

Essays in Urban Economics and Macro Economics

DISSERTATION

of the University of St. Gallen,

School of Management,

Economics, Law, Social Sciences,

International Affairs and Computer Science,

to obtain the title of

Doctor of Philosophy in Economics and Finance

submitted by

Neha Gupta

from

India

Approved on the application of

Prof. Guido Cozzi, PhD

and

Prof. Anurag Narayan Banerjee, PhD

Dissertation no. 5087

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The University of St. Gallen, School of Management, Economics, Law, Social Sciences, International Affairs and Computer Science, hereby consents to the printing of the present dissertation, without hereby expressing any opinion on the views herein expressed.

St. Gallen, November 19, 2020

The President:

Prof. Dr. Bernhard Ehrenzeller

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Neha Gupta

Summary

This dissertation comprises of three chapters in macroeconomics and urban economics with a particular focus on the underlying monetary policy and fiscal policy in real estate economics.

The first chapter considers user costs of housing as a major part of a household's expenditure. I empirically investigate the heterogeneous impact of an unanticipated expansionary monetary policy on housing markets and household tenurial decision by exploiting the user cost of housing channel. Drawing on a Swiss household panel data and daily interest rate futures, I find that the less financially constrained households are 3.45 percentage points more likely to become homeowners in case of unexpected decrease of 100 basis points in 3-month CHF Libor. The households in the upper income quartile with pillar 3a savings benefit the most in case of an unanticipated negative monetary policy shock. The real user cost expenses of renting also benefits significantly by a decrease of on average 19% from an unexpected expansionary monetary policy. Single family houses do not benefit from the shocks in the monetary policy. The findings highlight the importance of apartments and multifamily housing.

The second chapter examines the dynamics of housing rents which are a major part of a slum household's expenditure. I exploit a large scale 'big-push' national urban renewal policy reform in India between 2005 and 2012 to empirically evaluate the multi-dimensional effect of rental reforms and housing provisions on home ownership, rental expenditures, women empowerment and quality of dwelling for slum households. Com-

binning a novel pooled cross-sectional household survey data for year 2002, 2008, 2012 and nighttime lights activity data at district level, I find the reform significantly increases the real rents by 18.2% and the probability to transition to homeownership by 16.7 percentage points. Females are more likely to be the head of the household. The findings highlight the role of market failure.

The final chapter focuses on the slums as an integral part of urban spaces in India. Using state level nighttime light intensity as a measure of urbanization I empirically evaluate the impact of urbanization on slum growth from 1993 to 2012. In the process, I also exploit a large scale 'big-push' national policy reform in India between 2005 and 2012 to further examine if such a policy was efficient in curbing the slum growth. Combining a novel pooled cross-sectional household survey data and nighttime lights activity at state level, I find the likelihood of being a slum household is 14.2 percentage points more in states lying within the third quartile of nighttime light intensity. After the introduction of the policy the likelihood decreases for all quartiles, where the effect for the 3rd quartile is reduced by 3.9 percentage points. The results are preliminary and highlights the role of underlying social phenomenon linked to migration and middle tier urbanized spaces.

Zusammenfassung

Diese Dissertation umfasst drei Kapitel in Makroökonomie und Stadtwirtschaft mit speziellem Fokus auf die zugrundeliegende Geldpolitik und Fiskalpolitik in der Immobilienwirtschaft.

Das erste Kapitel betrachtet Wohnkosten als grossen Teil der Haushaltsausgaben. Ich untersuche heterogene Auswirkungen von einer nicht antizipierten expansiven Geldpolitik auf den Immobilienmarkt und auf die Mietentscheidungen eines Haushaltes empirisch, indem ich die Wohnkosten betrachte. Basierend auf Schweizer Haushaltspaneldaten und täglichen Zins-Futures komme ich zu der Erkenntnis, dass Haushalte mit beschränkten finanziellen Mitteln um 3.45 Prozentpunkte wahrscheinlicher zu Immobilieneigentümern werden, wenn der 3-Monats Libor unerwartet um 100 Basispunkte sinkt. Haushalte im oberen Einkommensquartil mit Ersparnissen der 3a Säulen profitieren am meisten. Mieter und Mieterinnen profitieren ebenfalls signifikant von einer durchschnittlichen Abnahme der realen Wohnkosten von 19%. Diese Ergebnisse zeigen die Wichtigkeit von Wohnungen und Mehrfamilienhäusern.

Das zweite Kapitel untersucht die Dynamiken der Mieten, welche einen wichtigen Teil der Haushaltsausgaben in Slums darstellen. Ich untersuche eine grossangelegte, nationale städtische big-push Erneuerungspolitikreform in Indien zwischen 2005 und 2012, um empirisch die multidimensionalen Effekte von Mietreformen und Wohnungsversorgung auf Wohneigentum, Mietausgaben, die Rolle der Frauen und die Qualität der Unterkunft von Slumhaushalten zu evaluieren. Durch die Kombination von einer neuen Querschnittser-

hebung von Haushalten mit der naechentlichen Lichtaktivitaet auf dem Distriktlevel stelle ich fest, dass die Reform die realen Mieten signifikant um 18.2% erhoehrte und die Wahrscheinlichkeit, Hauseigentuerer oder Hauseigentuerin zu werden, um 16.7 Prozentpunkte zunahm. Es ist wahrscheinlicher, dass eine Frau Haushaltsvorstehende ist. Diese Resultate weisen auf die Wichtigkeit von Marktversagen hin.

Das letzte Kapitel befasst sich mit Slums als integraler Bestandteil von Staedten in Indien. Mithilfe der nationalen Lichtaktivitaet als Mass fuer Urbanisierung untersuche ich die Auswirkung von Urbanisierung auf das Slumwachstum zwischen 1993 und 2012. Ich untersuche ebenfalls die grossangelegte, nationale big-push Politikreform in Indien zwischen 2005 und 2012, um zu sehen, ob eine solche Politik erfolgreich war. Durch die Kombination von einer neuen Querschnittserhebung von Haushalten und der naechentlichen Lichtaktivitaet auf nationalem Level stelle ich fest, dass die Wahrscheinlichkeit, ein Slumhaushalt zu sein, um 14.2 Prozentpunkte hoeher im dritten Quartil der naechentlichen Lichtaktivitaet ist, was nach der Einfuehrung der Politik um 3.9 Prozentpunkte abnahm. Diese Resultate sind vorlaeufiger Natur und unterstreichen die Rolle der zugrundeliegenden sozialen Phaenomene, welche mit Migration und urbaner Mittelschichtregionen verbunden sind.

Monetary Policy, User Cost and Inequality: Homeowners versus Renters

User costs of housing are a major part of a household's expenditure. I empirically investigate the heterogeneous impact of an unanticipated expansionary monetary policy on housing markets and household tenurial decision by exploiting the user cost of housing channel. Drawing on a Swiss household panel data and daily interest rate futures, I find that the less financially constrained households are 3.45 percentage points more likely to become homeowners in case of unexpected decrease of 100 basis points in 3-month CHF Libor. The households in the upper income quartile with pillar 3a savings benefit the most in case of an unanticipated negative monetary policy shock. The real user cost expenses of renting also benefits significantly by a decrease of on average 19% from an unexpected expansionary monetary policy. Single family houses do not benefit from the shocks in the monetary policy. The findings highlight the importance of apartments and multifamily housing.

1.1 Introduction

Switzerland scores high on income levels and is more income equal country compared to the other developed countries. Switzerland is also constrained by a rigid housing supply owing to landscapes, higher house prices and rents and a greater proportion of renters (Bourassa and Hoesli, 2010 [8]) protected by strict rent contracts. Moreover, the Swiss monetary policy has been constantly expansionary since a few years which has a potential effect on financial and housing markets. Moreover, Switzerland is also not affected by interventions such as Tax Relief Act 1997 in the US or the financial crisis and the renters in Switzerland enjoy a high degree of protection from the federal government. This serves as a strong ground to be able to clearly quantify the housing channel effect.

The research question contributes to the literature by empirically investigating the heterogeneous impact of an expansionary monetary policy on housing markets and household tenurial decision exploiting the 'user cost of housing channel'. User cost is an important component for a typical household's decision to either own or rent a house. User cost for homeowners is monthly cash expenses in the form of mortgage payments, maintenance costs, depreciation, imputed rents etc. Similarly, for renters this expense accounts for the monthly rents and utility costs.

Further, I also aim to quantify the income inequality channel which amplifies the impact of monetary policy transmission, as wealthy households can more easily qualify for a mortgage. By exploiting the rent

reforms period the study addresses an important aspect of the Swiss housing markets.

Literature documents several channels via which monetary policy shocks affect inequality, such as the income composition, the financial segmentation, the portfolio, the savings redistribution, the earnings heterogeneity channel (Doepke and Schneider, 2006, [15], Andrei et al., 2015 [4]) and the consumption channel (Di Maggio et al., 2017 [14]). Therefore, I contribute to the literature by exploiting the 'user cost of housing' channel, specifically in the context of Switzerland.

Drawing on a Swiss household panel data and daily interest rate futures, I use market expectations approach to construct a monetary policy shock to investigate the above claim and argue the credibility of the estimates.

On average, the estimates suggest that the rich households are 3.4 percentage points more likely to become homeowners in case of unexpected decrease in monetary policy rate. The households in the upper income quartile with pillar 3a savings benefit the most in case of an unanticipated negative monetary policy shock. The real user cost expenses of renting also benefits significantly by 19% from an expansionary monetary policy. However, the estimates for the homeowners are in contradiction with the hypothesis.

The remainder of this paper is organized as follows. In Section 1.2, I summarize the related literature. In Section 1.3, I present in detail the institutional aspects of Swiss monetary policy. In Section 1.4 , I give

an overview of Swiss housing markets. In Section 1.5 , I describe the transmission channel of monetary policy via user cost of housing . In Section 1.6, I explain the Data. In Section 1.7, I present the identification strategy. Section 1.8 discusses the empirical findings of the affect of expansionary monetary policy on Swiss households via user cost channel. Section 1.9 concludes the paper.

1.2 Literature Review

Income and wealth distributions and therefore, inequality has always been at the relevant front of the economic research. Tradition dates back to Pareto's iron law of inequality arguing a stable income distribution and hence an unchanged coefficient of inequality in modern industrialized economies. Studies dating back to earlier times have been carried out in light of various macroeconomic and fiscal determinants for example, Kuznets (1955)[30] sketches an inverted U shape income inequality curve as a country moves through different phases of economic growth. Studies like Bourguignon and Morrisson (1998)[9], Heathecote et al. (2010) [25] studies determinants like government spending, foreign trade openness, transfer policies and wages to explain income inequality. However, studies examining the linkage between inflation and income distribution has been comparatively fewer. Bulir and Gulde (1995)[11] finds that countries with less developed financial sectors experiences a stronger negative effect of inflation on income equality. Al- Marhubi (1997) [31]

argues in the opposite direction that countries with greater inequality have higher average inflation. Albanesi (2007)[2] supports the evidence that countries with greater inequality makes higher average equilibrium inflation more costly for low income households (withholding more cash) due to their weak bargaining position in the political process. Cysne et al. (2005) [13] uses shopping time rationale to formalize inflation tax and its effect on inequality. They argues higher inflation, better access to transacting technology concentrates the income more for the rich. Poor, uneducated and unskilled workers are more inflation averse simply because of their lack of alternative asset incomes, their inability to hedge against difficult times, inflation hurts their real buying power. This curse of inflations falls disproportionately on poor people on many dimensions like poverty rate, wages, and bottom quintile of income. Easterly (2001) [16] in an international comparison of 38 countries using polling data finds that inflation lowers the share of bottom quintile and real minimum wage of the poor. Mian et al. (2013)[32] discussing housing wealth effect states that consumption responds strongly to a decline in highly levered asset class like housing which they refer to as housing net worth shock during great recession. Such a response is heterogeneous across households. Heterogeneity comes from the net worth distribution of households. Marginal propensity to consume (MPC) for poorer households out of a dollar decline in home value is larger compared to the richer households. Such a spending is estimated for autos. Housing leverage also potentially contributes to the heterogeneity in the marginal

consumption. Fuess and Zietz (2016)[21] investigates the effect of funds rate on house prices for U.S. Using quarterly data (1992-2014) for 19 Metropolitan Statistical Areas (MSAs), they investigate the importance of local demand and supply factors as a channel to explain house prices. The authors find that the interaction of monetary policy with population growth and undevelopable land significantly explains house price variations for each MSAs. By exercising the discretionary powers, injecting money into the economy or draining out money from the economy the central banks not only functions to restore and stabilize an ailing economy but also has long-term consumption redistributive effects. The actions of central bank percolates through every layer of the economy, but such effects are not uniformly distributed. These effects have serious long term implications for the growth of the economy. Channels such as inflation channel, portfolio channel, wealth channel, banking channel, redistribution channel which affects real estate sector in case of a shock. Homeowners and renters are an important component of real estate sector and are directly affected by the 'user cost of housing'. Therefore, the transmission mechanism channel for any potential shocks in the economy which in this particular study is an unanticipated shock to monetary policy affecting the 'user cost of housing' is being mentioned and compared with other transmission mechanism channels in the literature review.

Various channels play a role to determine these redistributive effects at the household level. Channels such as inflation channel, portfolio channel, wealth channel, banking channel, redistribution channel affects

real estate sector in case of a shock. Studies like Bhattacharya et al. (2005)[7], Palivos (2005)[33], Shi (1999)[39] illustrates how devaluation of cash balances serves as a channel for redistributive effects of monetary policy. These studies state that monetary expansion redistributes real wealth from people who hold large amounts of cash/endowments to people who hold relatively lesser amounts. Erosa and Ventura (2002)[19] however, find results contrary to the above. The real wealth is redistributed from mainly cash holding poor people to capital intensive rich people. Romer and Romer (1999)[35] argues for a number of countries, where the monetary policy is aimed at higher inflation, that macroeconomic volatility deteriorates the incomes of the poor leading to increased inequality in the long run. Economic distances between various agents and central bank also serves as a potential redistribution channel. Andrei et al. (2015)[4] shows that agents like governments and investment banks with the shortest economic distance, i.e. direct interaction with the central bank, benefit the most from the redistributive effects of an expansionary monetary policy.

Saiki and Frost (2014)[36] studies the impact of unconventional monetary policy of the Bank of Japan on income distribution between 2008Q4 to 2013Q3 via the portfolio channel. As of 2012 the top 20% of Japanese households held 15.4% of their assets in stocks and bonds five times higher than the share of the second top quintile. Under Abenomics, quantitative easing (QE), i.e., unconventional monetary policy (UMP), Phase II (since September 2008) saw an increased sales of condominiums

and luxury products benefiting wealthy households. Using a VAR model the authors find evidence of increased inequality via capital gains from higher asset prices. Areosa and Areosa (2006)[6], theoretically examines link between optimal monetary policy and inflation via differential financial market access of agents. They argue that welfare losses increases and interest rate variability decreases with the financial exclusion.

The asset market channel is a further important redistribution channel with serious implications on wealth. Asset purchasing program as a part of QE can have significant wealth distributional implications. In U.K. top 5% of households held 40% of assets other than pension funds whose value was affected by QE (Bank of England, 2012). Doepke and Schneider (2006)[15] assess the impact of unanticipated inflation on nominal asset positions within households and across different sectors in post war U.S. economy. Their findings suggest that inflation induces wealth transfer from foreigners to domestic households where young, middle class households with mortgage debt benefit the most. Rich households had lower nominal savings and rich households held long term bonds. Both these groups lost from inflation. Schularick and Taylor (2012)[38] discusses how credit financed asset booms are more dangerous in a highly financialized economy. Many studies like Rajan (2012)[34], Kumhof et al. (2015)[28], links rising inequality to credit booms and financial crises. Coibion et al. (2014) using data on mortgage applications demonstrates the expansion of credit supply for low income households in low income inequality area. The causality runs from inequality to debt accumula-

tion.

Owing to the great financial crisis of 2007, the effects of monetary policy have also been of important consequences for the housing markets. Housing tenurial choice is an important variable over a household's lifetime decision and is greatly influenced not only by macro economic environment and socio- cultural factors but can be directly regulated by the central bank's decisions. Iacoviello and Neri (2010)[27] examines the sources of fluctuations in U.S. housing markets and argue the importance of housing market spillovers on consumption goods rather than investments. The fluctuations in real house prices are explained by demand and technological progress in the housing sector. However the authors do not rule out the growing importance of monetary factors on housing cycle, which explains 20% of the house price changes. Greenwald et al. (2018)[3] investigates transmission mechanism of monetary factors to house prices via credit growth. A similar argument in case of U.S. housing markets was put forward by Vavra and Imbs (2015)[20]. The authors aim to establish the expansion of mortgage market driven by 1996 deregulation of the U.S. banking sector as a causation of the house price booms from 1994-2005. Aditya Aladangady (2017) [1]uses geographically linked micro data to identify the causal effect of house price fluctuations on consumer spending particularly, for credit constrained households. Cloyne et al., (2016) [12] examines the effect of interest rate changes on expenditure of mortgagors and outright homeowners in the United Kingdom and United States. The authors claim that the general

equilibrium effect of monetary policy on income is quantitatively more important than the direct effect on cash flows.

Though the above literature on housing markets discusses the transmission of the unexpected monetary policy on the housing prices, I aim to investigate the 'user cost of housing' as a mechanism channel for unanticipated shock to monetary policy at the household level. Homeowners and renters are an important component of real estate sector and are directly affected by the 'user cost of housing' which further affects the household's tenure choices. User cost for homeowners is monthly cash expenses in the form of mortgage payments, maintenance costs, depreciation, imputed rents etc. Similarly, for renters this expense accounts for the monthly rents and utility costs. The decision to own or rent a house depends on the cheaper tenure mode, i.e., relatively cheaper user costs.

1.3 Swiss Monetary Policy

Since the onset of 2000 until 13 June 2019, the Swiss National Bank (SNB) implemented its monetary policy by defining a target range with a bandwidth of 100 basis points (one percentage point) for the reference interest rate, 3 month CHF LIBOR. The three-month CHF Libor for Swiss franc investments, is the trimmed mean of the interest rates for the unsecured Swiss franc interbank loans with a three-month maturity, as reported daily by interbank market in London. The other two important

monetary policy strategy pursued by the SNB are the price stability under a range of 2% and a twelve quarter conditional inflation forecast. Of the three strategy elements, three-month Libor served as an important benchmark for credit relationships in Switzerland from 2000 to mid 2019.

