

STOCKHOLM SCHOOL OF ECONOMICS

Department of Economics

Master's Thesis

A Note on the Link between Regional Market Integration and Financial Development in Rural India

Abstract

Promoting financial development has been a long-prevailing goal for Indian policymakers. However, across the Indian regions, significant variation in the level of financial development is observed. By understanding the factors underlying this variation in financial development, policymakers will be better equipped to design policies that promote development of the financial system. The purpose of this Master's thesis is to contribute to our understanding of the factors underlying the regional variation in financial development in rural India. Theories of economics of trade and the historical-empirical evidence of Indian financial market development suggest that the level of market integration can be an important factor in determining the level of financial development. In this study, the hypothesis that higher market integration leads to higher financial development is tested. The results suggest a negative empirical relationship between regional market integration, measured by the average regional share of non-homegrown consumption in total consumption, and the marginal interest rate a household pays on its loans (an inverse measure of financial development). This is consistent with higher market integration leading to higher financial development.

Keywords: Market integration, financial development, rural credit markets.

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1. Introduction

According to financial market theory, a well-functioning financial system can contribute to economic growth by channeling funds to their most productive use and allocating risks to those who can best bear them. The recent empirical finding of a causal relationship between a country's level of financial development on the one hand and economic growth and poverty reduction on the other hand, first shown by King and Levine (1993) and followed by a subsequent large body of literature¹ has renewed interest for financial development by policymakers worldwide. If financial development represents a route to growth and prosperity, the promotion of financial development becomes an important consideration for economic policy.

In India, financial sector development in general and the functioning of rural credit markets in particular has remained an important topic of economic policy discussion over the past century. It is documented that already by the end of the 19th century, officials of British India expressed their concern over farmer indebtedness and what they perceived as the exploitative nature of credit market transactions (Bhattacharya 1994).

After Indian independence from British rule in 1947, credit market reform remained a priority in the government's development efforts following the socialist model of development. In an effort to promote agricultural investment and productivity as well as providing an alternative to the local moneylender, the Indian state engaged in direct intervention in the credit market. In the period between 1950 and 1980, the state promoted the setting up of credit cooperatives and regional rural savings banks, nationalized the banking sector and implemented mandatory bank lending to the prioritized sectors at subsidized interest rates (Bali Swain 2001).

Despite the considerable policy measures taken in order to promote the so called formal financial sector, access to credit remains limited and the informal sector continues to play an

¹ See for example Levine (2005) for an overview.

important role in the credit markets². According to the latest official estimates which date from 2002, 13.4 percent of rural households had cash loans outstanding from formal sources whereas 15.5 percent had loans outstanding from informal sources. Informal sources of credit accounted for 43 percent of the credit supply in rural areas with the professional moneylender as the major supplier (21 percent). It was also estimated that 32 percent of outstanding credit in rural areas command an annual interest rate higher than 20 percent (NSSO 2006). From a policy perspective, the Reserve Bank of India considers that that the direct intervention in the rural credit market has failed to reach the desired objective of access to financial services at an affordable cost for a wider segment of the Indian population (RBI 2009).

In order to be better equipped to design policies that favor financial development for the approximately 700 million people who constitute the Indian rural population, it is useful to gain further understanding of the factors underlying financial development and what role the government has to play. The following section describes some of the factors that are found to be of importance for financial development³.

There is wide agreement that financial development is highly dependent on macroeconomic stability as well as on the contractual and informational infrastructure (World Bank 2007). Macroeconomic stability implies in particular a stable price level. High and variable inflation lead to uncertainty about the future value of money that further contributes to informational asymmetries which give rise to credit market frictions (Huybens and Smith 1999). Allowing the financial system to work efficiently is clearly an additional reason for governments to keep inflation under control.

A recent and growing body of literature is exploring the importance of the institutional framework, including the nature of the legal system, in determining financial development. In a cross-country study, La Porta et al. (1997) find that countries with poor investor protection have less active capital markets. In particular, they find that French civil law countries display both weaker investor protection and less developed capital markets compared to common law

² The formal sector consists of commercial banks, regional rural development banks, cooperatives and other registered financial institutions. The informal sector is mainly represented by professional moneylenders, agricultural moneylenders, landlords, traders and commission agents.

³ For an overview see World Bank (2007).

countries. However, the second finding has been somewhat challenged by Beck, Demirgüç-Kunt and Levine (2005) who find that the larger challenges in accessing external finance faced by firms in civil law countries is rather due to a lower degree of adaptability of the legislation under this system.

Among all legal institutions that may play a role in determining financial development, the protection of private property rights is inarguably one of the most important. The right to property such as land, which can be used as collateral in financial transactions, significantly reduces the risk taken on by the lender and increases the probability that financial market transactions take place. On a macro level, Acemoglu and Johnson (2005) have explored the importance of “property rights institutions” which protect citizens against exploitation by the government and “contracting institutions” which enable private contracts between citizens. By using instruments, such as settler mortality in the former European colonies (assuming that high settler mortality lead to poor property rights protection) and legal origin for the contracting legislation, they show that private property rights institutions rather than contracting institutions seem to determine investment to GDP ratios, private credit to GDP ratios as well as stock market development.

Among other factors of relevance for financial development, that may not have been fully empirically explored, are improved literacy in general and improved financial literacy in particular that may help individuals in evaluating and using financial services. Government action that favors the general business climate such as communications, transportation, energy and the security situation are of course also of importance for financial development (World Bank 2007).

In India, it can be observed that financial development is unevenly spread across the subcontinent. The official estimates show that whereas 40 percent of households in Andhra Pradesh and Kerala have access to any form of credit the corresponding figure in Uttaranchal, Jharkand and Assam is below 10 percent. Access to formal financial institutions in rural areas also varies from 32.8 percent in Kerala, 22.8 percent in Maharashtra and 16.1 percent in Karnataka to 1.6 percent in Assam, 3.3 percent in Uttaranchal and 5.7 percent in Bihar. While in some states such as Bihar, more than 40 percent of rural credit commands a higher annual

interest rate than 30 percent, in other states such as Punjab and Gujarat less than 10 percent of credit commands such high rates (NSSO 2006). By understanding the factors accounting for these regional differences in financial development we can get further guidance on which policy measures to implement in order to promote the development of the financial system.

India is one country with a single legal origin so neither the regional variation in macroeconomic stability nor the variation in legal institutions is likely to account for the interregional differences in financial development. In a largely rural developing country such as India, it is plausible that the factors underlying financial development can be found among the basic infrastructure allowing and creating incentives for financial markets transactions to take place. According to the historical-empirical evidence of the development of the Indian financial market, the extent to which a region integrates into a wider economy seems to have been an important determinant for the development of a financial system. According to the theories of international trade, the integration of markets can, by increasing investment opportunities, the supply of credit and competition between lenders, also contribute to financial development.

The purpose of this thesis is to contribute to our understanding of the regional variation in financial market development in rural India. In particular, I aim to study how the regional variation in integration of markets can explain the regional variation in financial development.

The remainder of this thesis is organized as follows. In the second section, I will provide an overview of the historical development of credit markets in rural India. In a third section, I will describe the theories of the link between integration of markets and financial development as well as of the functioning of rural credit markets. Section 4 describes the methodology applied while section 5 describes the data used for estimating the econometric model. Section 6 describes the econometric analysis and results while section 7 presents a discussion of the results. Section 8 concludes.

