 2010 and since then data have been regularly updated and revised. As of February 2012, FAS is still incomplete with missing data for several countries as well as for different years.²²

We have made an attempt to complete the missing data, as far as possible, by using alternative sources. One of the alternative sources is the Central Banks of respective countries (including the European Central Bank); another one being an annual publication of the Bank of International Settlement (BIS), titled ‘Statistics on payment and settlement systems in selected countries’.²³ Apart from these, we have occasionally used International Financial Statistics (IFS) data base of the IMF, for data on volume of credit and deposit, if such data is missing for some country in the FAS data base. Data on adult population and GDP, whenever required, is taken from World Bank’s World Development Indicators (WDI) data base.

²² The FAS database is an outcome of the initiatives of ‘United Nations (UN) Advisors Group on Inclusive Financial Sectors’, established by the UN in 2006, which decided, in 2008, to involve IMF and the World Bank in collecting data on access to finance in order to support policy formulation and research. The initial funding for collection of the data was provided by Government of the Netherlands. In June 2010, the IMF came out with annual data on several indicators of access to finance for the years 2004-09 on its web site. The data for the year 2010 was released in June 2011. The data used in this paper was extracted from the web site www.fas.imf.org, last accessed in February 2012.

²³ For some countries when data were not available from either sources listed here, we obtained data directly from the Central banks/Regulatory authorities through individual requests. By this method, we obtained data for the following countries from their respective Central Banks: Bulgaria, Colombia, Greece, Jordan and Maldives. Responses from Central Banks of some other countries are still awaited. It should be noted here that data on some of the indicators that we use in this paper are also available in the WDI database of World Bank. However, due to definitional inconsistencies of the WDI data with other sources, we do not use the WDI data.

Table 2: Descriptive Statistics of indicators of different dimensions of financial inclusion

	2004	2005	2006	2007	2008	2009	2010
Panel 1: No. of Bank Accounts per 1000 adults							
Min	3.0	3.4	4.1	3.6	2.3	2.6	13.0
Max	7985	7827	7584	7294	7214	7173	7169
Mean	983	1020	1096	1112	1164	1215	1526
Standard dev	1361	1271	1223	1226	1224	1222	1342
CV	1.4	1.2	1.1	2	2	2.6	2.4
Total no. of countries	62	76	86	90	95	98	72
No. of low and lower middle income countries	26	32	34	37	40	41	24
No. of high and upper middle income countries	36	44	52	53	55	57	48
Panel 2: No. of Bank branches per 100,000 adults							
Min	0.34	0.37	0.41	0.44	0.57	0.58	1.29
Max	209.44	199.87	186.57	177.34	178.36	180.48	186.84
Mean	27.12	27.12	27.67	27.97	28.11	30.23	32.96
Standard dev	33.10	32.38	31.34	30.32	29.61	31.82	31.13
CV	1.22	1.19	1.13	1.08	1.05	1.05	0.94
Total no. of countries	114	120	126	127	132	131	101
No. of low and lower middle income countries	41	43	46	47	50	48	32
No. of high and upper middle income countries	73	77	80	80	82	83	69
Panel 3: No. of ATMs per 100,000 adults							
Min	0	0	0	0	0	0	0.31
Max	209.00	212.94	219.46	235.83	244.44	250.29	468.05
Mean	31.95	34.14	37.81	42.68	46.95	50.78	46.07
Standard dev	42.97	43.67	45.26	46.70	48.01	50.61	59.13
CV	1.34	1.27	1.19	1.23	1.5	1.7	2
Total no. of countries	125	126	125	126	126	126	126
No. of low and lower middle income countries	30	34	37	37	40	41	28
No. of high and upper middle income countries	95	92	88	89	86	85	98
Panel 4: Loans +Deposits (as percent of GDP)							
Min	0	0	0.07	0.09	0.09	0.10	13.11
Max	1282.82	1328.23	1341.28	1336.23	1250.15	1208.03	1098.58
Mean	118.18	129.81	135.34	145.68	146.31	153.42	151.25
Standard dev	146.57	156.96	165.89	174.86	167.88	168.65	143.84
CV	1.24	1.21	1.23	1.20	1.15	1.10	0.95
Total no. of countries	154	154	154	154	154	155	123
No. of low and lower middle income countries	61	63	63	63	63	64	46
No. of high and upper middle income countries	93	91	92	92	92	92	78