SNB used various monetary policy instruments like open market operations or interest rates on sight deposits to ensure well bounded LIBOR rate within the target range. As a rule, the SNB held the LIBOR as a midpoint of the target range, as illustrated in Fig 1.1. The determination of three month CHF-LIBOR on the interbank market in London limited the SNB's ability to control the three-month LIBOR rate directly. Therefore, in order to indirectly exert influence on three month LIBOR, SNB a) carried out transactions on the Swiss franc money market that either provided or absorbed liquidity by means of volume or conditions of the transactions b) and/or explicitly decided the interest rate on sight deposits.

The course of monetary policy does not evolve in a vacuum. Often the policy is conducted as a response to the prevailing economic environment, to smooth fluctuations. For instance, between mid-2010 and mid-2011, Swiss banking system was exposed to excess liquidity resulting from the high level of foreign exchange transactions against Swiss francs carried out by the SNB. In response, SNB influenced the reference interest rate by means of open market operations i.e. repo transactions and issuance of SNB Bills in order to absorb the excess liquidity in the system.

From 6th September 2011 to 15th January 2015, SNB enforced a

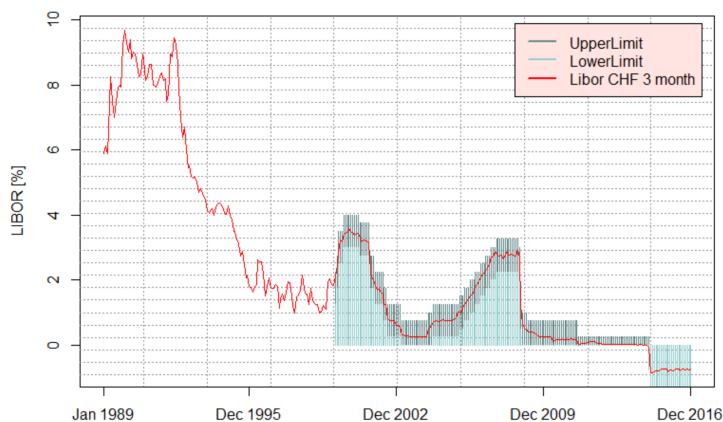


Figure 1.1: Monetary Policy Rate CHF-3 month Libor

Source: Author's own calculation. The figure depicts the monetary policy rate since 1989 to 2016. The monthly data is being retrieved from SNB. The colored bars denotes the CHF-3 month Libor target range.

minimum exchange rate of CHF 1.20 per euro as the main focus of monetary policy implementation. The shield on the exchange rate was discontinued later. Simultaneously on 15th January 2015, the SNB lowered the interest rate on sight deposits to -0.75% thereby, altering the target range for three month LIBOR downwards to -1.25% and -0.25%. Since then the negative interest rate has been the key element of the SNB's monetary policy, the other being the intervention in the foreign exchange market.

In June 2019, target range for the three-month Swiss franc Libor was replaced by the SNB policy rate. The decision was taken due to the declining relevance of Libor in the absence of the underlying money

market transactions. The negative interest rates also corresponds to the SNB policy rate.

1.3.1 Swiss Monetary Policy: Other Long Term Interest Rates

In Figure 1.2 and 1.3, I present the important long term interest rates in the economy from 1984-2016. All long term interest rates follow the same downward trend as the expansive 3 month CHF-LIBOR rate, since 1991. 'Nominal r ' in Figure 1.2 is the interbank lending rate. Therefore,

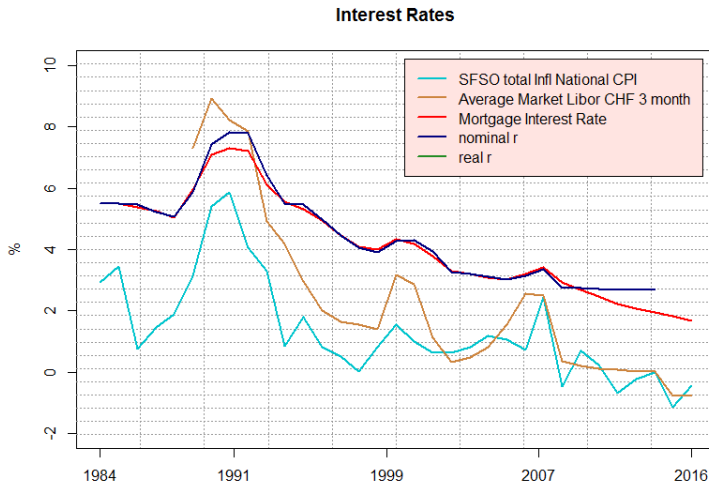


Figure 1.2: Long Term Interest Rates

Source: Author's own calculation. The figure depicts different interest rates from 1984-2016.

it is highly likely to hypothesize that the direction of the affect of the shocks in the policy rate is highly likely to be the same for shocks in other types of long term interest rates.

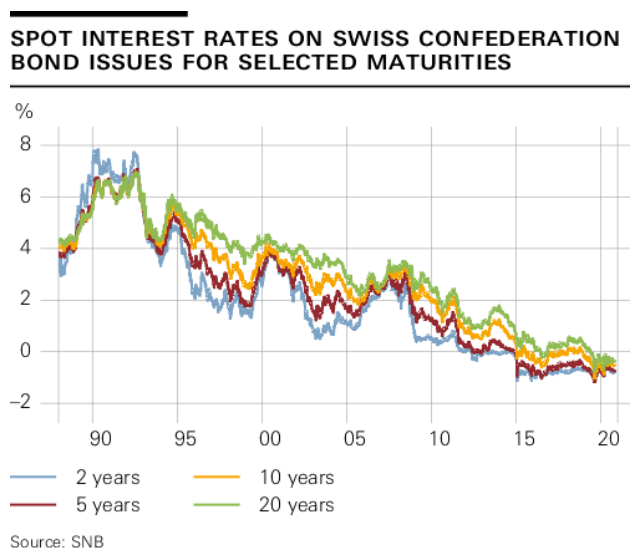


Figure 1.3: Spot interest rates

Moreover, in Fig 1.10 I demonstrate the correlation between the movements in the long term lending interest rate and tenure choice of households categorized by income. As the table depicts, the cyclical movements in the long term interest rate can potentially affect the household sector.

However, it is easy to argue that the mortgage rates are the most relevant interest rates for the housing markets and a major influencing factor for a typical household's decision to purchase a house. Therefore,

in the section 8 to this chapter I provide further robustness checks by constructing similar shocks to the long term variable mortgage interest rates. The results are robust lending credibility to the main specification.

The importance of cyclical movements of long term mortgage rates for real estate prices is depicted in the results in table 1.3. The results in column (1)-(4) suggests that an expansionary monetary policy that reduces the real mortgage rate by 1 percentage point increases the middle tier real house prices by 0.6% and upper tier real prices by 1.2%. The results are in line with the housing markets literature. However, the response of the housing markets with respect to shocks in the mortgage rates is also discussed in length as robustness checks in the section 8 of this chapter.

1.4 Swiss Housing Markets

Switzerland has politically autonomous administrative units comprising of 26 cantons and 2,222 municipalities ¹. Municipalities compete against each other in setting local tax rates, land use controls and public services, which effects the local housing markets (Hilber, 2001 [26]; Basten et al., 2014 [17]). With regards to the demography, majority (59%) ² of the Swiss population lives in the agglomerations of the five largest cities namely Zurich, Geneva, Basel, Bern and Lausanne. Remaining population lives in the other urban areas and countryside. Strong population

¹Office of Federal Statistics, 2018

²Swiss Federal Statistics Office, 2018

growth (including high immigration rate) and improved infrastructure have accelerated urban sprawl over the years.

1.4.1 Housing Demand: Home Owning vs. Renting

Switzerland is one of the most competitive countries with highest per capita income in the world. Yet, the home ownership rate in the country is one of the lowest amongst the European nations, at approximately 43.5% in 2017 (Swiss Federal Statistics Office, 2018).

The choices of renting and not owning a home arises from reasons of housing affordability embedded in the absolute user costs associated with homeownership, making it an expensive asset. Bourassa and Hoesli (2010)[8] uses a tenure choice model to explain economic reasons for low home ownership rates in Switzerland's five major cities. They find that the high house prices and imputed rent taxation relative to the household's income and wealth skews the choice towards renting. The taxation of imputed rents distinguishes Switzerland from most other developed countries. The competition among swiss municipalities for taxation rate indirectly affects the homeownership rate within a municipality. The homeownership rate particularly within urban areas in quite low, is the range of 10%³ which reflects a preferential shift in the housing demand towards renting. Preferences for homeownership are also directly affected by the mortgage rates, which are in turn affected by the monetary policy stance.

³Swiss Federal Statistics Office, 2018

Werczberger (1997)[41] cites rents laws as one of the factors for low home ownership rate. Swiss federal law guarantees high protection to renters in Switzerland in terms of unjustified price increases and abusive evictions. Landlords are not allowed to terminate the tenancy contracts as per their advantage. Moreover, the landlords can adjust rents according to two main economic indicators firstly, 'Rent Reference Index', a policy passed in 2008, which is based on the average of mortgage interest rates provided by banks in Switzerland. In case of a decline in mortgage rates tenants can ask for rent reductions. The second indicator is the Swiss consumer price index (CPI) where up to 40% of the inflation can be adjusted in the rents. In case of major renovations or increased maintenance costs, rents can be adjusted upwards.

1.4.2 Housing Supply

Glaeser et al. (2008)[23], discusses the importance of elasticity of housing supply to determine the sensitivity of house prices. Higher house prices in Switzerland directly converts from constrained topography and strict regulations on redevelopment. The heterogeneous geographic landscape of Switzerland comprising of water bodies, Alps, ruggedness, cultivable area, rocks and glaciers make a considerable proportion of the land not suited for development or urbanization. The revised Federal Law on Spatial Planning revolves around preservation of agricultural lands and natural landscapes containing urban sprawl. It strongly promotes den-

sification, especially in areas with above-average accessibility by public transport for e.g. Zurich and Geneva. Andrews and Sanchez (2011)[5] found the supply response to price changes in Switzerland to be the lowest in their sample of 21 OECD countries. The reasons for this muted supply response includes the stringency of planning and building regulations. Cantonal construction laws addresses conflicts with planning regulations, including those that inhibit densification. Zoning is done at the municipal level and it is not possible for the municipality to buy the land before zoning it for settlement purposes, as buying and selling agricultural land is permitted only for farmers. In addition, smaller municipalities sets land use controls at their own discretion.

Swiss construction costs are among the highest in absolute terms and relative to both the average price of goods and the price of other fixed investment spending⁴. Using a stock-flow model of the Swiss housing market, Steiner (2010)[40] finds that supply-demand disequilibria can endure for extended periods of time during which prices can overshoot. The author attributes these slow dynamics in part to the slow planning process for residential construction in Switzerland. Moreover, heterogeneous building laws and codes, differentiated labor laws at the cantonal level restricts the competition in the construction sector.

⁴OECD PPP database

1.5 Monetary Policy and the User Cost Channel

1.5.1 User Cost of Housing

Tenurial choice of housing i.e., home ownership vs. renting is a decision for a consumer which is not just attributed to respective prices of a dwelling but also involves other costs. These costs constitutes the user cost of housing consumption. User cost for homeowners is monthly cash expenses in the form of mortgage payments, maintenance costs, depreciation, imputed rents etc. Similarly, for renters this expense accounts for the monthly rents and utility costs. The decision to own or rent a house depends on the cheaper tenure mode, i.e., relatively cheaper user costs.

The costs associated varies with a country's political, administrative, economic and legal structure. Hence, the user cost function can be modeled at a country specific level.

To account for the user cost of housing in the empirical analysis, I consider the monthly accommodation expenses as a justified proxy variable for the user cost of housing as it accounts for significant proportion of the user cost. On a closer inspection in the section 'Empirical Results', the financial burden of the monthly accommodation expenses from renting are comparable to monthly accommodation expenses from owning

a house. This lends further justification to use the 'housing expense' related variable from the Swiss household panel dataset.

User Costs: Owner-Occupied Housing

The transmission channel of monetary policy for home owners is more complex since it affects the user costs in several ways, some of which can have compensating effects (Brueckner, 2011)[10].

$$UC_h = [(1 - \tau)(i + h + m) + \delta + \varpi + g]v \quad (1.1)$$

where, i denotes the mortgage interest rates, h is the property tax rate, m , is the maintainance costs, δ , is the depreciation rate, g is the capital gains defined as the annual percentage change in house values and ϖ the imputed rent expense. τ is household specific income tax rate and v is the value of house per unit of housing consumption. Therefore, equation 1.1 describes the user cost of per unit of owner occupied housing consumption.

In equation 1.1, I extend the user cost of homeownership function (Brueckner, 2011)[10] to include variables specific to Swiss housing market. Unlike the US housing markets imputed rents play a significant role for Swiss owner occupied housing and is not exempted from taxation thereby, eroding a tax subsidy for existing and potential homeowners. Additionally, Swiss homeowners are also subject to wealth tax and capital gains tax. Mortgage interest rates, property taxes and maintainance

costs are tax deductible.

Thus, equation 1.1, describes a more complex transmission mechanism of monetary policy through house prices and their gains, apart from the direct affect of mortgage interest rates. A decline in the mortgage interest rates raises house prices, affecting wealth level and capital gains today which increases the user costs of owner occupied housing, UC_h . On the other hand, lower interest rates also affects the future price expectations which lowers the user costs. The positive effect from higher prices is therefore partly compensated by a negative effect from future price expectations with the overall interest rate effect depending on the relative strength of both the factors. I expect the first component to be more relevant since it reflects the current prices while the expectation horizon of prices is the entire life of the housing asset and therefore only partly affected by current events. Regardless of the monetary policy stance, the inclusion of imputed rents acts as a strong deterrent for potential homeowners. Imputed rent increases the user cost of owner occupied housing linearly and constitutes a significant expenditure variable.

User Costs: Rental Housing

The transmission channel of monetary policy for tenants i.e. user costs of renting a home can be explained by equation 1.2 where, v , is the additional service charges other than rents. The user cost of renting is directly affected through the Swiss tenancy law that requires the rent change of existing contracts to be linked to a reference index (Hypothekarischer

Referenzzinssatz) as shown in figure 1.4.

$$UC_r = Rents_t + v \quad (1.2)$$

I investigate a scenario in which landlords are required by law to pass on interest rate changes in either direction to tenants directly. If landlords are forced to lower rents following an expansionary monetary policy, the user costs for the average tenant fall in a similar way as the average user cost of owning so that fewer households have incentive to become homeowners. This scenario leads to lower transitioning rates and a lower buying pressure on the housing market further depending on other factors that determine the sensitivity of price reactions. This is particularly true for regions that are densely urbanized, cities and towns placed in mountainous areas or between lakes, or other supply constrained areas. Consequently, the price dynamics of these supply inelastic regions would shift to lower and less volatile price paths compared to a scenario in which the majority of interest rate declines are not passed down to tenants. Thus, a well designed tenancy laws can provide beneficial outcomes that (1) help to mitigate the growing wealth inequality among households and (2) release some of the price pressure that has been accumulating in the Swiss real estate market.

1.5.2 Hypothesis

Hypothesis 1: An expansionary monetary policy leads to a decline in user cost of housing for both renters and homeowners.

A decline in the interest rate influenced by the central bank has a large and immediate effect on the mortgage rate as shown in Figure 1.4. Everything else equal, an expansionary monetary policy decreases mortgage rates and lowers the user costs of homeowners especially for existing homeowners with Adjustable Rate Mortgages (ARM) and potential homeowners.

On the other hand, the user cost of renting a house is calculated as the monthly rent and maintenance costs that the renter has to incur. The rental expenditure in Switzerland is indexed to the mortgage rates known as 'Hypothekarischer Referenzzinssatz' which in turn is affected by an expansionary monetary policy. Therefore, I hypothesize that an expansionary monetary policy decreases both the user cost of renting and owner-occupied housing.

Hypothesis 2: The decline in user costs due to an expansionary monetary policy is relatively more for homeowners than for renters

Equation 1.3 demonstrates that the rents respond asymmetrically to changes in the reference index, increasing in the same amount when the index goes up but being downward sticky when the index goes down.

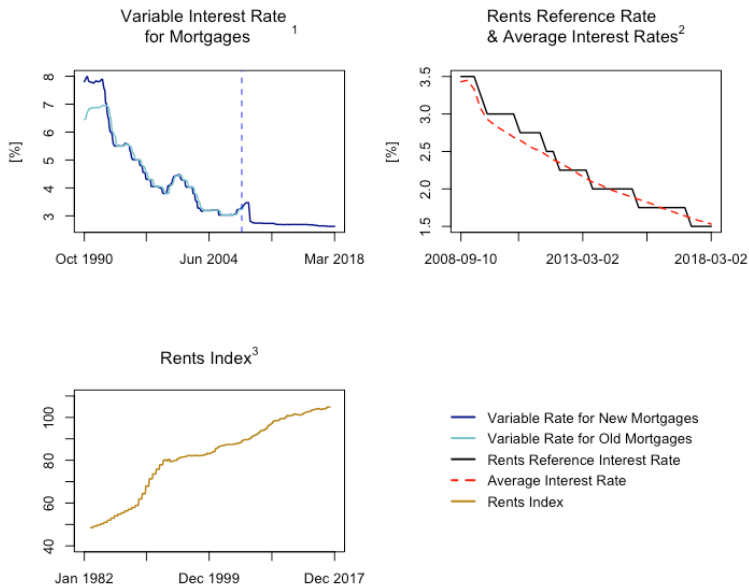


Figure 1.4: Reference & Average Interest Rate

Source: Author's own calculation. The figure depicts the monthly mortgage rates, rent reference rate and rents indices. The data is being retrieved from SNB.

$$\Delta UC_h > \Delta UC_r \quad (1.3)$$

The reason for the limited pass-through lies in the peculiarities of the Swiss tenancy law which treats increases in the reference index as an upper bound that is usually fully utilized by landlords but decreases as a lower bound that landlords have no incentive to act upon. As a consequence, rents usually stay constant when the reference index declines. Tenants have the right to enforce lower rents but most renters do not make use of their rights, either because they prefer to remain in good standing with the landlord or because they are not aware of this possibility. Therefore, I formulate a second hypothesis to test whether the relative change in the user cost of owner occupied housing expenditure is more than the user cost of renting a house.

Hypothesis 3: The relative decline in user costs and frictions generates larger incentives for high income renters to become homeowners.