2. Development of the rural credit market in India

2.1 The initial phase of commercialization

The following section mainly builds on Roy (2006). The integration of India into the world markets for capital, goods and labor took off in the 18th century and intensified after 1850. In this period, infrastructure and institutions necessary for a market economy to function were put in place such as uniform weights and measures, contract law, a uniform currency system, railways and canals as well as the institution of private property rights. The process of commercialization of agriculture implied that farmers started producing for sale in more distant markets, reachable by railway within India as well as abroad, rather than for subsistence needs or for the local village market. The process of commercialization increased the scale of credit transactions in the villages both for demand and supply side reasons. From the demand side, the major reasons were the following: 1) The scale of production expanded compared to subsistence farming which required more working capital 2) Farmers who substituted food production for cash-crop production may have needed to borrow for food purchases before harvest 3) Payment of rent and taxes in cash required cash borrowings 4) Cash-crops required more investment in marketing since they were traded over long distances 5) Cash-crops required more investment in high-cost inputs such as fertilizer.

From the supply side, the improved profit opportunities in agriculture increased investment funds available from persons from the trader or moneylender castes. The creation of private property rights also made land available as collateral, at least for those to whom property rights were granted. In the same time period, large-scale irrigation projects lead to higher productivity of land in some regions and an increase in land value. The new legislation giving creditors judicial support in recovering their debt also reduced the risk of lending (Roy 2006).

Still, post-independence economic discussion has displayed some disagreement over whether prosperity or poverty better explain the expansion of credit in the late 19th and early 20th centuries. Credit market activity was certainly often a sign of farmers engaged in capitalist production for the world market. In other cases, the debtors' dependence on the creditor displayed characteristics of serfdom. There is however general agreement on that the nature of the creditor debtor relationship varied across social groups and geographical regions (Bose 1994a).

2.2 Early financial development in the Indian regions

In the Tamil countryside, the period leading up to the First World War displayed an important growth in the value and volume of international trade. Trade needed finance and the rapidly expanding business contributed to a fast growth of financial institutions. Baker (1994) describes a pyramid of credit trickling down from the Imperial Bank at the top to the vast base of cultivators on the countryside at the bottom. The Imperial Bank and other modern-style banks lent mainly to substantial traders and prominent indigenous bankers. These substantial bankers lent to smaller colleagues who in their turn provided funds to prominent cultivators. The latter lent to neighboring tenants and laborers. At each stage of the pyramid, the creditor added her own capital and made an addition to the interest rate. However, following the great depression at the end of the 1920's, the value of agricultural products for which credit had been supplied decreased causing a contraction of business and failure of several financial institutions. Distressed debtors called for debt restructuring and several pieces of legislation were passed in the direction of protecting debtors. This legislation, including an interest rate ceiling, imposed new constraints on lending. Because of lenders' efforts in avoiding the interest rate ceiling, credit market transactions returned to the basis of the creditor's personalized knowledge of the borrower in the context of social power.

In Eastern India, professional moneylenders represented the major credit suppliers during most of the 19th century whereas big landowners with spare liquidity entered the market in the late 19th century. The normal interest rate on kind loans was 50 percent but since the loan was outstanding for only a few months the annual interest rate was higher. With the expansion of the jute economy in the early 20th century, so called trader-moneylenders started to provide credit to cultivators. The districts of East Bengal with intensive jute cultivation had a higher number of moneylenders relative to the population than other districts in the Bengal province. Interest rates in these districts were still usurious for small farmers with little collateral but lower than in West Bengal or Central Bengal (Bose 1994b).

From the Punjabi countryside, where the expansion of irrigation and canals had been the most prominent, Darling (1994) noted that agriculture was the most prosperous in India and that farmers also were the most indebted. The limit of borrowing capacity had increased from the value of an occasional good crop to the market value of the newly granted property rights. However, also in Punjab, a distinction could be observed between regions with high values of

land, which could be used as collateral, and regions of low land values where moneylenders demanded little security. The latter regions were characterized with high interest rates in order to compensate for the borrower's risk of default (Bhattacharya 1994). This view was later confirmed by Stokes' accounts from central India. According to Stokes (1994), the debtors' dependence on the creditor was strongest in regions where the agricultural productivity was low and there were no rich peasants to challenge the moneylender's monopoly. These were regions that had marginal experience with the market economy and were mainly engaged in subsistence agriculture.

2.3 Credit market development post independence

In the 1950's, an estimated 4 percent of commercial bank lending was directed towards the rural sector and almost 83 percent of household cash borrowings was provided by professional moneylenders (RBI 1954). The idea at the time was that farmers were credit constrained and that any additional credit supply would increase the level of productive investment and hence output. In addition to this liquidity effect, credit could provide an opportunity for consumption smoothing for the Indian farmers working under uncertain conditions of rainfall (Bali Swain 2001). The All-India Rural Credit Survey was set up in order to investigate the nature of the rural credit market and provide policy recommendations. In 1954, The authors of the survey concluded that credit was not only scarce but that the functioning of rural credit markets was further hampered by local moneylenders possessing important market power through which they could make economic profits at the expense of distressed farmers. The proposed solution to this credit constraint and moneylender monopoly was for the state to engage in direct intervention in rural credit markets (RBI 1954). The observations and policy recommendations of this report came to guide Indian policy towards rural credit markets in the following decades.

In the 1950's, an extensive network of rural cooperative banks was established with the intention of channeling countrywide deposits towards agriculture and small scale industries. However, this objective was not necessarily reached and, in order to control the banks' business, the 14 major Indian commercial banks were nationalized and incorporated into the state planning structure in 1969 (Ramji 2009). Between 1977 and 1990, an Indian bank was only allowed to open a bank branch in a location which already had bank branches if it opened four branches in so called "unbanked" locations (the 4:1 rule). The banks were also

mandated to sustain credit-deposit levels of at least 60 percent in each geographic area in order to make sure that savings were not diverted towards urban areas (Burgess and Pande 2005). Since 1969, Indian banks have to direct at least 30 percent of their lending to the so called “priority sector” consisting of small scale agricultural industries and 25 percent of the lending has to go to the weaker segment of the prioritized sectors. There is also an interest cap on bank loans with a nominal value of below Rs. 200,000 equal to the prime lending rate.

During the phase of this so called “social banking experiment”, the decennial All-India Debt and Investment Survey indicated a steady decline in the share of so called informal credit in favor of formal credit. In rural India in 1972, the share of credit provided by formal sources out of total credit outstanding was estimated to 29 percent. In 1992, the corresponding figure was estimated to 61 percent (NSSO 2006). However, independent studies have somewhat challenged these results. When studying various states in India and various regions within the states, Bell (1990) finds that commercialization of agriculture is associated with more borrowings not only from institutional sources but also from traders and commission agents.

Burgess and Pande (2005) have empirically shown that the so called 4:1 rule lead to relatively more bank branches opening in regions with initially lower levels of financial development. They find that between 1977 and 1990, the share of rural branches in total bank credit increased from 1.5 percent in 1977 to 15 percent and that, during the same time period, agricultural productivity increased faster in regions with initially lower levels of agricultural productivity. However, it is recognized that the extensive state intervention in promoting financial development came at a cost. In the 1980s, the default rate on loans from the state-owned commercial banks was estimated at 42 percent (as a share of all loans due for repayment) (Burgess and Pande 2005). Following significant losses in the banking system, the policy of mandatory opening of rural bank branches was discontinued in 1990 and privately owned banks were allowed to enter the Indian market. This shift in banking regulation may be the reason for the decline in the proportion of cash debt provided to rural households by formal sources from 64 percent in 1991 to 57 percent in 2002 (NSSO 2006).