Sources: IMF; BIS and Various Cenral Banks

Table 2 presents some descriptive statistics of the available data for computing the index of financial inclusion for the years 2004-2010. Statistics pertaining to each dimension of the index are presented in a separate panel for all the years. Descriptive statistics reported here are: minimum (Min), maximum (Max), mean, standard deviation and coefficient of variation (CV). At the bottom three rows of each panel, we are reporting the number of countries (total as well as segregated for high income and low income countries) for which the data is available for each year. As can be seen from these descriptive statistics, the data consist of a

diverse set of countries, with a good mix of lower (low and lower middle) income and higher (high and upper middle) income countries. To keep the discussion brief, we discuss some of these statistics for the latest year only, i.e., for the year 2010. The number of deposit accounts varied from a low of 13 accounts per 1000 adults in Iraq to 7169 accounts per 1000 adults in Japan. On an average, the number of bank accounts per 1000 adults in the 72 countries for which these data are available is 1526, i.e., about 2 bank accounts per adult. Data on the number of bank branches are available for 101 countries, ranging from a low of 1.3 bank branches per 100000 adults in Angola to a high of 187 in Bangladesh with the average being 33 branches per 100000 adults.²⁴ Of the 126 countries for which data on the number of ATMs per 100000 adults are available, the number ranged between less than 1 (0.31) ATMs in Ethiopia and 468 ATMs adults in Sweden. The average number of ATMs per 100000 adults in these countries is 46. Finally, data on the volume of credit and deposit as a percentage of the GDP are available for 123 countries and the value of this varied widely from 13.1 in Myanmar to 1099 in Luxembourg. On an average, the credit+deposit to GDP ratio in 2010 for these 123 countries was 151 per cent.

As seen from Table 2, the number of countries for which the data are available varies not only with respect to the indicators but also over years. In other words, the countries for which data on a particular dimension are available may not be the same as the countries for which data are available for another dimension. This poses a challenge in computing the IFI for a country, as we need data on each dimension for that country in a particular year to compute the IFI for that year. When all three dimensions are taken together, data are available for only 47 countries in 2004, 60 countries in 2005, 72 countries in 2006, 75 countries for 2007, 85 countries for 2008, 91 countries for 2009 and 63 countries for 2010. The maximum number of countries for which data are available for all dimensions is 91 in 2009.

4.2 Results

Table 3 presents the IFI values computed for various countries for the years 2004 - 2010. The numbers of countries for which IFI values are computed are different for different years, depending on the availability of data on component dimensions that we consider here for computing the IFI. As evident from Table 3 and as expected, different countries around

²⁴ The high number of bank branches in Bangladesh can be mainly attributed to the large network of micro-finance institutions (MFIs) there.

the world are at very different levels of financial inclusion. Among 91 countries in the year 2009, levels of financial inclusion, as measured by IFI, varied from as low as 0.016 for Chad to as high as 0.974 for Cyprus. In 2010, among the 63 countries for which IFI have been computed, Afghanistan ranked the lowest with an IFI value of 0.052 while Luxembourg with an IFI value of 0.996 ranked the highest.