Following an expansionary monetary policy, households which are less financially constrained are more likely to switch to homeownership and benefit from lower user costs. In contrast, the most income constrained households have no or very small possibility to become homeowners and are at a loss due to the lack of options. Only the high-income households are able to qualify for a mortgage. As a consequence of frictions,

a relatively small fraction of tenants actually transitions to homeownership. Hence, I hypothesize that an expansionary monetary policy may unintentionally amplify the already existing wealth inequality within the society.

1.6 Data

1.6.1 Monetary Policy Data

Data for three month CHF LIBOR rate, real mortgage rates, rents reference rates from year 1999 to year 2014 were extracted from Swiss National Bank . The trading prices for Swiss futures contract on the three-month CHF-LIBOR were retrieved from the Datastream. The implied policy rate was then calculated by subtracting 100 from the settlement price.

1.6.2 Swiss Household Data

Swiss Household Panel (SHP), supported by the Swiss National Science Foundation is a nationally representative, unique household longitudinal multi-topic survey database for Switzerland covering various socioeconomic indicators since year 1999. It is an annual panel study based on a random sample of private households in Switzerland over time, interviewing all household members mainly by telephone. The SHP interviewed a sample of 5074 households from year 1999-2004, adding a

second sample of 2538 households in 2004 and an additional third sample of 4093 households in 2013. Response rates have remained high in all three samples.

The survey covers indicators of (i) household characteristics for e.g., household size, age, occupation, religion, social group, household type, endowments, commuting times, etc. (ii) housing characteristics for e.g., tenurial type, user cost, residence in which the dwelling unit is located, neighborhood characteristics, hedonics, etc. (iii) social life for e.g., frequently going out for dinners, social gathering, etc. (iv) financial characteristics for e.g., housing expenditures, incomes, taxes, premiums, financial situation etc. (iv) locations for e.g., if households move, canton, region, etc.

I use the data from the year 1999-2014 with a sample of 12,508 households. The location of the every household is known at administrative units of regional and cantonal level. The municipal location code of the households were obtained separately on confidentiality basis by SHP data team and then later mapped to the respective households using MS region - municipality code list from the Swiss Federal Statistical Office (SFSO). For the purpose of the study, I extract the information on household's tenure, as homeowners or renters and the associated user costs, respectively. The other variables of interest considered are civil status, nationality, education, pillar 3a savings, etc.

1.6.3 Housing Markets Data

The house prices and rents for 106 MS regions since the year 1984 are obtained from Fahrlander Partner AG. These are the annual house price indices for single-family houses in lower, middle and higher tier range which are then matched with the vacancy rates, proportion of undevelopable land, population growth and GDP growth rate, consumer price index from SFSO. Price indices for privately owned apartments, rented building and construction costs at regional and cantonal level are also obtained from SFSO.

1.7 Identification

1.7.1 Identification: Monetary Policy Shock

For nineteen years (approx.), three-month CHF LIBOR rate has served as an important benchmark monetary policy rate for the other interest rates e.g., confederation bonds, mortgage rates, rents reference rates, etc. thereby, influencing the Swiss economy largely. In addition, the long expansive nature of the policy rate eases the access and cost of credit, impacting the financial markets, asset prices, and the household sector. Therefore, the cyclical movements or shocks to the policy rate also percolates within these various sectors of the economy.

The daily rate for three month LIBOR for investments in Swiss francs is the trimmed mean of the interest rates on unsecured Swiss franc in-

terbank loans with three-month maturity, reported by leading twelve banks. Thus, the daily three-month CHF LIBOR rate not only reflects the forces of demand and supply on the interbank loan market but also largely, reflects the perceptions of the leading market players at the interbank market about the SNB's future monetary policy decision. The market players anticipate in advance the decision of the SNB with regards to altering the target range for three-month CHF LIBOR. The expectations are partially embedded in the daily three-month CHF LIBOR rate to which various exchange traded financial instruments are linked, for e.g., Euro-Swiss futures contract on the three-month CHF-LIBOR.

In order to overcome the problem of endogeneity of policy rate, I follow the market expectations approach from the literature to construct the policy rate shock (Kuttner, 2001 [29]; Gertler and Karadi, 2014 [22]; Guerkaýnak et. al., 2007 [24]). I construct the shock as below:

$$\text{shock}_{tq} = i_{l_{tqd}} - i_{f_{tqd-15}} \quad (1.4)$$

where, in equation 1.4, $i_{l_{tq}}$ is the midpoint rate of the target range of three-month CHF LIBOR announced on day d , of quarter q , in year t . $i_{f_{tqd-15}}$ is the implied interest from the Swiss futures contract on the three-month CHF-LIBOR traded 15 days before the SNB monetary policy announcement⁵ $d - 15$, of quarter q , in year t . The shock_{tq} is the

⁵includes both scheduled and unscheduled announcements. Unscheduled an-

shock to the monetary policy at quarter q , in year t .

The expected rate derived from the future's contract on the three-month CHF LIBOR, fifteen days before the announcement reflects the information set of the market expectation about the monetary policy rate and any deviation from the announced policy rate is the surprise component of the policy rate. Thus, the difference can be interpreted as an unanticipated shock. This surprise component is exogenous.

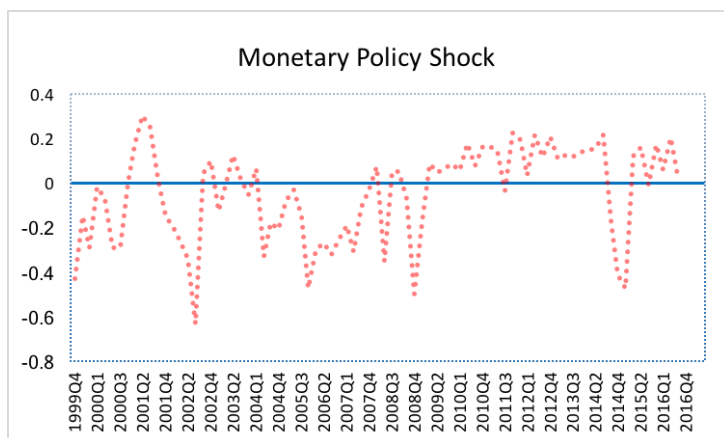


Figure 1.5: Monetary Policy Shock

Source: Author's own calculation. The data is being retrieved from SNB and Datastream. The figure depicts the quarterly shocks to monetary policy i.e., 3-month CHF LIBOR spanning a time period from 1999Q4 to 2016 Q4.

Figure 1.5, shows the time series of shocks to policy rate as calculated in equation 1.4. The shock in the negative territory implies that

nouncements are those which are not held at the predefined regular quarterly decision events of the SNB.

SNB has carried out more expansionary policy as opposed to the market expectations. In general, Figure 1.5 is evident of the overall expansionary monetary policy stance by SNB. The larger negative shocks can also be attributed to the world events of dot-com bubble (2002), sub-prime crisis (2008) and the discontinuation of the CHF-Euro peg (2015).

1.7.2 Identification: Potential Homeowners

To identify the effect of monetary policy on homeownership, I segregate the households into initial renters, r , and initial homeowners, o with a dummy variable D .

D_r for initial renting households:

$$D_r = \begin{cases} 1 & \text{if } d_r = \text{becomes a homeowner} \\ 0 & \text{if } d_r = \text{remains a renter} \end{cases} \quad (1.5)$$

Similarly, D_o for initial owner-occupied households:

$$D_o = \begin{cases} 1 & \text{if } d_o = \text{becomes a renter} \\ 0 & \text{if } d_o = \text{remains a homeowner} \end{cases} \quad (1.6)$$

In both the cases, the rest of the households in the sample are dropped. Specifically once a renter household becomes a homeowner, the observations for the same household for years after the transition are dropped from the sample. The similar procedure is used for home-

owners who transition to renters.

1.7.3 Identification: User Costs

To the best of the data availability I directly use a variable from SHP data called 'accommodation expenses for homeowners and renters'. These variables are identifiable via variable name h33 (homeowners) and h36 (renters). The variable give a monthly CHF rents and maintenance cost in case of tenants and monthly CHF accommodation related expenses in case of homeowners.

1.8 Empirical Results

1.8.1 Descriptive Results

In Table 1.1, I present summary statistics of the important variables that helps in building the identification. The SHP dataset is representative of the stylized facts about the Swiss household tenurial composition in Switzerland. 57% (approx.) of sampled households were initially renters at the time of their first interview. Only 14.5 % of initial renters transitioned to homeowners during the sample period. Whereas, only 8.4% (approx.) of the homeowners became renters. Therefore, this ratio is suggestive of national representation of Swiss household tenurial composition.

A clear distinction between initial renters and initial homeowners is

essential to the analysis in order to avoid double counting of a household and hence, the contamination of the empirical evidences.

Table 1.1: Descriptive Statistics: SHP

	Households (No.)	Households (%)
Tenants	7175	57.36
Home-owners	5038	40.3
NA	295	2.3
Transition to Ownership (% of tenants)	1039	14.5
Transition to Renting (% of owners)	423	8.4
Total	12508	

In Table 1.2 , I examine the monthly CHF differences in average monthly user cost payments for accommodation for owners and renters on the full sample over years. On average, a household exposed to the same policy rate in absolute prices spend on average CHF 1,700 per month as a homeowner, slightly more than the average expense incurred by a renter i.e. CHF 1,450. This is evident of the fact that the financial burden from owning a house is comparable to renting.

However, the differences in the average monthly user cost of accommodation between homeowners and renters gradually declines over the years which gives further validity to the empirical investigation of preferential transition towards homeownership in the presence of an expansion-

ary monetary policy via the user cost channel. The differential decline in the user costs can also be observed in terms of the real expenditure.

Housing expenses form one of the main components of monthly household expenditure. Hence, I also provide a summary statistics of ratio of housing expenses to household income in Table 1.2 indicating the percent of an income a typical household spends on the user cost of owning or renting a house. A typical homeowner spends about 1.6% per month of his yearly income as user cost expenses, while for a renter this percentage is slightly more, at 1.9% approximately and further increases over the years. The user cost to income ratio declines for homeowners which further increases the ratio gap between homeowners and renters, rendering renting as a more expensive alternative to homeownership.

Given the macro environment of an expansionary monetary policy, low mortgage interest rates and therefore, a lower rent reference rate, a positive trend in user cost to income ratio for renters is suggestive of only partial adjustments of housing rents to rent reference rates. These adjustments can potentially affect the housing markets via preferential shifts away from renting. This lends further credibility to the empirical investigation.

Figure 1.6 shows the CHF differences in user cost payments for accommodation after a household transitions to ownership. On an average, the households paid CHF 308 more. The lower 2.5% quantile is CHF 995 and the upper 97.5% quantile was CHF 1,625. Over all, households 30% had lower monthly payments once they were owners demonstrating

evidences of asymmetric effects.

Table 1.2: Average Income and Expenditure
of Household: By Tenure*

	1999-2005	2006-2010	2011-2014
Real Income (Median)			
Home-owners	114,312	118,010	121,154
Tenants	86,575	87,422	90,081
$\Delta \text{ expenses}_{\text{owners}-\text{tenants}}$	27,737	30,587	31,073
Nominal accommodation expenses (CHF/Month)			
Home-owners	1692	1709.5	1634
Tenants	1333	1451	1528
$\Delta \text{ expenses}_{\text{owners}-\text{tenants}}$	359	259	106
Real accommodation expenses			
Home-owners	1821	1737	1646
Tenants	1436	1475	1539
$\Delta \text{ expenses}_{\text{owners}-\text{tenants}}$	385	262	107
Housing expenses/Income Ratio (%)			
Home-owners	1.66	1.60	1.50
Tenants	1.85	1.97	2.04
$\Delta \text{ expenses}_{\text{owners}-\text{tenants}}$	-0.19	-0.37	-0.53

*for individual years, refer to Appendix. Income is yearly gross household income

In 1.7, I present the the spatial distribution of differences in annual house price growth rate from 1985 to 2014 for the low, middle, and high price category across Switzerland. The house price growth rate is calculated from house price indices (1985=100). There is a substantial heterogeneity in the dynamics of house prices across regions and tiers.

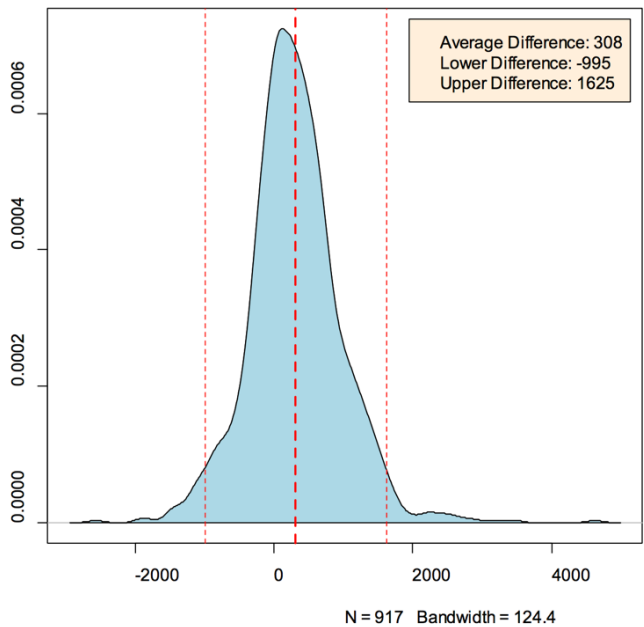


Figure 1.6: Distribution of Monthly Housing Expenditures

Source: Author’s own calculation. The data is being retrieved from SHP and spans a time period of 1999-2014.

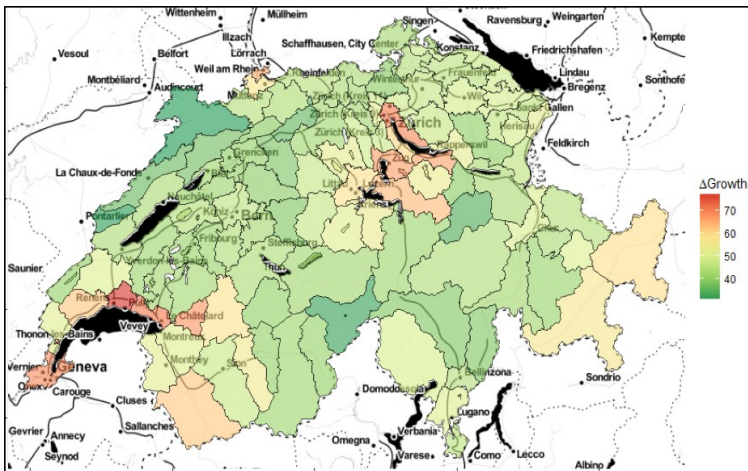


Figure 1.7: House Price Growth Rate

Source: Author's own calculation. The data is being retrieved from Fahrlander Partner AG. The figure depicts the Swiss house price growth rate from 1985-2014.

The gap between lower and upper tier growth rates within one region varies substantially and can be as high as 78%. The growth margin appears to be highest in highly urbanized regions such as around Lake Geneva, Basel, or the Zurich-Zug-Luzern metropolitan area. A few other regions which are popular tourist regions and have attracted a number of wealthy foreign individuals have also experienced an increase in the gap between lower tier and upper tier house prices. The differential margin of growth rates in tourist areas can also be suggestive of availability of land and other supply side measures influencing house price dynamics (Saez, 2010 [37]). Areas with constrained land have higher house prices compared to non constrained areas.

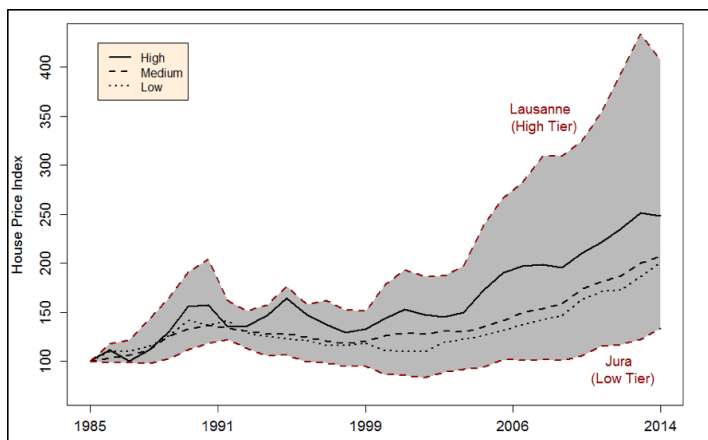


Figure 1.8: House Price Distribution

Source: Author's own calculation. The data is being retrieved from Fahrlander Partner AG. The figure depicts the Swiss house price distribution from 1985-2014.

In Figure 1.8, I further present that house prices belonging to the high tier category show pronounced cycles and have higher growth rates over time compared to medium or lower tier house prices. For instance, upper tier house prices (solid line) have increased by 150 % since 1985 while growth rates for the medium tier (dashed line) and the lower tier (dotted line) are at +107% and +100%, respectively. These house price indices are averaged across all 106 MS regions. The lowest growth rates are reported for the region Jura with an increase of only 34% in nominal terms, which corresponds to a 10% negative growth in real terms. In contrast, the highest price increase is observed for the high tier category of Lausanne, where house prices have increased by 307% since 1985.

1.8.2 Effect of Policy Shock on Housing Markets

I estimate the effect of the constructed policy shock variable on the housing markets precisely, to empirically examine how does an unanticipated monetary policy shock affects the house prices and housing rents. In theory, an expansionary monetary policy eases the option of homeownership which further translates in to inflated house prices and hence, rents.

Since housing markets are uniquely characterized by spatial linkages I estimate equation 1.7 with the spatial lag panel fixed effects model with house prices (rents) as the spatial lagged dependent variable. Equation 1.7 is estimated using the Maximum Likelihood (ML) estimator. The lag dependent spatial model allows to take into account spatial interactions

between the dependent variables or the error terms (Elhorst, 2010 [18]). Spatial fixed effects model helps to overcome the problem of omitted variable bias while assuming the spatial effects to be fixed.

$$y_{it} = \rho \sum_N^{i=1} W_{ij} y_{it} + X_{it} \beta + \mu_i + \epsilon_{it} \quad (1.7)$$

Similarly, I estimate equation 1.8 with spatial lag panel random effects model with house prices (rents) as the spatial lagged dependent variable. The model assumes unobserved spatial effects to be uncorrelated with other explanatory variables. Spatial effects are random in nature.

$$y_{it} = \rho \sum_N^{i=1} W_{ij} y_{it} + X_{it} \beta + \mu_i + \epsilon_{it} \quad (1.8)$$

Both, in equation 1.7 and equation 1.8, y_{it} , is the outcome variable of logarithm of tier wise real house prices (logarithm of real rents) in spatial mobility regions i.e., M.S. regions, $i = 1, \dots, 106$ at time $t = 1991, \dots, 2014$. $\rho \sum_N^{i=1} W_{ij} y_{it}$, specifies the spatial interaction effect. ρ is the spatial slope coefficient that explains the spatial dependence of house prices (rents) in M.S. region, i , on the house prices (rents) of a neighboring M.S. region, j . W , is the spatial weight matrix calculated using $k = 5$ nearest neighbors approach (by haversine distance). Therefore, the weight matrix allows us to account for the average price impact of the neighboring M.S. regions, j and is constant over time. X is a matrix of regressors variables i.e., population growth, $dlpop$, the vacancy rate, v ,

the real mortgage rate, r_m , constructed policy shock and the percentage of undevelopable land, udl , for all 106 M.S. regions.