The 21st century has seen a fast development of the microfinance sector, which generally has the intention of providing the poor with livelihood opportunities while being economically

profitable. There is no official estimate of the outreach of this sector but the industry organization Microfinance India claims that 76.6 million people are served by a microfinance organization (Microfinance India 2010). However, insufficient screening of borrowers has lead to repayment problems and economists now call for supervision of the industry (Banerjee et al. 2010).

3. Theories of rural credit markets

3.1 Theory of market integration and financial development

The mechanism by which market integration leads to financial development can be understood from the perspective of economics of trade. The effect of market integration on financial development is likely to go both via the integration of local product markets in a wider economy (which increases income, spare liquidity and competition between lenders) and via the integration of financial markets themselves (and the following opportunity to trade credit on other prices than prevailing in the local economy).

In a local economy which is not integrated with other markets, either due to physical barriers or other constraints, autarky can be assumed to prevail. In autarky, the production of goods and services equals the consumption of goods and services. If this local economy represents a developing country village, it is likely to be characterized by subsistence agriculture.

When this local economy integrates with a regional market, either thanks to development of the necessary infrastructure and communications or for other reasons, this local economy can benefit from the gains of trade. The gains from trade can be broken down to the gains from specialization and the gains from exploiting economies of scale (Krugman and Obstfeld 2009).

The most basic model illustrating the gains from trade, the Ricardian model, shows that total output can be increased if two economies trading with each other specialize according to their respective comparative advantage in the production technology. With an increase in total output, individuals in both economies are likely to be better off.

If two local economies have different resource endowments, for example two villages having different soil-type and climate, the Heckscher-Ohlin model illustrates that gains from trade can be obtained by each economy exporting the goods whose production is intensive in the resources with which the economy is abundantly endowed.

Even when there are no apparent differences between the two economies, opening up to larger markets can be beneficial when the production of a good is characterized by internal economies of scale. Since the markets for these goods are often imperfectly competitive, market integration can provide gains in terms of increased efficiency and competition. According to the simplest model of oligopolistic markets, the monopolistic competition model, an expansion of the monopolistically competitive market via trade will lead to more products being available to consumers at a lower cost (Krugman and Obstfeld 2009).

According to the theories of trade, when a local economy integrates into a wider market economy and trade in product market increases, the gains from trade are likely to generate a higher economic surplus. This increased surplus accumulation may increase the supply of loanable funds and contribute to credit market activity. If also the sources of loanable funds multiply this may increase competition (in an imperfectly competitive market) and drive down the price of credit.

The process of market integration can also contribute to financial development via a direct effect on financial markets. When integration of the market for finance takes place, the price of finance is likely to equilibrate across the whole market. By trading at other relative prices than prevailing in the local economy, the local economy has a chance to be better off. If the supply of credit is scarce in this local economy and abundant outside, the relative price of credit will decrease in the local economy which is to the advantage of those demanding credit.

Moreover, a subsistence economy with limited possibilities of producing for sale on the market is not likely to present attractive profit opportunities. From this perspective, market integration and the incentives it creates to expand production and make profits, can be seen as a prerequisite for investment opportunities and thus financial market activity to occur.

In summary, when a local economy reaches greater access to the wider market, the variety of suppliers of funds may increase, competition tighten and the cost of borrowing be reduced.

3.2 Theories of the functioning of rural credit markets

Some of the most prominent features of rural credit markets are described by Hoff and Stieglitz (1990):

- Formal and informal sectors coexist despite the fact that interest rates charged in the informal sector are substantially higher.
- Interest rates may not equilibrate demand and supply for credit but lending may occasionally be unavailable at any price.
- Interest rates in different areas vary by more than what can be considered as plausible based on the probability of default.
- There are a limited number of lenders in the informal sector despite the high interest rates.
- Interlinkages between credit transactions and transactions in other markets are common in the informal sector.
- Formal lenders are mainly present in areas where farmers have land titles.

From a microeconomic perspective, it has been proposed that there are three (possibly four) components determining the interest rate at which a household in rural India is borrowing⁴. These components are the alternative cost of funds, the transaction costs of the lender, a risk premium and possibly also monopoly profits of the lender (Bottomley 1963). However, there is wide disagreement over to what extent lender monopoly is an important feature of rural credit markets.

The traditional view emphasizes the market power of the local moneylender stemming from a lack of competition from other sources of borrowing as well as from control of marketing channels for agricultural output. This unequal bargaining power between lenders and borrowers is assumed to lead to interest rates out of proportion with the risk involved in

⁴ However, the interest rate paid on a loan may not be the only cost of borrowing incurred, especially when comparing informal and formal credit. Taking one day off to travel to the bank may be a costly alternative to moneylender credit at higher interest rates. In addition to the interest rate which is capped by a ceiling, some officials from the institutional side may demand a significant side payment (Bell 1990).

lending. Inspired by Marx, Bhaduri (1973) develops a theoretical model by which the high interest rates, typically between 50 and 100 percent, observed in West Bengal are the result of the “semi-feudal” production relations in the villages. In this model, farmers neither have direct access to capital markets, due to lack of collateral, nor to product markets. They are confined to selling their produce and meet their credit needs from a landlord who can decide on the terms of the transaction. According to this theory, the moneylender's risk of credit loss is low thanks to the personalized relationship between the lender and the borrower as well as the public loss of face by the borrower in case of default.

Another view claims that rural credit markets work as classical competitive markets should and the high interest rates observed simply reflect the high risk of the borrowers (Von Pishke, Adams and Donald 1983).

More recent approaches focus on the information asymmetries between borrowers and lenders in explaining the observed features of the rural credit markets in general and the relatively high interest rates in particular. These asymmetries, although also present in developed countries, are assumed to be more pronounced in developing regions due to lack of collateral and limited legal contract enforcement. According to the information asymmetries view, lenders in the rural credit markets face major challenges in terms of adverse selection, moral hazard and contract enforcement. Their response to these challenges is, to a large extent, reliance on personal relationships, trade-credit linkages and usufruct loans that result in a cost of borrowing above the market price (Hoff and Stieglitz 1990). In this situation, the interest rate does not only reflect the price of credit but also the cost of screening and contract enforcement.

3.3 My contribution

The purpose of this thesis is to contribute to our understanding of the regional variation in financial market development in rural India. The micro-level theories on the functioning of rural credit markets outlined above do not necessarily offer a full explanation of the differences in regional financial market development across the country. Theories emphasizing the importance of lenders' monopoly power do not provide a reason for why the regional variation in bargaining power of the moneylender would explain the regional differences in financial market development. Theories assuming that rural credit markets are

perfectly competitive fail to explain the variation in interest rates between different regions by the differences in default rates. Likewise, no relationship between the level of informational asymmetries and regional financial development has been established.

In order to understand the issue of financial development on a regional level, the historical-empirical account as well as the theoretical arguments provided above give us good reasons to believe that integration of markets can provide an important determinant in explaining the variation in financial development across India. Therefore, the hypothesis that will be tested in this thesis is the following: *Does a higher level of regional market integration lead to higher financial development in rural India?*

To the best of my knowledge, there is no previous study of the relationship between market integration and financial development in India or elsewhere.

4. Methodology

This section describes the definitions and measures of market integration and financial development used in the study. It also outlines the method through which the hypothesis will be tested and describes some limitations.

With market integration, I refer to the process by which households transfer from a subsistence economy to production for the market. It is also the process by which the local economy is integrated into a wider regional economy and eventually into the world economy (Roy 2006).