Table 3: IFI values for various countries, 2004-2010

Sl. No.	Country	2004	2005	2006	2007	2008	2009	2010
1	Afghanistan					0.033	0.045	0.052
2	Algeria	0.252	0.248	0.261	0.275	0.286	0.305	0.316
3	Angola	0.029	0.030	0.044	0.058	0.079	0.099	0.084
4	Argentina	0.183	0.195	0.207	0.226	0.229	0.238	0.252
5	Armenia	0.089	0.132	0.140	0.177	0.188	0.214	0.238
6	Austria	0.878	0.878	0.878	0.881	0.886	0.891	
7	Azerbaijan			0.059	0.074	0.095	0.111	0.128
8	Bangladesh	0.321	0.337	0.352	0.347	0.361	0.376	0.401
9	Belgium ^b		0.698	0.697	0.715	0.744	0.759	
10	Belize			0.513	0.544	0.582	0.612	0.597
11	Bosnia and Herzegovina			0.305	0.353	0.371	0.387	
12	Botswana	0.232	0.259	0.269	0.260	0.273	0.275	0.257
13	Brazil	0.309	0.291	0.299	0.315	0.331	0.341	0.354
14	Bulgaria		0.559	0.618	0.680	0.732	0.742	0.730
15	Cambodia			0.037	0.054	0.061	0.074	0.087
16	Cameroon	0.029	0.030	0.031	0.033	0.036	0.043	
17	Chad		0.008	0.010	0.009	0.011	0.016	
18	Chile	0.477	0.485	0.542	0.583	0.637	0.660	0.688
19	Colombia ^c	0.322	0.349	0.375	0.380	0.398	0.415	0.397
20	Comoros	0.068	0.065	0.063	0.062	0.062	0.070	0.079
21	Congo, Republic of	0.012	0.012	0.014	0.016	0.019	0.024	
22	Cyprus			0.853	0.915	0.970	0.974	
23	Czech Republic ^c			0.413	0.410	0.427	0.444	0.463
24	Djibouti		0.146	0.147	0.153	0.160	0.245	
25	Equatorial Guinea					0.104	0.104	
26	Estonia					0.623	0.724	0.695
27	Ethiopia				0.069	0.067	0.067	
28	Finland	0.663	0.681	0.684	0.768	0.785	0.791	0.835

Table continued in next page

Table 3: IFI values for select countries, 2004-2010 (contd.)

Sl. No.	Country	2004	2005	2006	2007	2008	2009	2010
29	France ^b	0.677	0.694	0.709	0.720	0.730	0.741	0.738
30	Gabon	0.033	0.037	0.038	0.049	0.048	0.056	
31	Georgia					0.249	0.251	0.272
32	Germany ^b	0.651	0.658	0.684	0.686	0.691	0.711	0.713
33	Greece		0.824	0.832	0.853	0.868	0.866	0.879
34	Hungary	0.348	0.365	0.388	0.409	0.456	0.467	0.481
35	India ^c	0.306	0.303	0.308	0.315	0.342	0.371	0.386
36	Iraq					0.040	0.059	
37	Ireland			0.745	0.879	0.895	0.890	0.881
38	Israel					0.725	0.731	
39	Italy	0.436	0.436	0.443	0.481	0.543	0.598	0.605
40	Japan ^b	0.922	0.921	0.920	0.920	0.920	0.920	
41	Jordan ^c		0.397		0.405	0.398	0.403	
42	Kazakhstan	0.234	0.271	0.296	0.333	0.326	0.317	0.311
43	Kenya	0.094	0.097	0.110	0.128	0.148	0.172	
44	Korea, Republic of	0.889	0.892	0.900	0.902	0.916	0.922	
45	Kosovo		0.145	0.166	0.206	0.251	0.283	0.293
46	Kyrgyz Republic						0.075	0.080
47	Latvia	0.427	0.446	0.493	0.545	0.549	0.565	0.587
48	Lebanon		0.447	0.452	0.458	0.471	0.483	0.497
49	Lesotho	0.081	0.098	0.129	0.093	0.092	0.098	0.114
50	Lithuania ^c			0.741	0.756	0.758	0.769	0.766
51	Luxembourg ^c							0.996
52	Madagascar	0.042	0.046	0.047	0.049	0.056	0.058	0.064
53	Malaysia	0.636	0.692	0.709	0.710	0.720	0.710	0.791
54	Maldives ^c	0.268	0.311	0.341	0.392	0.420	0.432	0.426
55	Malta	0.880	0.881	0.873	0.879	0.884	0.886	0.887
56	Mexico						0.380	0.430
57	Moldova	0.289	0.315	0.347	0.393	0.431	0.420	0.438
58	Namibia					0.345	0.371	
59	Netherlands	0.678	0.690	0.690	0.699	0.697	0.697	0.689
60	Norway		0.629	0.672	0.723	0.741	0.687	0.689
61	Oman						0.373	
62	Pakistan			0.108	0.113	0.110	0.106	
63	Peru	0.190	0.167	0.201	0.221	0.268	0.299	0.362
64	Philippines		0.216	0.221	0.218	0.228	0.231	0.258
65	Poland ^c			0.351	0.387	0.447	0.460	0.479
66	Portugal	0.864	0.898	0.913	0.920	0.933	0.944	0.943
67	Qatar	0.278	0.293	0.302	0.315	0.314	0.332	0.354