In Table 1.3, I present the estimates of equation 1.7 and equation 1.8. Columns (1)-(8) are based on a balanced panel. Panel (A) in Table 1.3, shows the estimated coefficients for a spatial panel fixed effects model with M.S. region fixed effects. The spatial lag parameter ρ indicates a high degree of spatial dependence on the level of M.S. regions. This is likely to be the result of the geographical proximity in combination with a well-functioning transportation network and high labour mobility. The coefficient for population growth is around 0.3 indicating that a 1% increase in population growth increases real house prices on average by 0.3%.

The vacancy rate, v , has the expected negative sign and is statistically significant. An expansionary monetary policy that reduces the real mortgage rate by 1 percentage point has no effect on lower tier real house prices, but increases middle tier real house prices by 0.6% and upper tier real prices by 1.2%. The effect of a lower real mortgage rate is therefore not symmetric but is much stronger for houses within the high price category. However, the constructed policy shock has an unexpected puzzling positive sign but is statistically significant. The more negative the policy shock is the more expansionary is the monetary policy stance of the SNB. Therefore, an unexpected expansionary policy is

Table 1.3: Effect of Real Mortgage Rate on Real House Prices

	Spatial Panel Fixed Effects Model (A)				Spatial Panel Random Effects Model (B)			
	RHP: Low (1)	RHP: Mid (2)	RHP: High (3)	Real Rents (4)	RHP: Low (5)	RHP: Mid (6)	RHP: High (7)	Real Rents (8)
ρ	0.82*	0.79*	0.82*	0.86*	0.81*	0.78*	0.82*	0.69*
dipop	0.32*	0.30*	0.24*	0.02	0.33*	0.32*	0.25*	0.20*
v	-0.44*	-0.44*	-0.43*	-0.04	-0.44*	-0.44*	-0.43*	-0.17*
r_m	-0.2	-0.6*	-1.2*	0.2*	1.2*	0.9*	0.2	1.14*
uull					0.001	0.001	0.001	0.001*
r_m *uull					-0.05*	-0.05*	-0.05*	-0.02*
ρ	0.75*	0.70*	0.82*	0.52*	0.74*	0.69*	0.81*	0.51*
dipop	0.04	0.06	0.24*	0.02	0.05	0.08	0.03	0.06
v	-2.29*	-2.41*	-2.8*	-0.6*	-2.44*	-2.54*	-2.9*	-0.77*
Policy Shock	0.08*	0.09*	0.06*	5.3*	0.05*	0.05*	0.02*	3.5*
uull					0.0001	0.0002	0.0002	0.0009
Policy Shock*uull					0.001*	0.001*	0.001*	0.06*
MS.Region F.E.	Y	Y	Y	Y	N	N	N	N

Note: * indicates a significance of 5% or less. The dependent variables are in logarithm.

associated with decreasing house prices although the effect is negligible around 0.08%. One potential explanation for this puzzle could be that even though the house prices react positively to lower mortgage rates, their reaction to expansionary policy beyond the market expectations is negligible. Glaeser et al. (2008)[23], show that the impact of demand and supply shocks affecting house prices depend on the elasticity of housing supply. In panel (B) of Table 1.3, I estimate a spatial panel random effects specification stated in equation 1.8 which includes the interaction of the real mortgage rate with the time-invariant percentage of undevelopable land, udl^6 , as an additional regressors. In this specification, the effect of the real mortgage rate is estimated to be initially positive but decreases with the level of undevelopable land.

Columns (4) and (8) represents the estimates of equation 1.7 and equation 1.8 for logarithm of real rents as the dependent variable. The statistically significant positive effect of the real mortgage rate on real rents is likely to be the result of a partial market adjustment of rents owing to the linkage of mortgage rates with rent reference rates. Further, the effect on real rents decreases with the level of undevelopable land.

To put the interaction into economic perspective, we illustrate the impact of an expansionary monetary policy (i.e. a 1 % lower real interest rate) in Figure 1.9. The marginal effects depend on the house price tier indicated by the solid line (high price tier), the dashed line (medium

⁶ udl is an abbreviation for undevelopable land. It is the percentage of land not suited for habitation at M.S. region level. Other variables are explained in the appendix to this chapter.

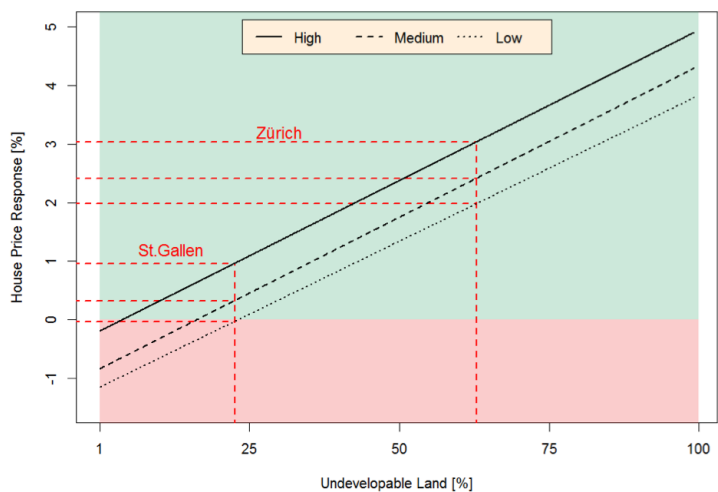


Figure 1.9: House price response

Source: Author's own calculation. The data is being retrieved from SFSO. The figure depicts the house price response as a function of the undevelopable land i.e., supply side factors.

tier) and the dotted line (lower tier). However, the effect is also strongly driven by the underlying level of undevelopable land. For instance, the region St. Gallen has 23% of its surface being undevelopable. St. Gallen can be therefore regarded as being relatively elastic in its housing supply. In this case, a 1% drop in the real interest rate has no effect on lower tier house prices but increases upper tier house prices by roughly 1%. In contrast, the same expansionary policy shock in Zurich with a high level of undevelopable land i.e. 63% is substantially larger. A 1% lower real interest rate increases lower tier house prices in Zurich by 2% and upper tier house prices even by 3%. Our findings in Figure 1.9 confirm that house prices do not respond symmetrically to changes in the monetary policy rate.

Even though there exists a possibility of spillovers between different tiers of houses. However, to measure the inter-dependence of the tier wise house prices is out of the scope of this study.

Table 1.4: Stationarity Test of Real House Prices

	<i>Augmented Dickey Fuller Test</i>			
	LRHP: Low	LRHP: Mid	LRHP: High	Log Real Rents
<i>DF – Value</i>	-6.99	-7.88	-8.63	-6.94
<i>Lag</i>	11	11	11	11
<i>p – value</i>	0.01	0.01	0.01	0.01

DF – Value is the Dickey-Fuller value. The prices are in log real terms.

To check for the stationarity of the house prices, I use the Augmented Dickey Fuller Test (ADF) on logarithmic of real house prices and rents by tiers in the Table 1.4. As the results show that the p-value is less than 5% level of significance. Therefore, the null hypothesis of logarithmic of real prices being non stationary can be rejected with confidence.

1.8.3 Effect of Policy Shock on Accomodation Expenses: Hypothesis 1

I estimate equation 1.9 with a linear panel fixed effects model to identify the effect of a monetary policy shock on the user cost of homeownership and renting. By empirically investigating equation 1.9, I aim to testify hypothesis 1.

Additionally, as an outcome variable already drops the household from the sample once they have transitioned to homeownership. Therefore in the remaining sample all households that were renters have transitioned to homeownership at one point.

$$y_{it} = \alpha + \beta \text{ policy shock}_{it}' + c_i + \mu_{it} \quad (1.9)$$

where, y_{it} , is the outcome variable logarithm of nominal user cost expenses (logarithm of real user cost expenses) for household, $i = 1, \dots, N$ at time, $t = 1999, \dots, 2014$. $\text{policy shock}_{it}'$, is the time varying vector of constructed monetary policy shock facing a household, i , at time, t . α , is the constant term, c_i , is the household specific effect, μ_{it} , is the

idiosyncratic error term. β is the parameter of interest.

Equation 1.9 is repeatedly estimated for sub sample of homeowners and renters, separately, where the outcome variable is the logarithm of nominal user cost expenses (logarithm of real user cost expenses) of homeownership and renting, respectively. In the appendix, I again present the estimates for equation 1.9 to identify the effect of a different kinds of interest rates on the user cost of home owning and renting. The explanatory variables are mortgage rates and monetary policy rate.

Unlike, equation 1.7 and equation 1.8 the outcome variable in equation 1.9 is the user cost of housing expenses for renters and homeowners at household level which are not spatially connected. Therefore, spatial spillovers in this case are not taken into account.

In Table 1.5, Panel (A), I present the estimates of equation 1.9 for the outcome variable logarithm of nominal user cost expenses for three different types of households. Panel (B), outcome variable is the logarithm of real user cost for three kinds of households. Columns (1)-(6) are based on an unbalanced panel. The estimates in Table 1.5, column (1)-(3) suggests monetary policy shock decreases the nominal user cost expenses for renters by 19 percent and is quite sizeable in economic terms. The user cost of housing decreases overall by 8.5 percent for all households in the sample and is highly statistically significant. Whereas, a 1% (100 bps) shock to the monetary policy increases the cost for homeowners which is contrary to the hypothesis stated. These estimates provide a mix evidence in support of hypothesis 1.

The estimates (Table 1.5) suggests that the benefits of expansionary policy regime are passed on to renters via rent reference rates. Hence, the evidence for hypothesis 1 is mixed which makes it further difficult to claim in favor of hypothesis 2.

1.8.4 Effect of Policy Shock on Tenure Choice: Hypothesis 3

I estimate equation 1.10 with a linear probability model to identify the effect of a monetary policy shock on the probability of homeownership. Such an effect helps to testify the stated hypothesis 3.

$$y_{it} = \alpha + \beta \text{ policy shock}'_{it} + \gamma D_{it} + \delta(D_{it} * \text{policy shock}'_{it}) + \phi z'_i + c_i + r_i + \mu_{it} \quad (1.10)$$

where, y_{it} , is the outcome dummy variable = 1 for homeownership status change of a household, $i = 1, \dots, N$ at time, $t = 1999, \dots, 2014$ that was initially a renter in the sample. $\text{policy shock}'_{it}$, is the time varying vector of constructed monetary policy shock facing a household, i , at time, t . D_{it} is the dummy variable if a household falls in the above or below median income category. z'_i is a vector of control variables at household level, i . α , is the constant term, c_i , is the household specific effect, r_i , is the region specific effect, μ_{it} , is idiosyncratic error term. δ is the parameter of interest.

Table 1.5: Effect of Monetary Policy Shock on Accommodation Expenses

	Log Nominal Accommodation Expenses (A)			Log Real Accommodation Expenses (B)		
	all hhds (1)	tenant (2)	homeowner (3)	all hhds (4)	tenant (5)	homeowner (6)
Monetary Policy Shock	0.084*** (0.013)	0.190*** (0.011)	-0.096*** (0.021)	-0.007 (0.013)	0.109*** (0.011)	-0.184*** (0.021)
Household Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.001	0.018	0.001	0.00001	0.006	0.004
F Statistic	56.225*** (df = 1; 53924)	522.224*** (df = 1; 28308)	28.585*** (df = 1; 23852)	0.376 (df = 1; 53924)	174.102*** (df = 1; 28308)	104.588*** (df = 1; 23852)

*(Policy Shock is the average shock)**Note: * p<0.1; ** p<0.05; *** p<0.01, (standard errors are clustered at the household level.)*

Unlike, equation 1.7 and equation 1.8 the outcome variable in equation 1.10 is not are spatially connected as well. Therefore, spatial spillovers in this case are also not taken into account. Additionally, as an outcome variable already drops the household from the sample once they have transitioned to homeownership. Therefore in the remaining sample all households that were renters transitioned to homeownership at one point.

In the appendix, I present robust estimates using equation 1.10 to identify the effect of a monetary policy shock on the probability of homeownership using full sample. I also test the effect of a monetary policy shock on the probability of renting.

In Table 1.6, I present the estimated coefficients of equation 1.10 along with household and region fixed effects. Columns (1)-(3) are based on an unbalanced panel. Column (1) estimates the effect of a monetary policy shock and gross income on the probability of transitioning from being a renter to a homeowner. The impact of the policy shock on the variables occurs with a lag of at least one year. The data sample for regression results in column (2) is grouped into rich households and poor households which is demonstrated by the dummy variable *Income(> q50)*. Rich households are assigned a value 1 and poor households as 0. Rich households are the one whose yearly gross income (in CHF) is more than the median income (calculated to be 90,000 CHF/year) of all households that are initial renters in the sample. Households that are below or at median income levels are considered to be poor households. Therefore, column (2) estimates the effect of a monetary shock on the

probability of transitioning from being a renter to a homeowner for a rich or poor household. The results in column (3) provides estimates with added controls.

The coefficient for lagged monetary shock (column 1) has expected negative sign and is highly statistically significant. Holding everything else constant, a negative monetary shock (expansionary monetary policy) of 1 percent (100 bps) is estimated to increase the probability of transitioning to home ownership by 2.35 percentage points for all households on average. However, the effect of a monetary shock is heterogeneous for poor and richer households (column 2). The interaction term between lagged policy shock and income status suggests that while, both groups of households tend to benefit from an expansionary monetary policy but the effect for richer households to transition to home ownership is estimated to be much stronger at 3.45 percentage points ($1.75+1.7$) and statistically significant.

In Table 1.7, the initial renters are further grouped into quartile incomes and Table 1.8 provides estimates of the interaction of grouped households with 'pillar 3a savings'. Within richer household, those within the upper income quartile (Table 1.7) benefit the most from a negative shock with increased probability of becoming a homeowner by 5 percentage points ($1.1+3.9$). The estimates are statistically significant and sizeable in economic terms. Figure 1.10 also illustrates this fact where the co-movement between interest rate and richer households transitioning to homeownership is strongly correlated than for the poor households.

However, without a change in any economic conditions like a change in monetary policy, the richer households are 1.9 percentage points more probable to change their status as a homeowner relative to poor households. This effect is even stronger and statistically significant for the cohort of households in the upper income quartile at 3 percentage points (Table 1.7).

The estimates provide a strong support to the hypothesis 3. From the results it can be inferred that income constraints act as an important impediment for Swiss households to become homeowners. The increased access to the financial market due to expansionary monetary policy favors the least financially constrained households the most, widening the wealth inequality gap. A Swiss household is 0.6 percentage points more likely to switch to homeownership (Table 1.6), with even a higher probability of 1.1 percentage points in case the household has a married couple and a slightly lower probability of 0.8 percentage points in case the married couple have children.

Pillar 3a savings⁷ (Table 1.8) are an important financial reserve which

⁷A pillar 3a investment account is a Swiss retirement savings vehicle which allows both a household to both save and invest. It also allows account holders to invest part of their assets in securities like bonds, stocks or funds and are best suited to long-term investments. Pillar 3a investment accounts are subject to limitations on fixed maximum annual contributions which are eligible to be deducted from taxes. However, because 3a investment accounts involve more risk than 3a savings accounts. Account holders can earn higher returns on their assets, but there is also a risk of loss. Pillar 3a savings can also be used to purchase a home or condominium. A household has the option of early withdrawal of the pillar 3a funds to purchase a home (withdrawals possible every five years). Or can pledge the retirement savings and benefit from the preferential tax treatment. Just as with assets withdrawn from the pension fund, the capital paid out of pillar 3a is subject to tax. However, unlike with the second pillar, one does not have to pay back these early withdrawals if they

can influence the decisions about home purchases for a household.

On an average, a renting household with pillar 3a savings is 0.9 percentage points more likely to buy a house. For a richer household this probability increases by 1.4 percentage points with a total effect of 2.3 percentage points. Within the richer households with pillar 3a savings, the probability to transition to homeownership is the even stronger and statistically significant for households in the uppermost income quartile at 2.6 percentage points. Therefore, any shock to the monetary policy can have sizeable effects for household with pillar 3a savings. Holding everything else constant, an average renting household with pillar 3a savings is 3.6 percentage points more likely to transition to home ownership once exposed to a negative monetary shock of 100 bps. The effect is statistically significant.

Figure 1.10 shows the time variation in the percentage share of households that transition to ownership. I distinguish between households with below median income (red line) and households with above median income (green line). Median gross income in the sample is estimated to be CHF 90,000. As expected, high income households are *ceteris paribus* more likely to become homeowners. The blue dashed line indicates the real interest rate. The graph suggests a weak negative correlation between the real interest rate and the percentage of households that sell their home.