There is not one obvious method for measuring the level of market integration. The degree of harmonization of price levels is generally used as a measure in markets for agricultural products⁵. It can be argued that a household or a region that uses all its production for its own consumption is not integrated into the wider market economy. If a significant share of a household's production is sold on the market, it can be assumed that the household is integrated into the market economy, even if, by this definition, the market may only represent

⁵ See for example Fackler, P. and Tasthan, H. (2008).

the local village market. Therefore, the share of a household's production that is sold on the market can be considered a fairly restrictive measure of market integration.

However, in contrast to consumption data, information on household production in rural India is not readily available. For the purpose of this study, the average regional share of non-subsistence goods in total consumption is used as an alternative measure of regional market integration. It is not a too strong assumption that a household only consuming home-grown goods is mainly engaged in subsistence production and does not transact widely on the market. On the other hand, a household for which a considerable share of the total consumption is non-home grown goods, the household can be assumed to transact widely on the market. It is of course possible that this assumption does not always hold for the individual household. However, on the regional level, which is considered for this study, if all households only consume products purchased on the market there must be a strong development of the market economy in the region. Likewise, if all households only consume home-grown goods, this region is not likely to be very integrated in the wider market. Therefore, on a regional level, the regional average share of market transactions in total household consumption is a relevant measure of the level of market integration.

Given the complexity of the process of financial development, there is no agreement on how the level of financial development can best be defined or measured. According to Guiso, Sapienza and Zingales (2004), the state of financial development refers to the variety of financial intermediaries available, the efficiency with which these intermediaries perform their functions of evaluation, monitoring, certification, communication and distribution as well as the legal and regulatory framework contributing to the performance of financial markets.

Guiso, Sapienza and Zingales (2004) propose to measure financial market development by the degree of ease by which individuals in need of external funds can access them and the premium they have to pay for these funds. However, information on the borrowing conditions and the cost of borrowing is rarely available and in practice more crude measures have often been used. In their cross-country study of financial development and growth, King and Levine (1993) measure financial development with the size of the formal financial intermediary

sector relative to GDP, the importance of banks relative to the central bank, the percentage of credit allocated to private firms and the ratio of credit issued to GDP. In another cross-country study, Rajan and Zingales (1998) measure financial development by domestic credit plus stock market capitalization as well as accounting standards in the country. In a developing world context, measures emphasizing financial access such as the number of bank branches per population, number of bank accounts per population or the proportion of households having access to credit, have been employed (World Bank 2007).

In developed countries, the financial sector may refer to a wide range of services including credit, investment, insurance and risk management services. In developing countries, the range of financial services offered is likely to be narrower and focus on the credit market. For the purpose of this study of rural India, I will rely on the theoretically sound concept of the cost of borrowing, in the form of the marginal interest rate a household pays on its loans, as a measure of financial development.

The interest rate prevailing in a region is likely to reflect both the liquidity supply on the market (which should be high in a financially developed region) as well as the degree of competition between lenders (which should also be high in financially developed regions). Therefore, financially developed regions are likely to be characterized by relatively low interest rates. In order to mainly take into account market based transactions, I exclude loans provided on concessional terms by the government or family members from this measure.

Following the reasoning above, the hypothesis “*Does a higher level of regional market integration lead to higher financial development in rural India?*” is translated to testing the hypothesis of a negative empirical relationship between the level of regional market integration, measured by the regional level of non-subsistence goods in consumption, and the marginal interest rate paid by a household on its loans (an inverse measure of financial development). The hypothesis test will be carried out by estimating an ordinary least squares (OLS) regression model of the relationship between market integration and financial development.

By estimating a model of how the regional level of financial development affects the interest rate of the individual household I can control for household specific characteristics that determine the household risk of default and thus the risk premium component of the interest rate. In addition to controlling for household specific variables I will also control for regional variables that may influence the level of financial development such as the regional level of wealth, income and education. The reason for using the household as the relevant unit of measurement rather than the individual is that households to a large extent are the relevant unit of economic production and decision-making in rural India.

5. Data and variables

5.1 Data

The data analyzed in this study derives from the All-India Debt and Investment Survey conducted by the National Sample Survey Organisation (NSSO). The latest round of the survey was conducted in 2003 (published 2005) with more than 140,000 households in all Indian states and union territories surveyed.

The NSSO presents data on a regional level where a state typically comprises 1-6 regions and a region comprises 5-10 districts. The sample of households considered in this study consists of the households that had credit outstanding on survey date from a source other than the government and family and with an interest rate other than a concessional rate. However, the number of observations from some of the smallest regions is very low and cannot be considered as statistically valid. Therefore, I have chosen to study the 23 major Indian states consisting of 63 NSSO regions. The total sample size is 25,382 observations and the distribution per region is presented in appendix A1.

For survey data, potential issues of data quality that may affect the internal validity of the study primarily stem from errors-in-variables and sample selection bias. A potential source to errors-in-variables would be that not all respondents are well-informed about the financial situation of the household and give incorrect answers. Variation in the training and experience among data collectors may also be responsible for errors in the recorded data. A source of sample selection bias would be if a data collector, belonging to a certain caste, voluntary or involuntary, is constrained to collect data from other households of the same caste. Variation

in the data can also occur due to the fact that indebtedness varies over the agricultural cycle and the survey data was collected at different points in time on the agricultural cycle in the different regions.

Despite these potential data quality issues, the NSSO dataset represents a unique opportunity to get an insight into the functioning of the Indian rural credit market. The considerable experience of the NSSO in conducting the All India Debt and Investment Survey ensures that there is currently no equivalent data source that can match the coverage and quality of this data set in India.

5.2 Variables

The dependent variable in the regression model is the marginal interest rate paid on loans outstanding on survey date with maturity of up to three years. Only cash-loans (as opposed to in-kind loans) are considered. All loans that are taken in cash are considered as cash-loans irrespective of whether they are repaid in cash or in kind. Loans that are provided at concessional interest rates (for example by the government or family members) are not considered. In rural India, the interest rate quoted is sometimes the simple rate and sometimes the compound rate. However, since the two interest rates do not differ much for loans with short maturities this is not likely to be a problem. This variable is referred to as *interest rate*.

The independent variable is the average regional share of non-homegrown consumption in total consumption. First the share of non-homegrown consumption in total monthly household consumption is calculated for each household. Secondly, the weighted average is calculated over the region as defined by the NSSO. This variable is referred to as *market integration*.

The following variables describe household characteristics that can be important in determining the marginal interest rate of the household:

Agricultural land area. Land represents high-quality collateral. A household with a significant amount of land is likely to be able to offer better collateral and thus borrow on more advantageous conditions than a household not being able to offer land as collateral. However there is likely to be a negative marginal return to an increase in land ownership so therefore a logarithmic relationship between the interest rate and the land area is assumed. This variable is referred to as *agricultural land area*.

Level of household consumption. Data on household income is not available and therefore data on monthly household expenditure serves as a proxy for income. A household with a high level of expenditure is also likely to have a high income and therefore a good capacity to service its debt. Lending to such a household can be considered as less risky and therefore the marginal interest of the household can be expected to be relatively low. Since the effect of a change in the income level on the interest rate is likely to be smaller for high income levels a logarithmic relationship between household consumption and the interest rate is assumed. This variable is referred to as *household consumption*.

Debt-to-assets ratio. The ratio of debt to total assets gives an indication of the household's capacity of servicing new debt. The higher the debt to assets ratio, the more vulnerable the household is to fluctuations in income and the higher is likely to be the interest rate. This variable is referred to as *debt-to-assets*.