Table continued in next page

Table 3: IFI values for select countries, 2004-2010 (contd.)

Sl. No.	Country	2004	2005	2006	2007	2008	2009	2010
68	Romania ^c						0.617	0.483
69	Russian Federation ^b		0.660	0.717	0.736	0.752	0.762	0.781
70	Rwanda					0.119	0.125	
71	Saudi Arabia	0.185	0.202	0.231	0.253	0.279	0.318	
72	Seychelles	0.238	0.279	0.263	0.265	0.307	0.597	0.618
73	Sierra Leone					0.046	0.054	0.079
74	Singapore	0.697	0.688	0.691	0.695	0.703	0.713	0.736
75	Slovak Republic ^c			0.515	0.562	0.676	0.691	0.695
76	Slovenia ^c			0.581	0.597	0.614	0.630	0.616
77	South Africa	0.201	0.246	0.291	0.313	0.336	0.369	0.388
78	Spain	0.856	0.898	0.914	0.935	0.945	0.952	0.951
79	Swaziland	0.165	0.175	0.180	0.181	0.201	0.213	0.217
80	Switzerland		0.476	0.477	0.478	0.478		
81	Syrian Arab Republic					0.117	0.114	0.123
82	Tanzania	0.052	0.059	0.065	0.072	0.080	0.076	
83	Thailand			0.643	0.655	0.655	0.673	
84	Togo						0.110	
85	Tonga	0.429	0.502	0.298	0.330	0.326	0.316	
86	Turkey		0.436	0.444	0.444	0.431	0.438	
87	Uganda	0.058	0.053	0.072	0.075	0.090	0.091	0.106
88	Ukraine		0.672	0.686	0.707	0.724	0.725	0.717
89	United Kingdom	0.957	0.949	0.988	0.983	0.964	0.953	0.949
90	United States	0.366			0.380			
91	Uruguay						0.214	0.237
92	Uzbekistan	0.240	0.279	0.318	0.335	0.343	0.350	0.372
93	West Bank and Gaza						0.192	
94	Yemen, Republic of					0.049	0.056	

Note: The IFI values computed in this table are mostly based on data from FAS database of IMF. Alternate sources; viz, BIS publications (b) and Central Bank sources (c) were also used along with the FAS data for some countries as indicated.

In this brief discussion of the results, we have placed countries into three categories depending on their IFI values – those having IFI values between 0.6 and 1 are categorized as high IFI countries, those having IFI values between 0.3 and 0.6 as medium IFI countries and those having IFI values less than 0.3 are called low IFI countries.