Table 1.6: Heterogeneous Effect of Policy Shock on Homeownership

	<i>Transitioning to Homeownership (=1)</i>		
	LPM	LPM	LPM
	(1)	(2)	(3)
¹ Gross Income (CHF/Year)	0.0041** (0.00000)		
Income(>q50)		0.019*** (0.001)	0.007*** (0.002)
Policy Shock _{t-1}	-0.023*** (0.003)	-0.017*** (0.003)	-0.016*** (0.003)
Policy Shock _{t-1} *Income(>q50)		-0.017*** (0.005)	-0.018*** (0.005)
Nationality (Swiss=1)			0.006*** (0.002)
Civil Status (Married = 1)			0.011*** (0.002)
Education (in years)			0.001*** (0.0003)
Age			-0.0001** (0.00004)
Family Type (married with kids)			0.008*** (0.003)
3 rd Pillar savings (Yes=1)			0.018*** (0.002)
Constant		-0.007*** (0.002)	-0.029*** (0.005)
Household Fixed Effects	Y	Y	Y
MS Region Fixed Effects	N	Y	Y
Observations	34,478	38,776	36,012
R ²	0.002	0.014	0.020
Adjusted R ²	-0.224	0.011	0.017
F Statistic	34.536***	5.050***	6.527***
	(df = 2; 28107)	(df = 108; 38667)	(df = 114; 35897)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level
(¹ indicates an effect of an increase in gross income by 50,000 CHF/Month)

Table 1.7: Heterogeneous Effect of Policy Shock on Homeownership

	<i>Transitioning to Homeownership (=1)</i>		
	LPM (1)	LPM (2)	LPM (3)
¹ Gross Income (CHF/Year)	0.0041** (0.00000)		
Income(25-50q)		0.007*** (0.002)	-0.001 (0.002)
Income(50-75q)		0.017*** (0.002)	0.004* (0.002)
Income(75-100q)		0.030*** (0.002)	0.012*** (0.003)
Policy Shock _{t-1}	-0.023*** (0.003)	-0.011*** (0.003)	-0.009*** (0.003)
Income(25-50q)*Policy Shock _{t-1}		-0.013** (0.005)	-0.014** (0.006)
Income(50-75q)*Policy Shock _{t-1}		-0.011* (0.006)	-0.013* (0.007)
Income(75-100q)*Policy Shock _{t-1}		-0.039*** (0.007)	-0.039*** (0.008)
Nationality (Swiss=1)			0.005** (0.002)
Civil Status (Married = 1)			0.010*** (0.002)
Education (in years)			0.001** (0.0003)
Age			-0.0001* (0.00004)
Family Type (married with kids)			0.008*** (0.003)
3 rd Pillar savings (Yes=1)			0.017*** (0.002)
Constant		-0.012*** (0.002)	-0.025*** (0.005)
Household Fixed Effects	Y	Y	Y
MS Region Fixed Effects	N	Y	Y
Observations	34,478	38,776	36,012
R ²	0.002	0.016	0.021
Adjusted R ²	-0.224	0.013	0.018
F Statistic	34.536*** (df = 2; 28107)	5.720*** (df = 112; 38663)	6.643*** (df = 118; 35893)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level
 (¹ indicates an effect of an increase in gross incomes by 50,000 CHF/Month)

relation between movements in the interest rate and the share of high income households that transition to ownership.

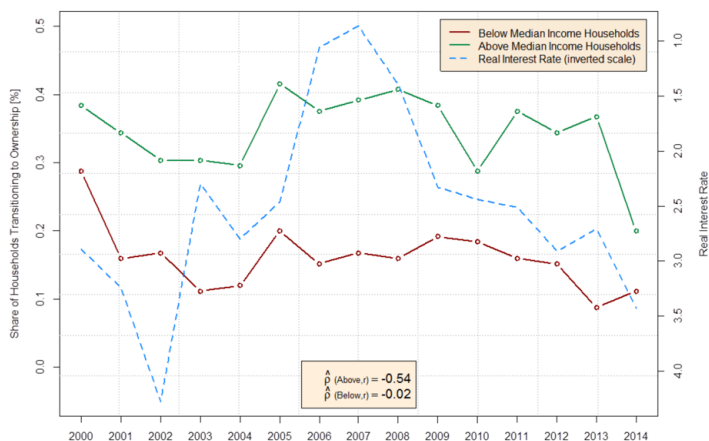


Figure 1.10: Tenure Choice

Source: Author's own calculation. The data is being retrieved from SHP and SNB. The graph depicts the comovement of interest rates with the tenure choice of the households.

In fact, the sample correlation between real interest rates and the transition share of high income households is -0.54 while the correlation for low income households is 0.02 and statistically insignificant. High income households are not only more likely to switch to home ownership, they also respond much stronger to lower interest rates, indicating that monetary policy can have some unintended consequences on wealth distribution and transfer, with high income households being the winners of

Table 1.8: Heterogeneous Effect of Policy Shock on Homeownership

	<i>Transitioning to Homeownership (=1)</i>	
	LPM (1)	LPM (2)
3^rd Pillar savings	0.009*** (0.002)	0.006** (0.003)
Policy Shock $_{t-1}$	-0.013*** (0.003)	-0.013*** (0.003)
Policy Shock $_{t-1}$ * 3^rd Pillar savings	-0.023*** (0.005)	-0.023*** (0.005)
Income(>50q)	0.009*** (0.002)	
Income(>50q) * 3^rd Pillar savings	0.014*** (0.003)	
Income(25-50q)		0.007*** (0.002)
Income(50-75q)		0.009*** (0.002)
Income(75-100q)		0.018*** (0.004)
Income(25-50q) * 3^rd Pillar savings		0.002 (0.004)
Income(50-75q) * 3^rd Pillar savings		0.012*** (0.004)
Income(75-100q) * 3^rd Pillar savings		0.020*** (0.005)
Constant	-0.012*** (0.002)	-0.016*** (0.002)
Household Fixed Effects	Y	Y
MS Region Fixed Effects	N	Y
Observations	36,054	36,054
R ²	0.019	0.020
Adjusted R ²	0.016	0.017
F Statistic	6.160*** (df = 110; 35943)	6.361*** (df = 114; 35939)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level

an expansionary monetary policy at the cost of low income households.

1.8.5 Alternative Policy Shocks: Further Robustness Checks

Owing to results presented in this chapter, I further present a brief section on the robustness of the results. There can be enough good reasons for the reader to doubt whether a typical Swiss household may be in reality more concerned about the monetary policy.

Therefore, to mitigate these concerns I construct another similar shock to the one constructed in the identification section by using the long term variable mortgage rates rather than the 3 month CHF Libor. For a typical Swiss household, changes in the mortgage rate should be more relevant in general. Any changes in the monetary policy path are not only directly transmitted to the mortgage rates but also any unanticipated policy shocks are reflected in the mortgage rates. Moreover, the housing rents are also indexed to the mortgage rates since 2008.

I construct the policy shock for a typical household as follows:

$$\text{shock}_{tq} = i_{m_{tqd}} - i_{f_{tqd-15}} \quad (1.11)$$

where, in equation 1.11, $i_{l_{tq}}$ is the variable mortgage rate on the day of three-month CHF LIBOR announcement d , of quarter q , in year t . $i_{f_{tqd-15}}$ is the implied interest from the Swiss futures contract on the three-month CHF LIBOR traded 15 days before the SNB monetary

policy announcement⁸ $d - 15$, of quarter q , in year t .

The $shock_{tq}$ is the shock to the policy for a typical household at quarter q , in year t . The $shock_{tq}$ is then annualized by taking the yearly average of the quarters.

The expected rate derived from the future's contract on the three-month CHF LIBOR, fifteen days before the announcement reflects the information set of the market expectation about the monetary policy rate and any deviation from the mortgage rate is the surprise component to a typical Swiss household. Thus, the difference can be interpreted as an unanticipated shock. This surprise component is exogenous.

The results presented in the following tables are robust to the results from the main specifications. This lends credibility to the main derived conclusions that in event of unanticipated monetary policy shocks wealthy households in the upper income quartile are more likely to switch to homeownership.

The results in Table 1.9 are estimated using equation 1.9 with a linear panel fixed effects model to identify the effect of a alternative policy shock to a typical Swiss household (constructed as above) on the user cost of homeownership and renting.

In light of hypothesis 1, the results in Table 1.9 column (1)-(3) suggests that the alternative policy shock to a typical Swiss household in the event of an unexpected expansionary monetary policy decreases the

⁸includes both scheduled and unscheduled announcements. Unscheduled announcements are those which are not held at the predefined regular quarterly decision events of the SNB.

nominal user cost expenses for renters by 1.1 percent.

Whereas, a 1% (100 bps) shock to the monetary policy increases the cost for homeowners which is contrary to the hypothesis stated. These estimates provided validate the puzzling results in Table 1.5 concluding the mixed evidence for hypothesis 1.

The results in Table 1.10 are estimated using equation 1.7 and equation 1.8 with a spatial lag panel fixed effects and random model to identify the effect of an alternative policy shock to a typical Swiss household (constructed as above) on the real house prices. The spatial lag parameter ρ indicates a high degree of spatial dependence on the level of M.S. regions. The vacancy rate, v , has the expected negative sign and is highly statistically significant.

The alternative policy shock to a Swiss household similarly like an unanticipated policy shock that reduces the real mortgage rate by 1 percentage point has no effect on lower tier and medium real house prices, but increases upper tier real house prices by 0.5%, as mentioned in column (3) of Table 1.10. The effect is highly significant and demonstrates the asymmetric nature of response of house prices to shocks in mortgage rates. The results also holds in the Panel (B) of Table 1.10 stating the spatial panel random effects specification (column (7)). The results are similar in direction to the results from the main specification.

Table 1.9: Effect of Monetary Policy Shock on Accommodation Expenses

	<i>Log Nominal Accommodation Expenses</i> (A)			<i>Log Real Accommodation Expenses</i> (B)		
	all hhds	tenant	homeowner	all hhds	tenant	homeowner
Policy Shock	0.001 (0.004)	0.011*** (0.002)	-0.013** (0.005)	-0.003 (0.004)	0.008*** (0.002)	-0.017*** (0.005)
Household Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.0000	0.001	0.0003	0.00001	0.0004	0.0004
F Statistic	0.141 (df = 1; 53924)	18.756*** (df = 1; 28308)	6.299** (df = 1; 23852)	0.560 (df = 1; 53924)	10.660*** (df = 1; 28308)	10.023*** (df = 1; 23852)

Policy Shock is the deviation from of the long term variable mortgage rates

from the implied interest rates on 3 month CHF Libor Futures.

*Note: * p<0.1; ** p<0.05; *** p<0.01, (standard errors are clustered at the household level)*

Table 1.10: Effect of Policy Shock on Real House Prices

	Spatial Panel Fixed Effects Model (A)				Spatial Panel Random Effects Model (B)			
	RHP: Low (1)	RHP: Mfid (2)	RHP: High (3)	Real Rents (4)	RHP: Low (5)	RHP: Mfid (6)	RHP: High (7)	Real Rents (8)
ρ	0.82*	0.79*	0.82*	0.86*	0.81*	0.78*	0.82*	0.69*
dlpop	0.32*	0.30*	0.24*	0.02	0.33*	0.32*	0.25*	0.20*
v	-0.44*	-0.44*	-0.43*	-0.04	-0.44*	-0.44*	-0.43*	-0.17*
r_m	-0.2	-0.6*	-1.2*	0.2*	1.2*	0.9*	0.2	1.14*
udl					0.001	0.001	0.001	0.001*
r_m *udl					-0.05*	-0.05*	-0.05*	-0.02*
ρ	0.84***	0.82***	0.86***	0.66***	0.83***	0.81***	0.86***	0.65***
dlpop	0.07	0.09	0.07	0.09	0.09	0.10	0.09	0.1
v	-1.92***	-2.01***	-2.37***	-0.75***	-2.17***	-2.25***	-2.61***	-0.96***
Policy Shock	0.002	0.002	-0.005*	-0.006**	-0.002	-0.002	-0.011*	-0.002
udl					-0.0004	-0.0004	-0.0005	0.0004
Policy Shock*udl					0.0001	0.0001	0.0001	0.0001
MS.Region F.E.	Y	Y	Y	Y	N	N	N	N

Policy Shock is the deviation from of the long term variable mortgage rates from the implied interest rates on 3 month CHF Libor Futures.
Note: * indicates a significance of 5% or less. The dependent variables are in logarithm.

Table 1.11: Heterogeneous Effect of Policy Shock on Homeownership

	<i>Transitioning to Homeownership (=1)</i>		
	LPM (1)	LPM (2)	LPM (3)
¹ Gross Income (CHF/Year)	0.0037** (0.00000)		
Income(>q50)		0.031*** (0.005)	0.019*** (0.006)
Policy Shock t_{-1}	-0.005*** (0.002)	-0.004*** (0.001)	-0.004*** (0.001)
Policy Shock t_{-1} *Income(>q50)		-0.005* (0.003)	-0.005* (0.003)
Nationality (Swiss=1)			0.006*** (0.002)
Civil Status (Married = 1)			0.011*** (0.002)
Education (in years)			0.001*** (0.0003)
Age			-0.0001*** (0.00004)
Family Type (married with kids)			0.008*** (0.003)
3 rd Pillar savings			0.017*** (0.002)
Constant		0.005 (0.003)	-0.012** (0.006)
Household Fixed Effects	Y	Y	Y
MS Region Fixed Effects	N	Y	Y
Observations	34,478	38,776	36,012
R ²	0.001	0.012	0.019
F Statistic	15.097***	4.316***	5.983***
F Statistic	(df = 2; 28107)	(df = 108; 38667)	(df = 114; 35897)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level
 Policy Shock is the deviation from of the long term variable mortgage rates
 from the implied interest rates on 3 month CHF Libor Futures.
 (¹ indicates an effect of an increase in gross income by 50,000 CHF/Month)

The results in Table 1.11 are estimated using equation 1.10 with a linear probability model to identify the effect of a alternative policy shock to a typical Swiss household (constructed as above) on the probability of transitioning to homeownership. Following the same specification and method of grouping the households by gross income quartile, the results are robust in magnitude and direction to the results estimated in the main specification.

The coefficient for lagged mortgage rate shock has expected negative sign and is highly statistically significant. Holding everything else constant, a negative shock to the mortgage rate (expansionary monetary policy) of 1 percent (100 bps) is estimated to increase the probability of transitioning to home ownership by 0.5 percentage points for all households on average. However, this effect for richer households (column 2) is estimated to be much stronger at 0.9 percentage points ($0.4+0.5$) and statistically significant. The effect becomes even stronger for households within the upper income quartile (Table 1.12, column (2)) with the increased probability of becoming a homeowner by 1.6 percentage points ($0.3+1.3$).

The estimates are statistically significant. On an average, the richer households are 3.1 percentage points more probable to change their status as a homeowner relative to poor households (Table 1.11, column (2)).

Table 1.12: Heterogeneous Effect of Policy Shock on Homeownership

	<i>Transitioning to Homeownership (=1)</i>		
	LPM (1)	LPM (2)	LPM (3)
¹ Gross Income (CHF/Year)	0.0037** (0.00000)		
Income(25-50q)		0.016*** (0.006)	0.007 (0.006)
Income(50-75q)		0.022*** (0.006)	0.008 (0.007)
Income(75-100q)		0.061*** (0.008)	0.043*** (0.009)
Policy Shock $t-1$	-0.005*** (0.002)	-0.003* (0.001)	-0.003* (0.002)
Income(25-50q)*Policy Shock $t-1$		-0.003 (0.003)	-0.003 (0.003)
Income(50-75q)*Policy Shock $t-1$		-0.002 (0.003)	-0.001 (0.003)
Income(75-100q)*Policy Shock $t-1$		-0.013*** (0.004)	-0.013*** (0.004)
Nationality (Swiss=1)			0.005*** (0.002)
Civil Status (Married = 1)			0.010*** (0.002)
Education (in years)			0.0004 (0.0003)
Age			-0.0001*** (0.00004)
Family Type (married with kids)			0.007*** (0.003)
3 ^r d Pillar savings			0.016*** (0.002)
Constant		-0.005 (0.004)	-0.012* (0.006)
Household Fixed Effects	Y	Y	Y
MS Region Fixed Effects	N	Y	Y
Observations	34,478	38,776	36,012
R ²	0.001	0.014	0.020
F Statistic	15.097*** (df = 2; 28107)	4.913*** (df = 112; 38663)	6.070*** (df = 118; 35893)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level

Policy Shock is the deviation from of the long term variable mortgage rates from the implied interest rates on 3 month CHF Libor Futures.

(¹ indicates an effect of an increase in gross incomes by 50,000 CHF/Month)

1.9 Concluding Remarks

The expansionary monetary policy affects the Swiss housing markets and households in a heterogeneous manner. The shock to the policy rate has a potential to increase homeownership for swiss households on average by 2.35 percentage points and for richer households with a probability of 3.45 percentage points. The expansionary monetary policy on homeownership rate cannot be attributed purely as causal relationship at this point but this finding is instructive. To understand the such an effect, I try to explore the potential user cost of housing channel by testing various hypothesis.

The results for the effect of monetary policy shock on the user cost of housing are mixed. While the tenants witness a decrease in their monthly user cost payments by 19%, the effect is opposite for the homeowners thereby constraining the evidence. Moreover, an unanticipated negative monetary policy shock decreases rents in line with hypothesis. The effect on single family homes is however, contrary. This may indicate the importance of multi-family houses and /or apartment housing markets in the event of a monetary policy shock, the empirical analysis for which is out of the scope of this study. On the whole, the study finds that an expansionary monetary policy strongly affects the homeownership decisions. However, the results provides mixed support to the hypothesized user cost as a potential transmission channel which is subject to further empirical investigation.

References

- [1] Aladangady, Aditya. “Housing wealth and consumption: Evidence from geographically-linked microdata”. In: *American Economic Review* 107.11 (2017), pp. 3415–46.
- [2] Albanesi, Stefania. “Inflation and inequality”. In: *Journal of Monetary Economics* 54.4 (2007), pp. 1088–1114.
- [3] Allen, Jason, Greenwald, Daniel, et al. “Managing a Housing Boom”. In: *2018 Meeting Papers*. 1310. Society for Economic Dynamics. 2018.
- [4] Andrei, Daniel, Herskovic, Bernard, and Ledoit, Olivier. “The redistributive effects of monetary policy”. In: *Available at SSRN 2938163* (2017).
- [5] Andrews, Dan, Sánchez, Aida Caldera, and Johansson, Åsa. “Housing markets and structural policies in OECD countries”. In: (2011).
- [6] Areosa, Waldyr and Areosa, Marta. “The inequality channel of monetary transmission”. In: *Banco Central do Brasil Working Paper* 114 (2006).
- [7] Bhattacharya, Joydeep, Haslag, Joseph, and Russell, Steven. “The role of money in two alternative models: When is the Friedman

- rule optimal, and why?” In: *Journal of Monetary Economics* 52.8 (2005), pp. 1401–1433.
- [8] Bourassa, Steven C and Hoesli, Martin. “Why do the Swiss rent?” In: *The Journal of Real Estate Finance and Economics* 40.3 (2010), pp. 286–309.
- [9] Bourguignon, Francois and Morrisson, Christian. “Inequality and development: the role of dualism”. In: *Journal of development economics* 57.2 (1998), pp. 233–257.
- [10] Brueckner, Jan K. *Lectures on urban economics*. MIT Press, 2011.
- [11] Bulir, Mr Ales and Gulde, Ms Anne Marie. *Inflation and Income Distribution: Further Evidence on Empirical Links*. International Monetary Fund, 1995.
- [12] Cloyne, James and Hürtgen, Patrick. “The macroeconomic effects of monetary policy: a new measure for the United Kingdom”. In: *American Economic Journal: Macroeconomics* 8.4 (2016), pp. 75–102.
- [13] Cysne, Rubens P, Maldonado, Wilfredo L, and Monteiro, Paulo Klinger. “Inflation and income inequality: A shopping-time approach”. In: *Journal of Development Economics* 78.2 (2005), pp. 516–528.