Total household assets. This variable comprises the total value of all household assets including buildings, vehicles, machinery, livestock and financial instruments such as shares and bonds. Information on gold and cash holdings is not available. The higher the value of household assets, the more solvent is likely to be the household and the lower is the expected interest rate. Since an increase in household wealth is likely to have a smaller impact on the interest rate for high levels of household wealth a logarithmic relationship between household wealth and the interest rate is assumed. This variable is referred to as *total assets*.

The household education level. This variable measures the education level of the head of the household. It is a discrete variable taking values between 1 (illiterate) and 11 (post-graduate and beyond). A well educated household is likely to be more informed about the financial markets and therefore able to transact on better conditions than an uninformed household. Therefore, a high education level is likely to lead to lower interest rates. The effect of an increase in education on the interest rate is likely to be less pronounced for higher education levels and therefore a logarithmic relationship between the education level and the interest rate is assumed. This variable is referred to as *education*.

Household primary occupation. This is a set of four dummy variables taking the value 1 for the primary occupation a specific household belongs to (agricultural laborer, self-employed in non-agriculture, other labor, and other). The base case is self-employed in agriculture. Households that are engaged in labor, perhaps on daily contracts, are likely to have a more uncertain source of income than the self-employed. Therefore, these households are expected

to face a higher cost of borrowing. These primary occupations are referred to as *self-employed agr.*, *self-employed non-agr.*, *agricultural labor*, *labor non-agr.* and *other occ.*

Household social type. A household's position in the caste hierarchy may play a role in determining the cost of borrowing where the higher casts are likely to face the lowest interest rates. Each caste group is represented by a dummy variable taking the value 1 for the group a particular household belongs to. These dummy variables are referred to as *scheduled caste*, *scheduled tribe* and *other backward caste*. The base case is *general category*.

The following variables are included in the regression model in order to account for the general level of (economic) development in the region that may affect the market interest rates:

Average regional consumption. Since data on average regional income is missing the weighted average of regional consumption expenditure serves as a proxy. Regions with high levels of expenditure, and thus high levels of income, are likely to have more developed financial systems and thus lower interest rates. This variable is referred to as *regional consumption*.

Median regional wealth This variable is calculated as the weighted median wealth of all households in a particular region and serves as a measure of regional economic development. A wealthy region can be expected to have a more developed financial sector from which credit can be obtained at more advantageous conditions. This variable is referred to as *regional wealth*.

The regional education level. Same as above but on a regional level. This variable is referred to as *regional education*.

A summary table of the variables together with their functional form and descriptive statistics is found in appendix A2. The mean *interest rate* for the total sample is 28.9 percent and this variable varies from 0.1 percent to 300 percent. The average regional market integration is 0.81 and *market integration* varies from 38.3 percent to 95 percent across the Indian regions.

6. Econometric estimation and results

This chapter first describes the specification of the model and the hypothesis to be tested. Secondly the chapter presents the results of the econometric estimation followed by a test of the model assumptions.

6.1 The model specification

The theoretical framework discussed above provides a basis upon which the econometric model is built. The model to be estimated is specified in the following way:

$$Y_i = \alpha + \beta \cdot X_j + \sum_{k=1}^n \chi_k \cdot Z_i + \sum_{l=1}^m \delta_l \cdot W_j + \mu_i$$

Where Y_i represents the dependent variable *interest rate* for household i , X_j represents the independent variable *market integration* for region j , Z_i represents a set of n household specific control variables and W_j represents a set of m region specific control variables.

The following one-sided hypothesis will be tested: $H_0 : \beta = 0$ versus $H_1 : \beta < 0$.

Whenever H_0 is rejected at a 5 percent significance level, H_1 will be accepted. The hypothesis is tested by estimating an ordinary least squares regression model using Stata 11.0.

A relevant question for complex survey data is whether to use weights in the estimation of the regression model. However, for most microeconomic studies using a control function approach weighting may not be needed (Cameron and Trivedi 2010). I have decided not to use weights in the estimation.

6.2 Results

First I estimate the effect of *market integration* on *interest rate* without taking additional control variables into account (Model 1). Model 2 includes all additional control variables described above. Model 3 takes into account the estimated results of Model 2 and presents the final specification of the model. Additional models are developed in order to test for the underlying assumptions of the ordinary least squares regression. The detailed results of the empirical estimation are summarized in appendix B.

Model 1, the most basic specification including *market integration* as the only explanatory variable, show a statistically significant negative relationship between *interest rate* and *market integration* at the 1 percent significance level. This implies that the null-hypothesis of no relationship between *market integration* and *interest rate* can be rejected at a 0.5 percent significance level (one-sided test). Interpreted at face value, the estimated β -coefficient of -0.18 indicates that when the level of market integration increases with 1 percentage point, the interest rate decreases on average with -0.18 percentage points. However, the adjusted R-squared (7.9 percent) of this basic model specification indicates that other factors than regional market integration may provide a significant explanatory power of the marginal interest rate a household pays on its loans.

Model 2 includes the full set of control variables described above. The β -coefficient of the effect of *market integration* on the *interest rate* doubles in magnitude, to -0.37, and remains significant at all relevant significance levels. The adjusted R-squared increases somewhat to 10.3 percent. However, the coefficients on *household consumption*, *agricultural land area* as well as the set of dummy variables representing the household's primary occupation are not significantly different from 0 and can therefore be dropped from the regression model.

Model 3 represents the final specification of the econometric model excluding the statistically insignificant variables from Model 2. The β -coefficient on *market integration* (-0.36) is statistically significant at all relevant significance so *H1* of a negative empirical relationship between market integration and the interest rate is accepted. Literally interpreted, the β -coefficient indicate that an increase in *market integration* with one percentage point leads to a decrease in the *interest rate* of -0.36 percentage points.

As expected, the coefficient on *education* and *total assets* are negative and the effect is statistically different from 0 at all relevant significance levels. Contrary to expectations however, *debt-to-assets* also displays a negative coefficient implying that the higher the debt-to-assets ratio the lower is the marginal interest rate paid by a specific household. One possible interpretation of this result is that households in financially developed regions display both higher debt-to-assets ratios as well as lower interest rates. Interestingly, the estimated model indicates that *scheduled tribes* pay on average lower interest rates (-4.79

percent) compared to the *general category*. This result is contrary to the expectation that the lower castes transact on worse conditions in the rural credit market and may be due to government programmes providing subsidized loans to members of scheduled tribes. As expected, *scheduled castes* and *other backward castes* seem to pay on average higher interest rates (3.3 percentage points and 3.1 percentage points respectively) compared to the general category.

The estimated negative relationship between *education* and *interest rate* does not hold on a regional level. In fact, the model estimates suggest that an increase in the average regional education level by one step leads to an increase in the *interest rate* by 4.9 percentage points. This outcome is interesting in the sense that it can be interpreted as if an increase in the regional level of human development does not necessarily translate into a higher level of economic and financial market development. Contrary to expectations, high regional consumption levels are associated with high interest rates whereas the level of regional wealth displays a coefficient that, although statistically significant, is close to nil.

The F-statistic can be used for testing the assumption that all coefficients are simultaneously different from zero against the alternative that at least one of the coefficients is non-zero. The observed F-statistic of 291.36 yields a p-value of 0.00 indicating that it would be very unlikely to observe the results de facto observed if the null hypothesis of all coefficients being zero was true. However, the adjusted R-squared of 10.3 percent indicates that the model captures approximately one tenth of the variation in the marginal interest rate of households in rural India. Therefore, additional factors are likely to play a significant role in the interest rate determination.

6.3 Testing the model assumptions

Before drawing the final conclusions about the estimated results it is necessary to test to what extent the assumptions underlying the ordinary least squares estimation have been fulfilled.