High IFI countries: Countries that consistently have high IFI values in all the years during 2004-2010 are as follows: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Japan, South Korea, Lithuania, Luxembourg, Malaysia, Malta, Netherlands,

Norway, Portugal, Russia, Singapore, Spain, Thailand, Ukraine and United Kingdom. As seen from this list, majority of the high IFI countries are high income OECD countries. The exceptions are Malaysia, Thailand, Ukraine and Russia that are middle income countries. Further, not surprisingly, many of the ‘overseas financial centres (OFC)’ like Cyprus, Malta and Singapore have high IFI values.²⁵ A second set of countries are those that belonged to the medium IFI category in 2004 and over the next four to five year have moved to the high IFI category. These are Belize, Bulgaria, Chile, Seychelles, Slovak Republic and Slovenia, all middle income countries, except Slovak Republic and Slovenia which are high income countries.

Medium IFI countries: The countries having IFI values in the medium range (between .3 and .6) consistently in all the years during 2004 – 2010 are as follows: Bangladesh, Bosnia and Herzegovina, Colombia, Czech Republic, Hungary, India, Jordan, Latvia, Lebanon, Mexico, Namibia, Oman, Poland, Switzerland, Tonga, Turkey and United States. This group has equal number of countries that belong to high income and medium incomes. While Czech Republic, Hungary, Oman, Poland, Switzerland and the United States are high income countries with medium IFI values, Bosnia and Herzegovina, Colombia, Jordan, Latvia, Lebanon, Namibia and Turkey are upper middle income countries with medium IFI values. Only Bangladesh, India and Tonga are lower middle income countries with medium IFI values. Apart from these, there are a number of mainly middle income countries that had low IFI values in 2004 and then moved to medium IFI values by 2009 or 2010. These are Algeria, Brazil, Kazakhstan, Maldives, Moldova, Peru, Qatar, Saudi Arabia, South Africa and Uzbekistan. Of these only Qatar and Saudi Arabia are high come countries. Moldova and Uzbekistan are lower middle income countries. All the rest of them are upper middle income countries.

Low IFI countries: The last category of countries, those consistently having low IFI values during 2004 – 2010 are: Afghanistan, Angola, Argentina, Armenia, Azerbaijan, Botswana, Cambodia, Cameroon, Chad, Comoros, Republic of Congo, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Georgia, Iraq, Kenya, Kosovo, Kyrgyz Republic, Lesotho, Madagascar, Pakistan, Philippines, Rwanda, Sierra Leone, Swaziland, Syria, Tanzania, Togo, Uganda, Uruguay, West Bank and Gaza and Yemen. This list is dominated by low and middle income countries. The only exception is Equatorial Guinea which is a high income OECD country.

²⁵ For definition of OFCs, see IMF (2000).

Countries with improvement and deterioration in their IFI values during 2004 and 2010: Generally, it is expected that with development and improvements in incomes financial inclusion is likely to improve.²⁶ Further, major decline in IFI values are not expected, unless there are situations such as the financial crisis of 2007-08 or that involve war and conflict. Thus in general we could expect the IFI values to improve for all countries over the years. Of the countries that had significant improvements in their IFI values are countries such as South Africa, Russia, Italy, Chile, Bulgaria, Maldives, Kosovo, Latvia, Armenia, Moldova, Peru, Malaysia, Hungary, Saudi Arabia, Uzbekistan and Spain. While improvements in IFI are expected, deterioration in the IFI values are rare. Although we do not expect drastic fall in IFI values over time, some countries have nevertheless shown a declining trend in their IFI values. High income and high IFI countries such as the Netherlands, United Kingdom and Japan had marginal decline in their IFI values during this period. In case of these countries, the secular decline in their IFI values over the years can perhaps be attributed to a falling or stagnant number of physical outlets (bank branches and ATMs). It is perhaps the case that in these countries, the decline in physical outlets is accompanied by a rise in non-conventional outlets of financial services, like electronic, telephonic and mobile banking. However, as lack of appropriate and consistent data on these non-conventional outlets do not allow us to incorporate them as part of the availability dimension, as explained in an earlier section. This definitely points to a limitation of the present index. Among the low income countries, Pakistan and Tonga have displayed a decline in their IFI values during the period of our study.