- [14] Di Maggio, Marco et al. “Interest rate pass-through: Mortgage rates, household consumption, and voluntary deleveraging”. In: *American Economic Review* 107.11 (2017), pp. 3550–88.
- [15] Doepke, Matthias and Schneider, Martin. “Inflation and the redistribution of nominal wealth”. In: *Journal of Political Economy* 114.6 (2006), pp. 1069–1097.
- [16] Easterly, William. “The lost decades: developing countries’ stagnation in spite of policy reform 1980–1998”. In: *Journal of Economic growth* 6.2 (2001), pp. 135–157.
- [17] Ehrlich, Maximilian von, Basten, Christoph, and Lassmann, Andrea. “Income Taxes, Sorting, and the Costs of Housing: Evidence from Municipal Boundaries in Switzerland”. In: *KOF Working Papers* 362 (2014).
- [18] Elhorst, J Paul. *Spatial econometrics: from cross-sectional data to spatial panels*. Vol. 479. Springer, 2014.
- [19] Erosa, Andrés and Ventura, Gustavo. “On inflation as a regressive consumption tax”. In: *Journal of Monetary Economics* 49.4 (2002), pp. 761–795.
- [20] Favara, Giovanni and Imbs, Jean. “Credit supply and the price of housing”. In: *American Economic Review* 105.3 (2015), pp. 958–92.

- [21] Füss, Roland and Zietz, Joachim. “The economic drivers of differences in house price inflation rates across MSAs”. In: *Journal of Housing Economics* 31 (2016), pp. 35–53.
- [22] Gertler, Mark and Karadi, Peter. “Monetary policy surprises, credit costs, and economic activity”. In: *American Economic Journal: Macroeconomics* 7.1 (2015), pp. 44–76.
- [23] Glaeser, Edward L, Gyourko, Joseph, and Saiz, Albert. “Housing supply and housing bubbles”. In: *Journal of urban Economics* 64.2 (2008), pp. 198–217.
- [24] Gürkaynak, Refet S, Sack, Brian P, and Swanson, Eric T. “Market-based measures of monetary policy expectations”. In: *Journal of Business & Economic Statistics* 25.2 (2007), pp. 201–212.
- [25] Heathcote, Jonathan, Perri, Fabrizio, and Violante, Giovanni L. “Unequal we stand: An empirical analysis of economic inequality in the United States, 1967–2006”. In: *Review of Economic dynamics* 13.1 (2010), pp. 15–51.
- [26] Hilber, Christian AL, Mayer, Christopher J, et al. “Land supply, house price capitalization, and local spending on schools”. In: *The Wharton School, University of Pennsylvania* <http://realestate.wharton.upenn.edu/newsletter/392.pdf> (downloaded 17/12/2010) (2001).

- [27] Iacoviello, Matteo and Neri, Stefano. “Housing market spillovers: evidence from an estimated DSGE model”. In: *American Economic Journal: Macroeconomics* 2.2 (2010), pp. 125–64.
- [28] Kumhof, Michael, Rancière, Romain, and Winant, Pablo. “Inequality, leverage, and crises”. In: *American Economic Review* 105.3 (2015), pp. 1217–45.
- [29] Kuttner, Kenneth N. “Monetary policy surprises and interest rates: Evidence from the Fed funds futures market”. In: *Journal of monetary economics* 47.3 (2001), pp. 523–544.
- [30] Kuznets, Simon. “Economic growth and income inequality”. In: *The American economic review* 45.1 (1955), pp. 1–28.
- [31] Al-Marhubi, Fahim. “A note on the link between income inequality and inflation”. In: *Economics Letters* 55.3 (1997), pp. 317–319.
- [32] Mian, Atif, Rao, Kamalesh, and Sufi, Amir. “Household balance sheets, consumption, and the economic slump”. In: *The Quarterly Journal of Economics* 128.4 (2013), pp. 1687–1726.
- [33] Palivos, Theodore. “Optimal monetary policy with heterogeneous agents: a case for inflation”. In: *Oxford Economic Papers* 57.1 (2005), pp. 34–50.
- [34] Rajan, Raghuram G. *Fault Lines-Verwerfungen: Warum sie noch immer die Weltwirtschaft bedrohen und was jetzt zu tun ist*. FinanzBuch Verlag, 2012.

- [35] Romer, Christina D and Romer, David H. *Monetary policy and the well-being of the poor*. Tech. rep. National bureau of economic research, 1998.
- [36] Saiki, Ayako and Frost, Jon. “Does unconventional monetary policy affect inequality? Evidence from Japan”. In: *Applied Economics* 46.36 (2014), pp. 4445–4454.
- [37] Saiz, Albert. “The geographic determinants of housing supply”. In: *The Quarterly Journal of Economics* 125.3 (2010), pp. 1253–1296.
- [38] Schularick, Moritz and Taylor, Alan M. “Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870–2008”. In: *American Economic Review* 102.2 (2012), pp. 1029–61.
- [39] Shi, Shouyong. “Money, capital, and redistributive effects of monetary policies”. In: *Journal of Economic Dynamics and Control* 23.4 (1999), pp. 565–590.
- [40] Steiner, Elizabeth. “Estimating a stock-flow model for the Swiss housing market”. In: *Swiss Journal of Economics and Statistics* 146.3 (2010), pp. 601–627.
- [41] Werczberger, Elia. “Home ownership and rent control in Switzerland”. In: *Housing Studies* 12.3 (1997), pp. 337–353.

Homeownership, Renting and Market Failures: Evidence from Indian Slums

Housing rents are a major part of a slum household's expenditure. I exploit a large scale 'big-push' national urban renewal policy reform in India between 2005 and 2012 to empirically evaluate the multi-dimensional effect of rental reforms and housing provisions on home ownership, rental expenditures and quality of dwelling for slum households. One of the main benefits accruing to the affordable housing policy was to provide the entitlement of the land to the female head of the households as a measure of women empowerment.¹ Combining a novel pooled cross-sectional household survey data for year 2002, 2008, 2012 and nighttime lights activity data at district level, I find the reform significantly increases the real rents by 18.2% and the probability to transition to homeownership by 16.7 percentage points. Females are 2.4 percentage points more likely to be the head of the household. The findings highlight the role of market failure.

¹Given the data sample I make use 'gender of the household head' as a proxy variable to measure the success of this particular benefit.

2.1 Introduction

After the financial reforms of 1991, India has been growing at a very fast pace. The growth is driven by cities. 31.16% of India is already urbanized with four metropolitan cities namely, Delhi, Mumbai, Chennai and Kolkata and further urbanizing at a faster pace, creating mega cities like Hyderabad and Bangalore (Census, 2011). 117,000 people migrated to Delhi in year 2016 (Economic Survey of Delhi, 2018/19). Rural to urban migration creates slums (Katz et al., 2001 [17]), which represents the shortage of affordable housing. Roughly 21.9% of Indian population lives under poverty line and has a vivid income gap between the rural and urban incomes (Planning Commission of India, 2013). The economic opportunity provided by the cities leads to the slums clusters around residential locations, major office centers, industrial areas or touristic locations (Barnhardt et al., 2015 [5]). Yet, in order to accommodate the huge inflow of people there are costs associated at the city level in the form of regional inequality that picks pace with the increased level of industrialization and urbanization (Cutler and Glaeser, 1997 [8]). The limited availability of urban land space restricts spatial planning, creates additional need for housing and puts pressure on land and stress on civic amenities like health, education, water, sanitation etc. Underdeveloped infrastructures, lack of effective policy like service provisioning and dilapidated housing for poor households, lack of tenure and market failures lead to social and economic disparities among the lives of slum

residents.

The research question contributes to the field of urban economics literature by investigating the impact on the welfare of the slum dwellers when the 'governance gap' void is filled by an acute governance reform at all levels of administrative functioning. I exploit a national policy intervention, the JNNURM-IHSDP program from year 2005-2012 to empirically estimate the multi-dimensional impact of the policy on housing rental expenditure, homeownership, women empowerment and the overall quality of dwelling for slum households living in districts exposed to the policy intervention.

Drawing on a novel pooled cross sectional slum household survey data from National Sample Survey Organization of India and district level nighttime lights from NOAA-DMSP, I use difference-in-difference methodology to investigate the above claim and aim to provide a credible estimation. However, the results should be interpreted with caution as causal interpretation of the estimates can not be entirely established. The reasons for such a limitation is attributed to the paucity of pre-policy data.

By exploiting the rent control reforms as one of the mandatory reform clause of the policy, the study addresses an important research gap by investigating the economic well-being of the slum dwellers in the absence of 'rent seeking, non-state agents or slumlords'. On average, the estimates indicates that the reform led to a significant increase in real rents by 35%. The results shed light on the importance of market fail-

ures even in case of a major 'big push' government administered policy interventions.

The estimates also suggests that the reform increases the probability of homeownership by 15% , females are by 2.7% more likely to be the head of the slum household. The estimates for the quality of dwelling suggests improvement in quality score by 1.9% to 10.8% for certain indicators. The overall index deteriorates over time.

The remainder of this paper is organized as follows. In Section 2.2, I summarize the related literature. In Section 2.3, I present in detail the institutional aspects of slums in India. In Section 2.4 , I present various data sources and the final data set constructed for the purpose of analysis. In Section 2.5, I present the JNNURM-IHSDP policy intervention framework. In Section 2.6, I present the identification strategy. Section 2.7 discusses the empirical findings of the impact of the program on real rents, homeownership, changing gender perception in the Indian household and quality of dwelling. Section 2.8 concludes the paper.

2.2 Literature Review

The 'Modernization Theory' states the importance of urbanization in lives of the poor. The theory argues that slums represent a transitory phase in the life cycle of a rural migrant. (Marx et. al., 2013 [19]). Eventually over years, the households move into the formal housing paving way for generations to reap the benefits of a city life. Slums acts as a

platform for a typical rural migrant to seize the economic opportunities of urban and economic growth by providing geographical proximity to the city.

However, the slum dwellers find themselves trapped in poverty for generations because of multiple factors. Such factors include market failures, lack of acute governance and coordination problems that not only worsens the conditions of living for slum dwellers but also acts as an impediment to boost investment inertia to develop in social and human capital. Azariadis and Drazen (1990) [2] argues that a lack of investment inertia in the slums, gives rise to a 'low skill-low equilibrium' situation for slum inhabitants. Low skilled slum labor force often do not meet the critical threshold to compete adequately in the labor market.

In a seminal paper by Murphy et. al.,(1989) [20], slum upgradation requires large private investments. The marginal returns from small upgradations are quite small. Moreover, there is a lack of general willingness on account of slum dwellers to pay for improved public goods in poor urban areas. Highly illiquid, informal property rights, lack of tenure and land titles provides disincentives for a typical slum household to improve the quality of dwellings. Such disincentives lead to decline in the quality of neighborhood around the slums.

Davis (2006) [9], using the example of Mumbai slums argues that an extreme coordination failures and a presence of 'governance gap' makes life in slums difficult. Governance mechanism are intrinsic to a slum dwellers life and often their absence is filled by private actors, bureau-

cratic entrepreneurs, gangs, and local agents which can lead to more entrenched tenancy rights. The non-government actors pursue a self interest of maintaining the status-quo of the slums. Slums often presents an opportunity for rent extraction. Proximity to the city life comes at a cost of unjustified high rent premiums extracted by slum landlords, non-state actors in absence of a formal public allocation mechanism.

I contribute to the research gap by investigating the multi-dimensional aspect of the lives of urban poor, in terms of tenure security, land titles, rents and the quality of dwelling when the 'governance gap' is filled by an acute public allocation mechanism at all tiers of political and administrative layers. For this purpose, I study the effect of the nation-wide urban poor housing policy (JNNURM- IHSDP) of Government of India from 2005-2012. This was the largest standalone single policy framework of the decade 2000 with a national coverage for all urban areas of the country. In addition, all existing national policies were subsumed under this policy.

Many empirical studies explore the relationship between tenure security and investment in land in rural setting, (Banerjee et. al., 2002 [3]). I further, contribute to the literature by analyzing the relationship at the urban level.

Durand-Lasserve et. al. (2007) [11] argues that a formal land titles reduces tenure security for two reasons. Firstly, formal land titles allow for lawfully enforced evictions and secondly, such projects often benefits the 'slumlords' at the cost of hurting at the bottom of the pyramid.

The informal ownership rights exerted by slumlords are well-recognized locally and can lead to outright evictions or increased rents in the titled areas. This finding lends support to the empirical findings of the research question, where I find that the slum households living in districts that benefited from the JNNURM-IHSDP policy saw an increase in their real rents by an average of 35%.

Barnhardt et al. (2017) [5] argue that the option of taking refuge in slums in the city is rather a choice. Demonstrating a case for public housing assignment in the city of Ahmedabad (India) the authors argues that relocation of slums is a welfare loss that rips them off their social capital, namely informal social insurance and ties. 34% of slum dwellers continued living in public housing and the remaining returned back to the slums after fourteen years of the housing assignment.

The JNNURM-IHSDP policy employed to investigate the research question addresses major hurdles to public policy intervention that negatively affects the welfare returns from the development process of the slum life. The policy overcomes the conflict of interest between central government and municipal authorities, high transaction costs, opaque governance mechanism, enumerative hurdles of a representative slum population, genuine political commitment, legal recognition of informal/illegal slum squatters for an inclusive urban planning, encouragement of public- private partnership, enabling efficient functioning of land markets. Such factors are by definition different from market failures.

Land titles provides collateral for poor urban household giving them

access to credit markets to finance small business investments and educate their children. This in turn encourages investments in home up keeping and upgradation. Such investments are viewed as safe by the households, (Hernando de Soto, 2000 [10]).

Using 2001 National Household Transportation Survey for US, Glaeser et al. (2008) [15] puts forward the linkages between the transportation networks and costs, as well as the centralization of poverty in urban areas or inner cities. The argument was also advocated by LeRoy and Sonstelie (1983) [18]. They argue that the income elasticity of demand for land is significantly lower for poor people than for the richer class. Hence, the authors validate the puzzle regarding the existence of urban poor in central cities. The importance of analyzing neighborhood characteristics owes to the fact that they can have significant effects on social economic outcomes as proposed by Durlauf (2003) [12] and Oreopoulos (2003) [22]. Feng et al. (2015) [14] and Cutler and Glaser (1997) [8] argue that spatial segregation of blacks and white in terms of housing choices and neighborhood negatively affects employment and educational outcomes of blacks. This point is of particular interest to the study as I aim to investigate the heterogeneous impact of the policy on slum households with varying socio-economic background.

However, the majority of studies evaluating neighborhood effects either private housing market or public housing schemes seems to find a positive impact on quality of life and an ambiguous impact on economic outcomes. In general, they focus on poor people living in community

or low tier houses. I explore a specific stratum of a lower social class, i.e., illegal and unorganized slums which are very common for many developing countries where a similar pattern can be seen.

For the purpose of the study, I use a novel comprehensive national sample household survey for years 2002, 2008 and 2012 conducted by national statistical office in India. The survey covers all types of households in India at village level but the information available to researchers is restricted to district level. The dataset is measured on various socio-economic variables of a household. The survey explicitly states the location area of the household. I consider households living in notified and non-notified slum areas. These households constitute as a typical slum household for this study. The surveys covers 5818 households in the year 2002, 7510 households in year 2008, and 5318 households in year 2012. The advantage of the data set is that the unit of survey is a household. Often such nation-wide repeated surveys are difficult to achieve. To the best of my knowledge, I have not come across any empirical studies that uses the same survey data. Most of the studies uses another slum survey data which does not cover household characteristics and the unit of survey is a slum cluster instead of a household.

2.3 Slums in India

Slums are a global but surprisingly, an urban phenomenon. Slums in urban areas particularly, in big cities like Delhi in India, are a source

of cheap labor supply for activities like chauffeur, vegetable vendors, domestic help etc.

According to the Slum (Improvement and Clearance) Act of 1956 ?a slum is a compact settlement with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate infrastructure, inadequate sanitary and drinking water facilities in unhygienic conditions in that compact area (commonly known as Jhuggi Jhopri (JJ)).? These slums are segmented into various categories. The categorization of slums and minimum number of households required to be labeled as slum varies according to different agencies in India.

According to one of the national survey organization a slum pocket is defined as a cluster of minimum 20 households and is categorized as a notified or a non- notified slum. *Notified slums* are all areas subsumed under the slum act of 1956 as 'slums' or areas recognized as slum by State, UT Administration or Local Government, Housing and Slum Boards, which may have not been formally notified as slum under any act. For e.g., majority of Old Delhi (famously known as walled city) falls under this category. On the other hand, *non-notified slums* are squatter settlements called as Jhuggi Jhopri Clusters (JJC) and are considered to be an illegal encroachment on land (DUSIB 2010). Usually, over the years the government legalizes these slums by either rehabilitating or by providing in-situ upgradation of these slums.

78% of slums are not located on private but built on public land owned by municipal bodies (54%), railways (14%), state government,

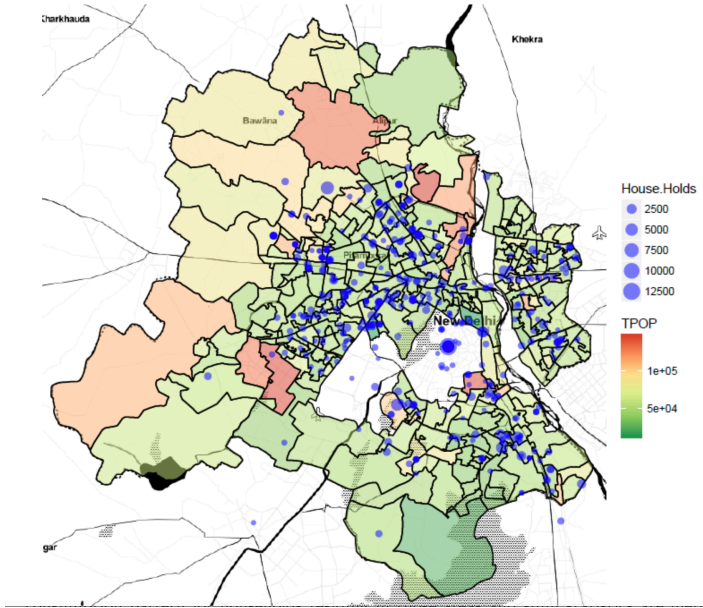


Figure 2.1: Jhuggi Jhopri Clusters (JJC)/
Non Notified Slum Clusters in Delhi

Source: Author's own calculation. The figure maps the distribution of illegal slum clusters at the municipal ward level in Delhi, India. The blue dots represents the number of households in a particular slum cluster. The heat color pattern of the municipal ward represents the total population of the respective ward.

or other public entities. Approximately 64% of slums are surrounded by residential areas (Government of the National Capital Territory of Delhi 2010, UNDP 2009 [26]). Census (2001) estimated that 16.3% of population in Delhi was located in urban slums, which is higher than the national average of 14.8%. Other cities like Mumbai, Kolkata, Hyderabad, Bangalore, and Chennai are also witnessing an increase in the slum population. 66% of all statutory towns in India have slums, 17.4% of total urban households live in slums according to Census of India (2011). Over a quarter of urban population is poor with consumption below poverty line (Tendulkar 2009 [25]).