The assumption of $E(e_i) = 0$ can be violated if the relationship between the dependent and the independent variables is non-linear, that is if large outliers have a strong effect on the estimated regression coefficients or due to omission of influential factors that are correlated

with the error term. In this relatively large sample of 25,832 observations, graphical methods may be less useful in detecting the pattern of the error term and instead, other methods can be considered.

In order to check for significant outliers, Cook's D allows us to capture the effect of one observation on all regression coefficients simultaneously. An influential observation must have an unusual value of the dependent variable as well as an unusual combination of independent variables and the Cook's D measure of influence is calculated as influence = leverage * discrepancy according to the formula below (Kohler and Kreuter 2009).

$$D = \frac{h_i}{1 - h_i} \times \frac{e_i'^2}{k + 1}$$

Cook's D larger than 4/n, in this case, 0.000158, are considered as large. For the estimated model 3, we obtain 931 observations (3.7 percent) that can be considered as influential. Appendix C1 shows a table of how the influential observations are distributed across the model variables. We see that the average *interest rate* for the observations displaying a large Cook's D is 95.8 percent whereas the average *interest rate* in the sample of observations which are not considered as influential is 25.78 percent. The observations with large Cook's D are also characterized by lower *education*, higher likelihood of being a *scheduled tribe*, *scheduled caste* or *other backward caste* as well as higher *debt-to-assets*. In order to verify that influential observations are not the drivers of the model results, the model is reestimated without these observations (Model 4). As seen from appendix B, the β -coefficient on *market integration* increases slightly to -0.32 but remains statistically significant at the 1 percent significance level. All other coefficients maintain their previous sign and magnitude which indicates that influential points are not driving the regression results.

In order to check for a linear relationship between *interest rate* and the independent variables, a so called component plus residuals (CPR) plot is a useful tool in large samples. It plots the product of the residuals and the linear part of the independent variable against the other independent variables (Kohler and Kreuter 2009). The relevant CPR plots are displayed in appendix C2. According to the graphical results, the explanatory variables display a reasonably linear relationship with the *interest which* confirms the suitability of a linear regression model.

The assumption of homoscedasticity, $Var(e_i) = \sigma^2$, can be tested using White's heteroscedasticity test. The result of this test is found in appendix C3. The null hypothesis of a homoscedastic error term can be rejected at all relevant significant levels. In fact, the problem of heteroscedasticity is rather common in cross-sectional data where members of the population display significant differences (Gujarati 2003). To correct for a heteroscedastic variance of the error term, the model can be reestimated using heteroscedasticity only standard errors (Model 5). For Model 5, the coefficient on *market integration* stays largely the same whereas the standard error increases slightly from 0.0174 to 0.0176. However, neither the coefficients nor the standard errors change significantly compared to Model 3 which indicates that the results remain valid while estimating the model with the heteroscedasticity robust standard errors.

In order to see how the variance of an estimator is inflated by the presence of multicollinearity, the variance inflation factors (VIF) are calculated and presented in appendix C4. The obtained VIF-values are below 3 for all variables indicating that multicollinearity between the variables does not contribute significantly to the variance of the estimated coefficients.

Normality of the error term is investigated by a Kernel density plot (Appendix C5). The plot displays that the error term of regression 3 has a higher kurtosis and a longer right tail than the normal distribution. The Shapiro-Wilk's test for normality confirms this result. However, due to the very large sample size in this study, it is not very problematic to assume normality of the error term.

7. Discussion of results

7.1 Validity of the study

The results of this study suggest a negative empirical relationship between the level of market integration, measured by the regional average share of non home-grown consumption in total consumption, and the marginal interest rate a household pays on its loans. This indicates that higher market integration leads to higher financial development. The results remain robust

when testing for the assumptions underlying the estimated ordinary least squares regression model to hold.

However, the measures of market integration and financial development employed in this study represent only one possibility of how these two variables can be proxied. Therefore, the quantitative estimate of the effect of market integration on financial inclusion shall not be interpreted in its literal sense. Additional robustness checks would be useful in order to explore how alternative measures of market integration and financial development influence the model results and could provide further indications of the quantitative effect. As a variation, the level of market integration could be estimated by a production-based measure or by a measure of infrastructural development. It would also be interesting to proxy the level of financial development by other micro-level measures such as access to credit. However, for a developing country such as India, data on these variables may not be readily available.

In assessing the empirical results, potential issues of external validity of also deserve attention. The population studied is the population of households in rural India in 2003. The population for which I want to apply the causal inferences is the population of households in rural India in 2011. If these two populations differ significantly from each other the external validity of the study is weakened. Between 2003 and 2010, India has experienced average annual economic growth of 8.4 percent (IMF 2011). This growth has in particular taken place in the service sector which has expanded at a pace of around 10 percent per year compared to agricultural production which has grown at approximately 4 percent⁶ (Ministry of Finance and Programme Implementation 2011). However, India still remains a largely agricultural country with an estimated two thirds of the population of 1,144 million⁷ still residing in rural areas (RBI 2011). Given the fast pace of economic growth in the urban service sectors compared to the agricultural sector we can assume that the major economic changes have been taking place in the urban environment and that conditions in the rural sector have remained more stable over the past decade.

⁶ Between 2004 and 2009. Net domestic product.

⁷ OECD estimate for 2008. The last Census in India was carried out in 2001 (published in 2003) estimated the population to 1029 million.

In order to find more recent evidence on the link between market integration and financial development in present day rural India, it would be useful to reestimate the model developed in this thesis using data from the next round of the All India Debt and Investment Survey that is likely to take place in 2013. Last but not least, the relevance of market integration as a determinant of financial development in other geographical areas and for other institutional settings remains to be empirically explored.

7.2 Policy implications

Financial market development has empirically proved to have a positive impact on economic growth and poverty reduction and the result of this study indicates that market integration contributes to financial development. This result encourages thinking of policy options for promoting market integration. In order to facilitate for farmers to trade on more distant markets and to allow for more advanced supply channels to develop, investments in physical infrastructure such as roads and railways are of importance. The physical infrastructure can be complemented by additional measures promoting transportation. Inhabitants in rural areas could also benefit from communication opportunities allowing them to access market data in order to know where to trade on the most advantageous conditions. Communication can, among other things, be improved by investment in the mobile telephone network.

A second policy implication may be that if market integration is a prerequisite for financial development to take place, a policy of direct government intervention in credit markets is likely not to have the desired effect in terms of financial development. If investment opportunities in a region are poor due to missing market integration, the supply of subsidized credit may have a limited contribution to agricultural growth and productivity.

Eventually, what policies to implement in order to further economic growth and poverty reduction depend on their respective costs and benefits. As seen in the introduction, development of the financial sector largely depends on the macroeconomic environment and the overall contractual and informational infrastructure. Market integration alone may not be sufficient for furthering financial development and the desired economic growth. However, market integration in itself is to some extent a prerequisite for the transition from an agricultural economy to an economy that enjoys the gains from specialization. Therefore,

market integration is likely not only to have an indirect effect on growth via financial development but also a direct effect on economic growth via allowing for the gains of trade.

7.3 Why would market integration differ between regions?

A more open question relates to why the level of market integration would differ between the Indian regions. The Indian economic-historical literature provides two alternative explanations to the regional differences in agricultural production and productivity which can also cast light on the differences in market integration: the resource endowment view and the institutional/class structure view (Roy 2006).