It is important to understand factors that lead to improvement or deterioration in financial inclusion as reflected in the IFI values. The relationship between financial inclusion, income levels and development is complex and needs to be studied. However, this is not the focus of this paper; therefore we do not probe further on this and do not attempt to investigate what causes changes in the IFI values.²⁷

Falling IFI values during the years 2009 and 2010: Notwithstanding the IFI categories they belong to, a large number of countries had displayed declining values of IFI for the years 2009 and 2010, as compared to earlier years. Could it be a fall out of the global financial crisis? The impact of the global financial crisis on financial inclusion may be either through closure of banks leading to a fall in both banking penetration and banking availability and/or

²⁶ See, eg., Sarma and Pais (2011) for evidence of significant positive association between per capita GDP and financial inclusion.

²⁷ Elsewhere we have attempted to understand this relation. For details see Sarma and Pais (2011).

through a decline in the usage of banking services (credit and deposit to GDP ratios) due to contraction of economic activities. A close look at our data indicates that for some countries the fall in IFI during the last two years of our study is due to a fall in the banking penetration and availability dimensions (for Botswana, Bulgaria, Colombia, France), while for some other countries (eg. Maldives and Spain), the fall is driven by a decline the value of usage dimension. In several countries (Angola, Belize, Estonia, Kazakhstan, Norway and Ukraine), the fall in the IFI value in the last two years of the study period is due to a fall in a combination of two or all the dimensions of financial inclusion. In case of Romania, the fall in IFI between 2009 and 2010 is striking – from a value of 0.612 in 2009 (high IFI level) it fell to medium level of 0.483. This is due to a fall in number of depositors and number of bank branches during these periods despite rising trend in the no. of ATMs and volume of credit and deposit as per cent of GDP in Romania during these two periods. Whether the fall in any of the dimension indexes reflects an impact of the global financial crisis is an important question but it is beyond the scope of this paper. Here, we merely point out that as many as 23 countries have shown a decline their IFI values between 2009 and 2010 which also happen to be the years when the impact of the global financial crisis is being felt in various ways.

While we are not focusing on investigating factors driving the IFI values for individual countries, it will perhaps be of interest to take a look at some descriptive statistics of the computed IFI values, at an aggregate level. Tables 4 and 5 present these descriptive statistics of the IFI values.

Table 4: Descriptive Statistics of IFI for all countries (2004-2010)

	2004	2005	2006	2007	2008	2009	2010
Min	0.012	0.008	0.010	0.009	0.011	0.016	0.052
Max	0.957	0.949	0.988	0.983	0.970	0.974	0.996
Mean	0.373	0.402	0.421	0.433	0.421	0.423	0.478
Standard dev	0.29	0.28	0.28	0.29	0.29	0.29	0.27
CV (standard dev/Mean)	0.78	0.70	0.67	0.66	0.70	0.68	0.57
Total no. of countries	47	60	72	75	85	91	63
High IFI countries	13	18	23	23	28	30	24
Medium IFI countries	10	15	20	26	24	26	20
Low IFI countries	24	27	29	26	33	35	19
Proportion of low IFI countries (%)	51.06	45.00	40.28	34.67	38.82	38.46	30.16

Table 4 presents descriptive statistics of computed IFI values for all countries for the period 2004 – 2010. The descriptive statistics indicate that over the years, there is a general improvement in financial inclusion in the countries considered here. The IFI values ranged between 0.012 and 0.957 in 2004 and in 2010, the range was between 0.052 and 0.996. Similarly, the mean IFI increased from 0.373 in 2004 to 0.478 in 2010. The declining trend of the coefficient of variation (CV) over the years from 0.78 in 2004 to 0.57 in 2012 seems to indicate convergence in IFI values. This can also be viewed from the fact that in 2004, about 51 per cent of the countries were low IFI countries while in 2010, about 30 per cent of the countries were low IFI countries.