2.4 Data

In order to analyze the impact of the JNNURM-IHSDP policy, I construct a comprehensive repeated cross section dataset for year 2002, 2008, 2012 at the district level combining multiple datasets as described below.

2.4.1 Slum Household Data

National Sample Survey Office (NSSO) is an organization of the Ministry of Statistics and Program Implementation of the Government of India (MoSPI). NSSO conducts nationwide detailed household surveys on various socio-economic indicators in successive rounds for an assessment of housing stock and formulation of housing policies and programs. The collection of the data on housing condition of the dwelling units and ba-

sic housing amenities is available since 7th round (October 1953 - March 1954) to the 69th round (July 2012-December 2012).

The survey covers indicators of (i) household characteristics for e.g., household size, occupation, religion, social group, household type, endowments, tenurial type, dwelling location in which the dwelling unit is located, distance to work, monthly per capita consumer expenditure, etc. (ii) particulars of living facilities, such as major source of drinking water, availability of bathroom, use of latrine, type of latrine, electricity for domestic use, etc. (iv) particulars if dwelling such as number of rooms, floor area of the dwelling, ventilation of the dwelling, total numbers of married couples in the household, kitchen type, floor type, wall type, roof type, etc. (v) particulars of construction and repair undertaken by the households during the last 365 days for residential purpose.

For the purpose of the study, I extract the information on households living in notified and non notified slum areas. The district-wise location of a household is known from year 2002 onwards. The variables of interest considered are house rents, type of slum, gender of the household head, tenurial status of the household, social group, distance to work, type of dwelling, and various well being indicators of a dwelling.

2.4.2 Policy Coverage Data

In January 2019, the Ministry of Housing and Urban Affairs (MoHUA) in India published a detailed monitoring report of successful housing

projects at the town and city level for all districts in every Indian state.

To identify a successful housing policy I consider every mentioned town or city where at least 50% or more of the completed dwelling units were taken into occupation by the beneficiary households. However, the report states both the number of sanctioned housing units and completed units along with the initial date of the sanctioned project. It may not be necessary that all the sanctioned units have been completed until the end of the policy period 2012. Therefore, in order to get a true effect of the policy, I consider the occupation rate of the completed units.

If a town/city/urban area with at least 50% of dwelling take up rate falls within a certain district boundary, that district is classified as a treatment group, D . Districts that were not covered under the IHSDP policy are taken as control group.

2.4.3 Nighttime Light Activity Data

The official estimates for GDP are only available at state level which makes it harder to account for economic activity at district level. Therefore, in order to get economic activity at granular level of districts, I use a set of Nighttime Lights (NTL) as a proxy for district GDP. The US Air Forces (USAF) Defence Meteorological Satellite Program (DMSP) operates a series of satellites, which carry sensors that detect light emission from the earth's surface at night. A value of light intensity from 0 (darkest) to 63 (brightest) is for every pixel around the globe. Night

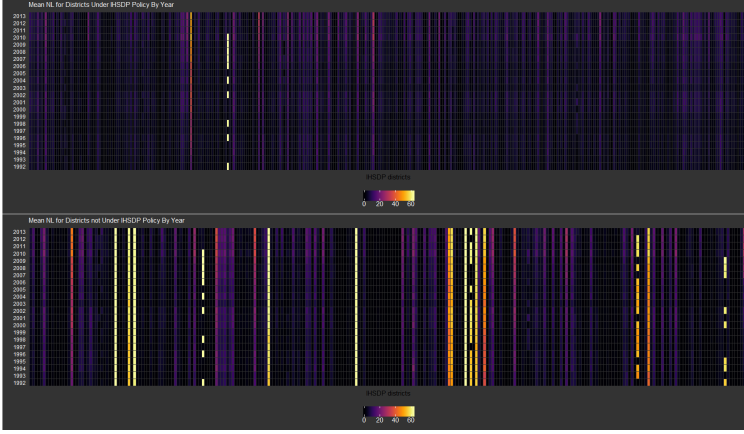


Figure 2.2: Nighttime Light Distribution of Districts in India

Source: Author's own calculation. The matrix plot depicts the distribution of nighttime light intensity in all districts of India by JNNURM policy status from year 1993-2013.

lights is a reliable measure of not only economic activity but also for various socio-economic indicators e.g., poverty, income, spatial development, etc. around the world. (Elvidge et. al., 2012 [13]; Chakravarty and Dehejia 2017 [7]; Henderson et. al., 2012 [16]). I create a nighttime Light Intensity dataset for 631 districts for years 1992 to 2013 by spatially overlaying the luminosity data with the shape files of districts of India to obtain an average value of the illuminated pixels in the districts. Chakravarty and Dehejia (2017) [7], argue that there exists a high, 75-80 % correlation between state light indices and state GDP across the years 1992 to 2013.

The matrix plot in Figure 2.2 shows the distribution of average nighttime light intensity over the period 1992-2013 separately for treated and

control group. Each grid on the horizontal axis represents a district under the treated or control group. The vertical grid measures the night-time light intensity of the districts in horizontal axis over different years. The average growth rate of all districts that were assigned the IHSDP policy grew at 8% over the time period 1992-2012, double than that of the districts in the control group.

I further merge all three datasets by states and districts to construct a final dataset for the empirical investigation. The final dataset contains 5818 distinct households for year 2002, 7510 distinct households for year 2008 and 5318 households for year 2012. There are 241 districts in the treated group and 123 districts in the control group.

2.5 The JNNURM Program

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in 2005 as the single largest governance reform-driven initiative of the Government of India (GOI) for a planned development of Indian cities and towns. The mission was implemented in conjunction with Ministry of housing and Urban Poverty Alleviation (MoHUPA) along with the respective state governments, Urban Local Bodies (ULB), city-level institutions and private partnerships.

The mission initially covered seven-year period i.e. up to March 2012 which was extended up to March 2014 for completion of the already approved projects. During March 2013, the Mission period was extended

by one more year i.e. up to March 2015 to complete.

To create economically productive, efficient, equitable and responsive cities, the Urban Renewal Mission focused on (i) improving and augmenting the economic and social infrastructure of cities; (ii) ensuring basic services to the urban poor including security of tenure at affordable prices; (iii) initiating wide-ranging urban sector reforms whose primary aim is to eliminate legal, institutional and financial constraints that have impeded investment in urban infrastructure and services; and (iv) strengthening municipal governments and their functioning in accordance with the provisions of the Constitution (seventy-fourth) Amendment Act, 1992. It provides for public disclosure of local spending decisions together with earmarking of budgetary allocations for basic services to the poor.

The mission comprised of two components e.g. Basic Services for Urban poor (BSUP) and Integrated Housing and Slum Development Program (IHSDP) which aimed at integrated development of slums through projects for providing shelter, basic services and other related civic amenities with a view to providing utilities to the urban poor with governance reform as an overarching third component. Under both the components, the participatory state governments and the ULB were mandated to implement a set of (i) mandatory (ii) optional reforms in order to access financial help from the central ministry².

The first component i.e. BSUP was implemented in 65 Mission Cities/Urban Agglomerations with more than four million population

²For details of the reforms, refer to the appendix concerning this chapter.

(Census 2001). These cities are at the forefront of economic importance (E.g, Mumbai, Delhi), cultural, religious and touristic importance (Eg, Varanasi, Amritsar). The second component i.e. IHSDP covered the remaining 887 cities/urban areas/small towns, relatively less developed than the identified 65 BSUP mission cities. The two components of JN-NURM were mandated to pursue 3 key pro-poor reforms, namely (a) earmarking of 25% of municipal budget for the urban poor for provision of basic services including affordable housing to the urban poor; (b) implementation of 7- Point Charter, namely provision of land tenure, affordable housing, water, sanitation, education, health and social security to the poor in a time-bound manner ensuring convergence with other programs and (c) reservation of 25% of developed land in all housing projects, public or private, critical for slum improvement. In order to implement the JNNURM-IHSDP program from year 2005-2012 , repeal of the Urban Land (Ceiling and Regulation) Act (ULCRA) 1976 was done in different stages for different states. The interplay of JN-NURM with this act is difficult to take into account directly due to the difficulty of accessing detailed data on ULCRA 1976. However, intuitively the JNNURM-IHSDP program data indirectly takes this into account since the monitoring report in detail mentions about the housing projects sanctioned, started and completed.

2.5.1 The JNNURM - IHSDP Scheme

Under the IHSDP Program, the already existing pro- poor schemes like VAMBAY and NSDP were subsumed in order to implement a single comprehensive program nationwide. The IHSDP was designed to explicitly target urban slum dwellers from all sections of the society with the objective to provide a holistic slum development. These urban slum dwellers comprise of urban poor i.e., Economically Weaker Section (EWS) and Low-Income Groups (LIG).

The JNNURM - IHSDP Scheme: Governance Setup

Slum dwellers in the urban agglomerations living in dilapidated conditions were eligible to provision of (i) affordable new houses, land tenure (ii) In-Situ slum upgradation and rehabilitation (iii) basic infrastructure facilities like water, sanitation, storm water drains, community bath, toilets, sewers, street lights (iv) community infrastructure like provision of community centers (for pre-school education, non-formal education, adult education, recreational activities), community primary health care center (v) social amenities like pre-school education, non-formal education, adult education, maternity, child health, health care including immunization and social security.

The scheme applied to towns and urban areas with elected local bodies and was implemented through a State level nodal agency, as appointed by the State Government. In addition, the State governments

were authorized to prioritize towns and cities on the basis of their existing infrastructure, economically and socially disadvantaged sections of the slum population and difficult areas. However, the selection of the beneficiaries was made by the State level nodal agency or ULB's.

Detailed Project Reports (DPRs) were to be prepared by the implementing agencies for funding in order to access Central assistance (grant). Release of Central share to nodal agency was dependent on availability of State share and submission of utilization certificates in accordance with the provisions of General Financial Rules (GFRs).

The sharing of funds was distributed as 80:20 between Central Government and State Government/ULB/Parasatal agencies. The funds from the central ministry were allocated to the States on the basis of the States urban slum population to total urban slum population in the country.

States/Implementing Agencies were also allowed to raise their contribution from their own resources or from beneficiary contribution/ financial institutions. For special category States³ the ratio of funding pattern between Center and the States was 90:10.

The State Governments, ULBs and parasatal agencies were required to execute a Memorandum of Agreement (MoA) with the Government of India committing to implement an agenda of reform program⁴ both at the state level and ULB level. MoA laid down specific milestones to

³special category States are North Eastern States and hilly States, namely Himachal Pradesh, Uttaranchal and Jammu and Kashmir

⁴ refer to the appendix concerning this chapter

be achieved for each item of reform. Signing of this tripartite MoA was a necessary condition to access Central assistance.

The JNNURM - IHSDP Scheme: BENEFITS

The benefits accruing to the subsidized affordable housing included:

- The title of the land should be in the name of the female head of the household⁵
- Contribution by the beneficiary was stipulated to be 12% of the cost of housing in case of poor slum dwellers. In case, if a beneficiary belonged to the lower strata of social groups (caste system) namely, SC/ST/BC/OBC/PH, the contribution was reduced to 10%.
- A minimum dwelling area of 25 s.q. meters was allocated to the beneficiary. The constructed dwelling should include two room accommodation with kitchen and a toilet.
- Ceiling cost for a dwelling unit was 80,000 INR (approximately 1000 USD) per unit for cities. An additional, 12.5% was permissible for special category/hilly States and difficult/far flung areas.
- Amendment of Rent Control Laws balancing the interest of landlords and tenants.

⁵In exceptional cases, title in the name of male beneficiary was permitted

The JNNURM - IHSDP Scheme: Rent Control Laws

Housing is a state subject in India. The enactment and enforcement of these laws vary from state to state. There have been three generations of rent control legislations, the first one being introduced in Bombay in 1918. The third generation law is the 'Model Rent Control Legislation' 1992 (MRCL) which are as follows:

- Prohibition of rent increases by the landlords beyond a standard limit ensured in the law.
- Tenure security and prohibition of unlawful evictions except in case of certain violations like non-permissible subletting, for bona fide by the landlord, wear and tear of the building and non payment of rents.

Amendment of rent control laws under JNNURM sought to revise certain provisions of rent laws that are as follows:

- Provision for the revision of rents over time since the rents were determined below the market or economic rents. The monetary value for such revisions varied from state to state.
- Due and timely payment of all property taxes by the landlords and timely payment of rents by the renter. The tenants are not obliged by law for day to day maintenance of the property.

Though only very few states adopted such amendments under the JNNURM program.

2.6 Identification Strategy

I investigate the multi-dimensional implications of the exposure to IHSDP program for the the slum households living in the exposed district. I study the direct and the indirect effect of the policy precisely, the housing rental expenditure, homeownership, women empowerment and the overall quality of dwelling. First, in purview of implementation of the rent control reforms as one of the mission mandates : *what is the impact of the reform on the average housing rents paid by the slum households exposed to the IHSDP program?* Second, *Did the policy (i) increase the probability of home-ownership for slum households, specifically for females, (ii) improved the overall quality of the occupied dwelling, along the provisions mentioned in the JNNUR-Mission*

A slum household in a district is exposed to the policy based on the detailed monitoring report of successful housing projects at the town and city level for all districts in each State (Ministry of Housing and Urban Affairs, Monitoring report, January 2019). To identify, a successful housing policy I consider every mentioned town or city where at least 50% or more of the completed dwelling units were taken into occupation by the beneficiary households. If a town/city/urban area with at least 50% of dwelling take up rate falls within a certain district boundary, the slum household in that district is classified as a treatment group, *D*. Slum households in districts that were not covered under the IHSDP policy are taken as control group. Thus, a successful take up rate in the

urban area and the region (district) of residence jointly determines an individual's slum households exposure to the program. There are 7284 distinct households distributed over 123 districts in the control group and 11086 distinct households in 241 districts in the treated group.

For identification, I exploit the difference-in-difference methodology to identify the parameter of interest, δ that potentially allows for a causal interpretation. The empirical approach estimates the average treatment effect on treated.

I define the Time (T_i) as the pre/post policy period as follows⁶:

$$T_i = \begin{cases} 1 & \text{if } t_i = 2008, 2012 \\ 0 & \text{if } t_i = 2002 \end{cases} \quad (2.1)$$

Similarly, the unit of Treatment (D_{ij}) for individual slum household i in the district j and policy area/urban area k :

$$D_{ijk} = \begin{cases} 1 & \text{if } d_{ijk} = \text{IHSDP district} \\ 0 & \text{if } d_{ijk} = \text{No IHSDP district} \end{cases} \quad (2.2)$$

⁶The implementation of the policy could be stagnant since land is a state subject. However, to tackle this issue firstly, the data describes in detail the projects sanctioned, started and completed for all towns and states. Secondly, the estimated results are provided with State fixed effects.

I test the following regression equation:

$$y_{ijk} = \alpha + \beta T_i + \gamma D_{ijk} + \delta(T_i * D_{ijk}) + \chi z'_i + \eta r_j + a_{jk} + \mu_{ijk} \quad (2.3)$$

In equation 2.3, y_{ijk} , is the outcome variable for the individual slum household i residing in district j and if exposed to the IHSDP policy area k . The outcome variables include logarithm of real rents, gender of the household, the tenurial status and the deprivation score of quality of dwelling, respectively. Equation 2.3 is estimated separately for each of the outcome variables mentioned. The coefficient of interest is δ . α and μ_{ijk} denotes the constant and the idiosyncratic error term, respectively.

The δ captures the average difference between the difference in outcome among the slum households residing in districts when exposed to the policy and the difference in outcome among the slum households residing in districts which were never exposed to the concerned policy, in both pre and post policy period.

The regression equation 2.3 helps to remove biases associated with a common time trend unrelated to the exposure to the policy. It also removes biases in post-intervention period comparisons between the treatment and control group that could be the result from permanent differences between those groups. The estimates can be effected by individual household level characteristics like the type of slum area, social identity of the household etc. The z'_i is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{jk} , is the region

specific effect.

The underlying economic trends, political and institutional intensity of the program might vary across treated districts and control districts. Therefore, it can pose a potential threat to the identification of effect, violating the parallel trends assumption. However, a particular state can comprise of both the treated and control districts which implies that the underlying social outlook of a particular state affects the district in a similar way.

A graphical visualization of the parallel trends assumption for logarithm of mean real rents over time for the treated group and the control group is demonstrated in Figure 2.3. Similarly, Figure 2.4 shows the distribution of nominal housing rents (in INR) of the slum households in the treatment and control groups, respectively.

Empirical test of the assumption for each state (controlling for state level characteristics e.g., population, education enrollment socioeconomic characteristics) is left for a further investigation at a later stage.

Another potential threat to the underlying identifying assumption is the slum households may be influenced by the treatment status of the neighboring districts and may migrate to the districts exposed to treatment. An increased migration induces measurement error and bias the estimates of the program effects obtained by comparing the outcomes according a household's district of residence (Rosenzweig and Wolpin, 1988 [23]). In order to address this issue, I make use of the survey question on migration where households were asked if they moved to the

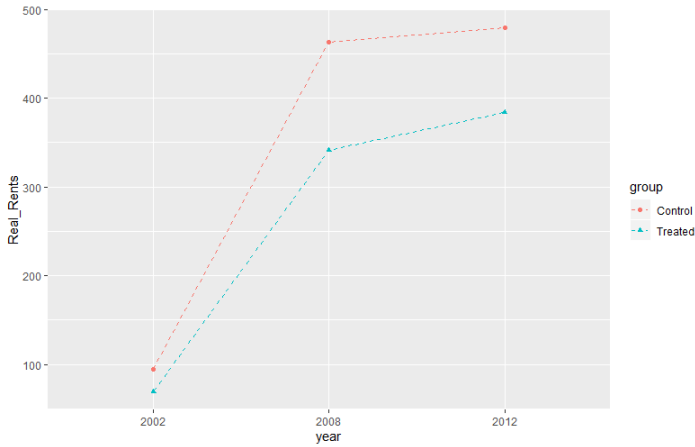


Figure 2.3: Mean Real Rents (INR): By Treatment Status

Source: Author's own calculation. The figure depicts the distribution of real rental expenditure for slum households in treated and controlled districts.