The class structure view mainly explains differences in agricultural organization and productivity by differences in landholding system. During colonization, two distinct systems of land taxation and land tenure were introduced in the country: the zamindari system and the ryotwari system (as well as a combination between the two systems). In the zamindari areas, the duty to pay taxes and land ownership was concentrated in the hands of large landowners whereas the actual cultivators remained tenants. It can be assumed that, without legal right to the land, incentives for cultivators to increase production for sale to the markets were limited. In the ryotwari areas, property rights were more evenly distributed even if land tenure was still common (Roy 2006). It can be assumed that farmers in these areas had stronger incentives to increase production for sale on the markets since they would also enjoy the benefits.

A second explanation is offered by the resource endowment view which holds the scarcity and unequal distribution of natural resources responsible for the regional differences in agricultural organization and productivity. This view stresses that over the past century, the area of cultivated land has increased by 30 percent whereas the population has increased by 500 percent (Roy 2006). The inherently fertile rice-growing regions in the east with high man-to-land ratios left few opportunities to exploit economies of scale and expand production beyond the subsistence level. The drier and inherently less fertile regions had lower man-to-land ratios which became an advantage when irrigation was introduced and productivity of the soil increased. These conditions offered more of an opportunity to exploit economies of scale and allowed for an expansion of agricultural production destined for the market.

8. Conclusion

If financial development contributes to economic growth and poverty reduction, the promotion of financial development becomes an important consideration for economic policy. India is a country with large regional differences in financial development and by understanding the reason to why some regions are more financially developed than others the right policies for promoting financial development can be designed. The purpose of this thesis is to contribute to our understanding of the regional variation in financial market development in rural India by providing empirical evidence on the relationship between regional market integration and financial development. There are no obvious definitions or measures of the complex processes of market integration and financial development. For the purpose of this study, market integration is measured by the regional average share of non-homegrown consumption on total consumption and financial development is measured by the marginal interest rate a household pays on its loans (with a low interest rate indicating high financial development). The results of an OLS regression indicate that there is a negative and statistically significant relationship between the level of market integration and the interest rate. The hypothesis of a positive relationship between market integration and financial development is therefore accepted. This result remains robust when controlling for the assumptions of the OLS model to hold. However, additional robustness checks, using other measures of market integration and financial development, would be useful in order to firmly establish the empirical relationship between the two phenomena.

The fact that missing market integration may still be an impediment to financial development in rural India has two main policy implications. First, policy measures aimed at promoting market integration such as investment in transportation infrastructure becomes a priority on the policy agenda. Secondly, if an absence of market integration reduces profit and investment opportunities, the traditional Indian policy of state provision of subsidized credit may not have the desired effect on productivity and income.

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Appendix A. Data and variables

A1. Summary of number of observations per region

Region	No. obs	Region	No. obs
Himachal Pradesh	428	MP Vindhya	275
Punjab N	318	MP C	253
Punjab S	374	MP Malwa	392
Haryana E	298	MP S	165
Haryana W	289	MP SW	165
Rajasthan W	493	MP N	252
Rajasthan NE	618	Gujarat E	76
Rajasthan S	94	Gujarat plains N	89
Rajasthan SE	265	Gujarat plains S	66
Uttar Pradesh W	1,393	Gujarat dry	69
Uttar Pradesh C	484	Gujarat Saurashtra	107
Uttar Pradesh E	976	Maharashtra coast	193
Uttar Pradesh S	169	Maharashtra inland W	526
Bihar N	1,157	Maharashtra inland N	277
Bihar C	704	Maharashtra inland C	521
Sikkim	152	Maharashtra inland E	400
Nagaland	123	Maharashtra E	144
Manipur plains	345	Andhra Pradesh coast	1,141
Manipur hills	196	Andhra Pradesh inland N	896
Tripura	296	Andhra Pradesh SW	304
Meghalaya	90	Andhra Pradesh inland S	239
Assam plains E	185	Karnataka coastal ghats	85
Assam plains W	393	Karnataka inland E	221
West Bengal Himalaya	85	Karnataka inland S	478
West Bengal plains E	386	Karnataka inland N	632
West Bengal plains C	399	Kerala N	706
West Bengal plains W	327	Kerala S	902
Jharkand	372	Tamil Nadu coast N	728
Orissa coast	629	Tamil Nadu coast	510
Orissa S	212	Tamil Nadu S	727
Orissa N	367	Tamil Nadu inland	551
Chattisgarh	675	Total	25,382

A2. Descriptive statistics and functional form of variables

Variable type	Variable short name	Unit	Descriptive statistics (levels)				Functional form
			mean	st. dev	min	max	
Dependent variable	<i>interest rate</i>	percent on nominal amount	28.9	21.7	0.1	300	level
Independent variable	<i>market integration</i>	percent	80.9	10.4	38.3	95	level
Household specific control variables	<i>agricultural land area</i>	Ha	0.96	1.9	0	52	logarithmic
	<i>household consumption</i>	Rs thousands.	52.1	30.2	0	4,115,000	logarithmic
	<i>debt-to-assets</i>	percent	6.2	20	0	1567.6	level
	<i>total assets</i>	Rs. thousands					logarithmic
	<i>education</i>	A scale from 1 (not literate) to 11 (post-graduate and above). 3 signifies literate but below primary school.	3	2.21	1	11	logarithmic
	<i>self-employed agr.</i>	1 if household primary occupation is self-employed in agriculture, otherwise 0	0.42	0.49	0	1	bivariate
	<i>self-employed non-agr</i>	1 if household primary occupation is self-employed in non-agriculture, otherwise 0	0.14	0.35	0	1	bivariate
	<i>labour non agr.</i>	1 if household primary occupation is non-agricultural labour, otherwise 0	0.11	0.31	0	1	bivariate
	<i>agricultural labour</i>	1 if household primary occupation is, otherwise 0	0.26	0.44	0	1	bivariate
	<i>other occ.</i>	1 if household primary occupation is other than above and other than self-employed in agriculture, otherwise 0	0.07	0.25	0	1	bivariate
	<i>scheduled caste</i>	1 if household belongs to scheduled caste, otherwise 0	0.21	0.41	0	1	bivariate
	<i>scheduled tribe</i>	1 if household belongs to scheduled tribe, otherwise 0	0.06	0.24	0	1	bivariate
	<i>other backward caste</i>	1 if household belongs to other backward caste, otherwise 0	0.47	0.5	0	1	bivariate
Regional control variables	<i>regional consumption</i>	weighted average of regional consumption (Rs thousands)	51.9	10.5	26.3	84.8	level
	<i>regional wealth</i>	weighted median regional wealth (Rs. thousands)	283.9	149	68.6	13337600	level
	<i>regional education</i>	Regional weighted average of education on a scale from 1 (not literate) to 11 (post-graduate and above).	3	0.5	2	5	level