In Table 5, we have presented the same descriptive statistics by income categories of the countries (as indicated in the four panels of the table). As shown in Panel 1 of Table 5, the low income countries had a range of IFI values between 0.042 and 0.321 in 2004 which improved to a range between 0.052 and 0.401. The average IFI amongst the low income countries has remained constant at around 0.1 during 2004 – 2010. As expected, these are also the countries that have low IFI values. Only 1 low income country was placed in the medium IFI category during 2005 - 2010.

Table 5: Descriptive Statistics of computed IFI (2004-2010)

	2004	2005	2006	2007	2008	2009	2010
Panel 1: Low income countries							
Min	0.042	0.008	0.010	0.009	0.011	0.016	0.052
Max	0.321	0.337	0.352	0.347	0.361	0.376	0.401
Mean	0.11	0.09	0.09	0.10	0.09	0.10	0.12
Standard dev	0.11	0.11	0.11	0.10	0.09	0.09	0.12
CV (standard dev/Mean)	1.01	1.16	1.15	1.03	0.97	0.87	0.97
No. of countries	6	7	8	9	12	14	8
High IFI countries	0	0	0	0	0	0	0
Medium IFI countries	1	1	1	1	1	1	1
Low IFI countries	5	6	7	8	11	13	7
Proportion of low IFI countries	83.3	85.7	87.5	88.9	91.7	92.9	87.5
Panel 2: Lower middle income countries							
Min	0.012	0.012	0.014	0.016	0.019	0.024	0.084
Max	0.429	0.672	0.686	0.707	0.724	0.725	0.717
Mean	0.167	0.218	0.228	0.242	0.228	0.239	0.316
Standard dev	0.14	0.19	0.18	0.19	0.19	0.18	0.19
CV (standard dev/Mean)	0.86	0.86	0.79	0.78	0.82	0.77	0.59
No. of countries	10	14	16	16	20	21	13

Table continued in next page

Table 5: Descriptive Statistics of computed IFI (2004-2010) (contd.)

	2004	2005	2006	2007	2008	2009	2010
Panel 2: Lower middle income countries							
High IFI countries	0	1	1	1	1	2	1
Medium IFI countries	2	3	4	5	5	4	4
Low IFI countries	8	10	11	10	14	15	8
Proportion of low IFI countries	80.0	71.4	68.8	62.5	70.0	71.4	61.5
Panel 3: Upper middle income countries							
Min	0.033	0.037	0.038	0.049	0.048	0.056	0.128
Max	0.636	0.692	0.741	0.756	0.758	0.769	0.791
Mean	0.286	0.357	0.389	0.410	0.422	0.442	0.467
Standard dev	0.15	0.17	0.20	0.20	0.20	0.20	0.20
CV (standard dev/Mean)	0.51	0.47	0.52	0.49	0.47	0.45	0.43
No. of countries	14	19	22	23	24	27	21
High IFI countries	1	2	5	5	6	7	6
Medium IFI countries	4	8	7	11	12	14	11
Low IFI countries	9	9	10	7	6	6	4
Proportion of low IFI countries	64.3	47.4	45.5	30.4	25.0	22.2	19.0
Panel 4: High income countries							
Min	0.185	0.202	0.231	0.253	0.104	0.104	0.354
Max	0.957	0.949	0.988	0.983	0.970	0.974	0.996
Mean	0.660	0.683	0.667	0.679	0.688	0.695	0.727
Standard dev	0.25	0.22	0.22	0.22	0.23	0.23	0.18
CV (standard dev/Mean)	0.38	0.33	0.33	0.33	0.33	0.33	0.25
No. of countries	17	20	26	27	29	29	21
High IFI countries	12	15	17	17	21	21	17
Medium IFI countries	3	3	8	9	6	7	4
Low IFI countries	2	2	1	1	2	1	0
Proportion of low IFI countries	11.8	10.0	3.8	3.7	6.9	3.4	0.0

Panel 2 of Table 5 presents descriptive statistics of IFI values pertaining to lower middle income countries. The range of IFI values for this category of countries changed from [0.012, 0.429] in 2004 to [0.084, 0.717] in 2010. The average IFI value recorded an improvement from 0.167 in 2004 to 0.316 in 2010. As shown in the last four rows of this panel, few of the lower middle income countries had high and medium IFI values, although majority of them had low IFIs.