Appendix B. Estimated regression models

Regressor	Model 1	Model 2	Model 3	Model 4	Model 5
<i>market integration</i>	-0.183** (0.013)	-0.370** (0.018)	-0.362** (0.017)	-0.315** (0.014)	-0.362** (0.018)
<i>agricultural land area</i>		-0.068 (0.104)			
<i>household consumption</i>		-0.137 (0.380)			
<i>debt-to-assets</i>		-2.736** (0.589)	-2.880** (0.545)	-5.258** (0.852)	-2.880** (1.030)
<i>total assets</i>		-3.566** (0.152)	-3.779** (0.126)	-3.173** (0.012)	-3.779** (0.131)
<i>education</i>		-2.370** (0.192)	-2.459** (0.187)	-1.670** (0.144)	-2.459** (0.187)
<i>self-employed non-agr</i>		0.450 (0.439)			
<i>labour non agr.</i>		0.448 (0.516)			
<i>agricultural labour</i>		1.172** (0.414)			
<i>other occ.</i>		-0.571 (0.555)			
<i>scheduled caste</i>		3.114** (0.427)	3.279** (0.422)	2.321** (0.326)	3.279** (0.450)
<i>scheduled tribe</i>		-4.790** (0.547)	-4.785** (0.545)	-4.222** (0.424)	-4.785** (0.524)
<i>other backward caste</i>		3.028** (0.346)	3.081** (0.345)	3.602** (0.264)	3.080** (0.332)
<i>regional consumption</i>		0.191** (0.023)	0.188** (0.022)	0.263** (0.017)	0.188** (0.120)
<i>regional wealth</i>		-0.023** (0.001)	-0.023** (0.001)	-0.022** (0.000)	-0.023** (0.001)
<i>regional education</i>		4.885** (0.332)	4.890** (0.330)	2.337** (0.255)	4.890** (0.288)
<i>Intercept</i>	42.62**	86.40**	87.53**	76.82**	87.52**
Model statistics					
<i>F-statistic (p-value)</i>	203.02 (0.00)	183.39 (0.00)	291.36 (0.00)	319.36 (0.00)	289.9 (0.00)
<i>Adjusted R-squared</i>	0.008	0.103	0.103	0.1152	0.103
<i>no. obs</i>	25,382	25,382	25,382	24,451	25,382

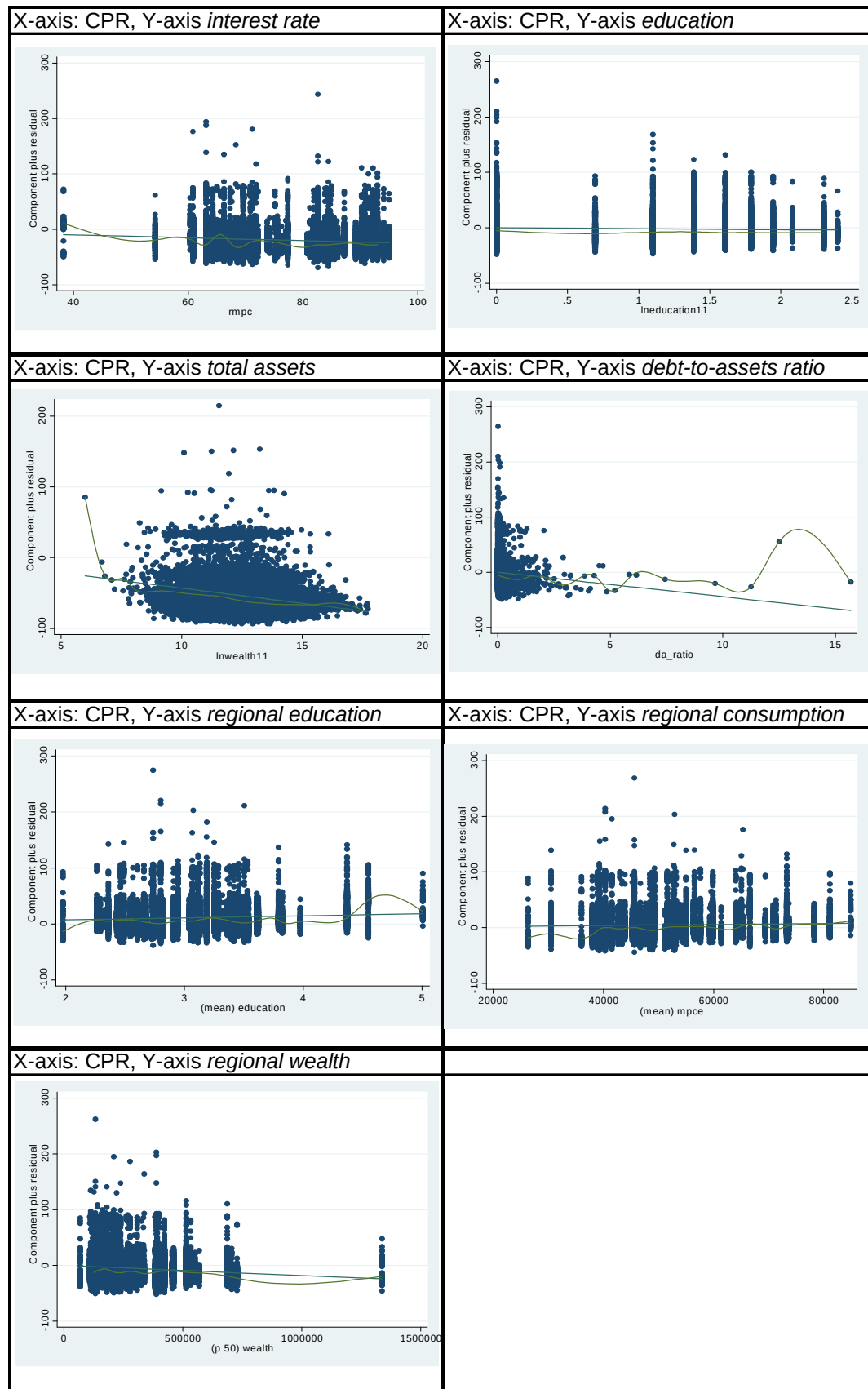
* significant at 5 percent level, ** significant at 1 percent level.

Appendix C. Tests of model assumptions

C1. Cook's D

Variable	Observations with "normal" Cook's D		Observations with large Cook's D	
	mean	sd	mean	sd
<i>interest rate</i>	25.78	17.28	95.79	39.13
<i>market integration</i>	78.33	10.99	73.26	12.44
<i>debt-to-assets</i>	0.06	0.13	0.25	1.05
<i>total assets</i>	12.68	1.27	11.89	1.43
<i>education</i>	0.08	0.78	0.07	0.78
<i>scheduled caste</i>	0.21	0.50	0.30	0.46
<i>scheduled tribe</i>	0.09	0.28	0.17	0.38
<i>other backward caste</i>	0.45	0.50	0.32	0.47
<i>regional consumption</i>	51.91	11.34	50.78	12.66
<i>regional wealth</i>	309.21	170.25	308.29	225.38
<i>regional education</i>	3.04	0.53	3.24	0.67

C2. Component plus residuals plots



C3. White's heteroscedasticity test

H_0 : homoscedasticity vs. H_1 : heteroscedasticity

Reject H_0 if $n \cdot R^2 > \chi_{5\%}^{df}$

Test-statistic: $n \cdot R^2 = 1342 > \chi_{5\%}^{59} = 79$

H_0 can be rejected at a 5 percent significance level.

C4. Multicollinearity

Regressor	VIF	1/VIF
<i>market integration</i>	1.390	0.719
<i>debt-to-assets</i>	1.020	0.980
<i>total assets</i>	1.230	0.813
<i>education</i>	1.200	0.833
<i>scheduled caste</i>	1.370	0.730
<i>scheduled tribe</i>	1.380	0.725
<i>other backward caste</i>	1.400	0.714
<i>regional consumption</i>	2.110	0.474
<i>regional wealth</i>	1.530	0.654
<i>regional education</i>	1.540	0.649

C5. Normality of the error term

Shapiro-Wilk test for normality :

H_0 : Sample comes from a normal distribution vs. H_0 : Sample comes from a non-normal distribution.

Reject H_0 if $W_{obs} < W_{crit}$

$W_{obs} = 0.88 < W_{crit} = 1321$

H_1 can be rejected at a 5 percent significance level.