As for the upper middle income category countries, as presented in Panel 3 of Table 5, the range of IFI values changed from [0.033,0.636] in 2004 to [0.128, 0.791] in 2010. On an average, a country in this category had a low IFI of 0.286 on 2004 which improved to be in the medium IFI category in 2010 with an average of 0.467. Further, this category of coun-

tries dominated the low IFI countries in 2004 but in 2010 they dominated the medium IFI countries.

For the high income countries (Panel 4, Table 5), the IFI values ranged between [0.185, 0.957] in 2004 and [0.354, 0.996] in 2010. The average IFI value for this category of countries improved from 0.660 to 0.727 between 2004 and 2010. As expected, high income countries dominate the high IFI countries, although some high income countries are in medium and low IFI categories.

Thus, the above tables indicate that there is a general tendency towards improvement in financial inclusion for countries in all income categories. While low and lower middle income countries dominate the low IFI countries, upper middle income countries dominate the medium IFI countries and high income countries dominate the high IFI countries. Thus, income levels and levels of financial inclusion seem to move in a similar direction. Further, for all income categories, the falling trends of the coefficient of variation imply that the variability of the IFI values in relation to the respective averages is falling, indicating a tendency towards convergence.

4.3 Limitations of the present study

The IFI proposed and computed in this paper is comprehensive as it is multidimensional. It is also easy to compute. Mathematically, it satisfies some important properties. However, as in the case of any index, its computation depends on the availability of data. As we have seen in the illustrative example presented in Table 3, data on all dimensions for all the years are available only for a very few countries. Further, as noted earlier, due to technological advancements, improvements in infrastructure and higher levels of education and particularly financial literacy, major changes are occurring in the way banking facilities are being made available to users. This has led to changes in the conventional banking, with the role of a bank branch being reduced while the role of technology driven service outlets such as telebanking and internet banking increasing. While all this has implications for financial inclusion and need to be studied, at the time this study is being undertaken, data for these new forms of banking were not available. Once data become available, suitable methods and corresponding weights for incorporating these new forms of banking into the IFI can be devised. Due to this data related limitation of the present index, the IFI estimates for some countries such as Norway, France, Germany, the Netherlands and Switzerland could be under estimates.

5. Conclusion

In this paper, we have proposed an Index of Financial Inclusion (IFI) – a multidimensional measure similar to the well known development indexes such as HDI, HPI, GDI and GEM. The IFI can be used to compare the extent of financial inclusion across different economies and to monitor the progress of the economies with respect to financial inclusion over time. For example, subject to availability of data, it can be used to measure financial inclusion at different time points and at different levels of economic aggregation (village, province, state, nation and so on). In this paper we present an illustrative example at the country level.

The IFI values computed for various countries for the years 2004 – 2010 indicate that countries around the world are at various levels of financial inclusion. Notwithstanding the level of financial inclusion, the IFI measures tend to indicate a general improvement in the level of financial inclusion during 2004-2010. The average IFI improved from 0.373 in 2004 to 0.478 in 2010. While low and lower middle income countries dominate the low IFI countries, the medium IFI countries are dominated by upper middle and high income countries. Most of the high IFI countries are also high income countries. Thus, financial inclusion and income levels tend to move in the same direction, although there are some exceptions.

This paper is only a first step in the direction of appropriately measuring financial inclusion over time and across regions. While improvements and technical innovations in the index are always possible, as we have noted here, presently the availability of data seems to be the biggest constraint.

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