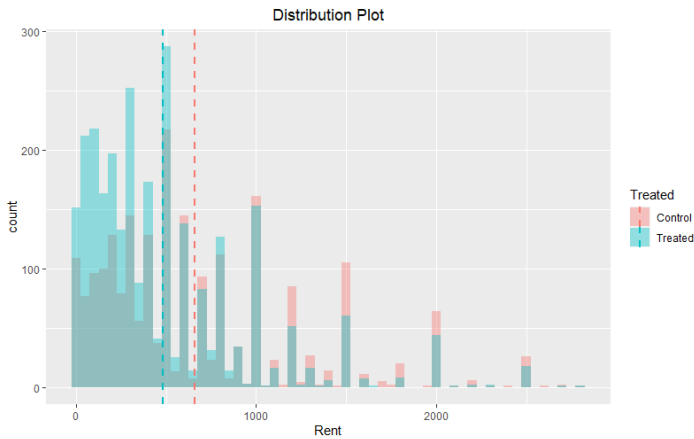


Figure 2.4: Slum Housing Rents (in INR) Distribution Plot

Source: Author's own calculation. The figure depicts the histogram of rental expenditure for slum households in the treated and controlled groups.

present area in the last one year. Approximately, 98% of the population responded as 'being not migrated'. This is also evident from Table 2.1, the treated slum households stay an average of 6 more years in the district of residence.

As argued by Chakravarty and Dehejia (2017) [7], the nighttime light intensity dataset is a good measure of economic activity. The level of economic activity influences not only the house price dynamics but also influences the average consumption basket a typical household consumes. House rent dynamics can be explained by economic activity. Estimates in Table 2.4, suggests that the effect of economic activity is statistically significant but economically negligible on real rents.

2.7 Empirical Results

2.7.1 Descriptive Results

In Table 2.1, I present the summary statistics of the important variables that helps in building the identification. The number of male and females in a typical slum household is balanced. However, according to the Census of India 2011, the gender ratio is skewed towards male, accounting for 947 females per 1000 males. On average, the slum households in the districts exposed to the IHSDP policy incur a monthly rental expenditure of approximately 80 INR (1 USD) more than the slum households in the non exposed district. The average basket of consumption for the ex-

posed households is higher in proportion to the average basket of goods consumed by households in the control group. The rationale behind such a pattern was inspected by the consumption puzzle in economics arguing a declining trend in consumption in urban India. Banerjee and Duflo (2011) [4], on the contrary attributed the decline in the trend as change in priorities of consumption good.

The average consumption expenditure estimate can be suggestive of the above mentioned evidence. The slums in treated and control group are located in urban areas. Slum households located in areas with much better economic perspectives are consuming on average less than the one located in areas with less economic development. The consumption disparity among the urban slum households can only be verified with further data item-wise analysis of the consumption expenditure, which is out of the scope of this study.

The average area of a typical dwelling unit constructed in districts exposed to the policy is higher than the districts not exposed to the policy. The average dwelling size in the exposed districts is 268 sq.feet as compared to an average of 236 sq.feet, approximately. Availability of land and other supply side measures influences house price dynamics (Saiz, 2010 [24]). Areas with constrained land have higher house prices compared to non constrained areas. However, on the contrary the results in table 2.1, indicates that the districts with less economic activity have higher housing rents compared to the other urban areas of interest.

Table 2.1: Descriptive Statistics I

	group	vars	n	mean	sd	median	trimmed	min	max
household composition									
male	Control	8	11321	2.4	1.4	2.0	2.3	0.0	13.0
male	Treated	8	6856	2.5	1.4	2.0	2.3	0.0	16.0
female	Control	9	10716	2.3	1.4	2.0	2.2	0.0	17.0
female	Treated	9	6832	2.4	1.4	2.0	2.2	0.0	14.0
household expenditure (INR)									
Rent	Control	12	3509	601.7	689.2	400.0	476.2	0.0	10000.0
Rent	Treated	12	1565	638.9	620.1	500.0	536.5	0.0	6000.0
real rent(cpi)	Control	13	3509	290.0	390.2	137.9	210.9	0.0	4646.8
real rent(cpi)	Treated	13	1565	360.2	333.5	275.9	312.4	0.0	4137.9
nominal avg cons(monthly)	Control	15	11529	4178.1	3248.7	3200.0	3652.7	150.0	40000.0
nominal avg cons(monthly)	Treated	15	7031	4724.2	4522.7	3800.0	4131.2	106.0	200000.0
real avg cons(monthly)	Control	16	11529	1866.6	1876.3	1069.0	1543.9	31.1	17241.4
real avg cons(monthly)	Treated	16	7031	2649.3	2190.3	2206.9	2382.6	73.1	92936.8
dwelling characteristics									
no of living rooms	Control	17	11244	1.5	1.5	1.0	1.3	0.0	80.0
no of living rooms	Treated	17	6945	1.6	1.3	1.0	1.4	0.0	80.0
no of other rooms	Control	18	6576	1.4	1.5	1.0	1.3	0.0	90.0
no of other rooms	Treated	18	4818	1.6	1.0	1.0	1.6	0.0	9.0
construction									
floorarea (sqft)	Control	23	383	236.5	210.5	180.0	196.5	0.0	1500.0
floorarea (sqft)	Treated	23	71	268.1	213.3	220.0	235.7	0.0	900.0
source of finance of construction									
own	Control	30	4005	3853.8	27865.7	0.0	100.7	0.0	1100000.0
own	Treated	30	3965	1485.2	16037.3	0.0	0.0	0.0	450000.0
govt	Control	31	5835	554.7	8150.2	0.0	0.0	0.0	336000.0
govt	Treated	31	11	42454.5	28894.2	30000.0	39222.2	14000.0	100000.0
financial institutions	Control	32	9363	150.4	4287.9	0.0	0.0	0.0	250000.0
financial institutions	Treated	32	3965	480.5	11132.1	0.0	0.0	0.0	400000.0
moneylenders	Control	34	176	20556.9	31936.0	8000.0	12851.5	150.0	200000.0
moneylenders	Treated	34	45	28072.0	39129.3	11000.0	20541.6	500.0	200000.0
friends and relatives	Control	35	153	21031.6	35470.4	10000.0	14657.7	30.0	350000.0
friends and relatives	Treated	35	55	22541.8	33938.0	5000.0	16062.2	350.0	115000.0
others	Control	36	3581	148.1	2236.1	0.0	0.0	0.0	75000.0
others	Treated	36	3965	86.9	2226.2	0.0	0.0	0.0	100000.0
Δhousehold composition (last365days)									
members moved in	Control	40	5865	0.1	0.5	0.0	0.0	0.0	8.0
members moved in	Treated	40	3055	0.0	0.3	0.0	0.0	0.0	5.0
members moved out	Control	41	5969	0.0	0.3	0.0	0.0	0.0	9.0
members moved out	Treated	41	3055	0.0	0.3	0.0	0.0	0.0	5.0
stayduration_presentarea	Control	42	7869	20.5	16.6	16.0	18.5	0.0	99.0
stayduration_presentarea	Treated	42	3064	26.1	18.5	25.0	24.6	0.0	88.0
mean nighttime lights									
nl-t	Control	43	32938	19.2	21.0	7.9	16.1	0.0	63.0
nl-t	Treated	43	22172	7.0	4.7	6.2	6.4	0.3	49.0
nl-t-1	Control	44	32938	19.0	21.0	7.9	16.0	0.0	63.0
nl-t-1	Treated	44	22172	6.8	4.4	6.0	6.2	0.2	49.1
nl-t-2	Control	45	32938	18.7	20.7	7.5	15.6	0.0	63.0
nl-t-2	Treated	45	22172	6.6	4.8	5.2	6.0	0.2	53.8
nl-t-3	Control	46	32938	16.7	20.2	5.9	13.3	0.0	63.0
nl-t-3	Treated	46	22172	5.2	3.7	4.4	4.6	0.2	46.9

This gives further validity for the empirical investigation of the impact of policy on slum house rents. Table 2.4, provides statistical support in favor of the argument. The estimated effect of the economic activity in the current and the previous period is positive and statistically significant for some periods but the economic impact is negligible.

Changes in household demographic can also explain housing dynamics (Angelini et. al., 2014 [1]; Bourassa et. al., 2015 [6]). The survey defines the household as a group of people living together under the same roof and sharing a common kitchen. Therefore, these group of people constitute as the members of the household. The descriptive statistics indicates the change in the composition of the household over a period of one year both in the treated and controlled districts. The results are suggestive of the findings from many empirical and theoretical studies advocating slums as a social trap (Marx et. al., 2013 [19]). Slums act as avenues of escape from rural poverty but suffers from low equilibrium social and human capital.

In Table 2.2, I present the summary statistics of the important variables that helps in constructing the 'Quality of Dwelling Deprivation Score' (QODDS). The quality of dwelling and basic services was an important rationale behind the JNNURM-IHSDP policy. I follow the methodology proposed by Nolan et. al. (2018) [21] and assign weights ranging from 0-2, in a decreasing order to the 15 most important in-

dicators of a quality of a dwelling, namely, drinking water, bathroom, toilet, electricity, drainage, garbage disposal method, approach road to the dwelling, kitchen, roof, wall, floor, condition of the dwelling and quality of the dwelling.

Table 2.2: Descriptive Statistics II

	group	n	mean	sd	median	trimmed	min	max
Overall Score								
QODDS1	Control	7284	8.10	3.80	8.00	7.90	0.00	22.00
QODDS2	Treated	11086	8.70	4.00	8.50	8.60	0.00	20.50
Individual Score								
Source of drinking water	Control	7283	0.30	0.60	0.00	0.20	0.00	2.00
Source of drinking water	Treated	11085	0.30	0.60	0.00	0.20	0.00	2.00
Bathroom	Control	7284	1.20	0.80	1.00	1.30	0.00	2.00
Bathroom	Treated	11085	1.40	0.80	2.00	1.40	0.00	2.00
Toilette	Control	5623	0.10	0.40	0.00	0.00	0.00	1.50
Toilette	Treated	7209	0.20	0.40	0.00	0.10	0.00	1.50
Electric wire	Control	6783	0.50	0.40	0.50	0.50	0.00	1.00
Electric wire	Treated	9880	0.60	0.40	0.50	0.60	0.00	1.00
Structure cond.	Control	7281	0.90	0.70	1.00	0.90	0.00	2.00
Structure cond.	Treated	11085	1.00	0.70	1.00	0.90	0.00	2.00
Structue type	Control	352	0.60	0.80	0.00	0.40	0.00	2.00
Structue type	Treated	573	0.50	0.80	0.00	0.40	0.00	2.00
Drainage	Control	7283	0.50	0.40	0.50	0.50	0.00	1.00
Drainage	Treated	11086	0.60	0.40	0.50	0.60	0.00	1.00
Garbage disposal	Control	7282	0.50	0.50	0.00	0.40	0.00	1.00
Garbage disposal	Treated	11086	0.50	0.50	0.00	0.50	0.00	1.00
Flooded last5yrs	Control	7282	0.20	0.40	0.00	0.10	0.00	1.00
Flooded last5yrs	Treated	11085	0.10	0.30	0.00	0.10	0.00	1.00
Approach road	Control	7282	0.70	0.70	0.50	0.60	0.00	2.00
Approach road	Treated	11084	0.70	0.70	1.00	0.70	0.00	2.00
Ventillation	Control	7281	1.20	0.70	1.00	1.30	0.00	2.00
Ventillation	Treated	11084	1.20	0.70	1.00	1.30	0.00	2.00
Kitchen	Control	7282	0.80	0.30	1.00	0.80	0.00	1.00
Kitchen	Treated	11082	0.80	0.30	1.00	0.80	0.00	1.00
Floor	Control	7284	0.40	0.70	0.00	0.20	0.00	2.00
Floor	Treated	11083	0.50	0.80	0.00	0.40	0.00	2.00
Wall	Control	7284	0.30	0.60	0.00	0.10	0.00	2.00
Wall	Treated	11085	0.40	0.60	0.00	0.30	0.00	2.00
Roof	Control	7284	0.50	0.50	0.50	0.40	0.00	2.00
Roof	Treated	11084	0.60	0.50	0.50	0.50	0.00	2.00

For individual, indicators, I assign the highest weight if a household has a best quality indicator or the lowest, otherwise. Aggregating over different indicators for an individual household, I then construct an overall household level QODDS which ranges from 0 to 24.5.

The results from the Table 2.2, show that the slum household living in districts exposed to the policy area are on average overall worse off than the households in the control areas, by an approximately, 0.60 points. However, the treated households perform well on type of dwelling structure constructed by 0.10 points compared to the control group. Therefore, it provides a further evidence of the prevalence of the IHSDP policy implementation.

2.7.2 Effect on Real Rents

I estimate equation 2.4 with a linear model for two cohorts of slums households, those who live in districts exposed areas receiving the policy treatment and for those who do not.

$$y_{ijk} = \alpha + \beta T_i + \gamma D_{ijk} + \delta(T_i * D_{ijk}) + \chi z'_i + \eta r_j + a_{jk} + \mu_{ijk} \quad (2.4)$$

where, y_{ijk} , is the outcome variable for the individual slum household i residing in district j and if exposed to the IHSDP policy area k . T_i 'policy period dummy' indicating the a value of 0 for households in 2002 and 1 for households in 2008 and 2012. D_{ijk} is the 'treatment dummy', which denotes a slum households exposure to the policy. As mentioned in the

section above, household's exposure to the policy is the function of their residence of district and the urban area of the district that received the policy. α and μ_{ijk} denotes the constant and the idiosyncratic error term, respectively. The z'_i is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{jk} , is the region specific effect. δ is the parameter of the interest that captures the intended effect. In Table 2.3 ⁷, I present the estimates of equation 2.4. Columns (1)-(4) are based on an unbalanced panel.

Table 2.3: Policy Effect on Real Rents

	<i>Dependent variable: Real Rents (INR)</i>				
	<i>Linear Panel</i>			<i>OLS</i>	
	(1)	(2)	(3)	(4)	(5)
Treated	-0.518*** (0.043)	-0.224*** (0.040)	-0.688*** (0.042)	-0.506*** (0.082)	-0.173** (0.058)
Time				1.298*** (0.079)	1.278*** (0.068)
Policy				0.355*** (0.094)	0.182** (0.073)
Constant			5.355*** (0.031)	4.247*** (0.073)	4.295*** (0.071)
State Fixed Effects	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>No</i>	<i>Yes</i>
Year Fixed Effects	<i>No</i>	<i>Yes</i>	<i>No</i>	<i>No</i>	<i>Yes</i>
Observations	5,039	5,039	5,039	5,039	5,039
R ²	0.028	0.006	0.050	0.250	0.385
Adjusted R ²	0.022	0.006	0.050	0.250	0.380
Residual S.E.			1.490	1.324	
F Statistic	145.042*** (df = 1; 5004)	31.931*** (df = 1; 5035)	265.419*** (df = 1; 5037)	560.060*** (df = 3; 5035)	84.446*** (df = 37; 5001)

*Note: *p<0.1; **p<0.05; ***p<0.01
(standard errors are clustered at the state level.)*

⁷I additionally mention year fixed effects in table 2.3. The results do not change in magnitude and direction after adding year fixed effects.

The result in Table 2.3 suggest that a difference in difference framework, significantly explains the effect of the policy on the real rents for households that were exposed to the treated district during the period of policy coverage i.e., the average treatment effect on the treated. The policy coefficient is statistically significant at 5% significance level and is sizeable in economic terms. The policy has a positive effect on real rents. The real house rents for slums households exposed to the policy increases by an average of 18.2%.

The individual and regional control variables, do not affect the policy coefficient. Table 2.4 to table 2.6 indicates that most of the individual level covariates has a significant impact on the policy coefficient. Slums household with a legal identity pay 22% more real rents than slums households with illegal identity. However, there seems to be a social disparity among the slum households belonging to different social groups. The group 'other backward classes' is the lowest in the hierarchy of the caste system and the estimate for this group is captured by the constant term. Real rents are negatively related with the social identity of the a typical household. The effect is the largest for social group which is relatively better than the lowest group along the social dimensions. This is corroborative of the fact that the households at the lowest strata of the society are at a disadvantaged position.

However, Table 2.4⁸ demonstrates that the level of economic activity

⁸I additionally mention year fixed effects in table 2.4. The results do not change in magnitude and direction after adding year fixed effects.

has an economically negligible effect on the real house rents paid by the slum dwellers. The results holds the same for economic activity of previous few years. This further strengthens the claim that increase in real rents are driven by the policy effect. The fluctuations in the direction of the effect also reflects the fact that for certain years the clarity in the measurements of the nighttime lights from the satellite are obstructed by certain external elements.

Table 2.5⁹ shows the effect of the locational choices on the real rents. Slum households living the 10-15 kms away from their place of work pay 16% significantly more compared to the one's who do not need to travel. The results stands contrary to the housing dynamics. Academic literature on housing argues that the housing rents are the highest near the employment hubs.

A possible reason for the results in Table 2.5, could be that the slums often squatter near the places of work, commercial districts and industrial areas. A presence of slum clusters deteriorates the land quality of such places thereby, decreasing the prices. Most of the slum clusters are found either on the public land or a government owned land (National Statistical Survey Office of India, 2008). This corroborates the empirical findings of Banhardt et. al. (2017) [5] who argue that slum households relocated to farther areas return back to the slums near their place of work after a period of 15 year.

⁹I additionally mention year fixed effects in table 2.5. The results do not change in magnitude and direction after adding year fixed effects.

Table 2.4: Policy Effect on Real Rents: Controls

	<i>Dependent variable: Log Real Rents</i>		
	(1)	(2)	(3)
Treated	-0.173*** (0.058)	-0.592*** (0.061)	-0.166*** (0.062)
Time	1.278*** (0.068)	1.202*** (0.109)	1.291*** (0.071)
Policy	0.182** (0.073)	0.327*** (0.080)	0.196** (0.078)
Δ Mean Nightlights _t		-0.015*** (0.002)	
Δ Mean Nightlights _{t-1}		0.0004 (0.0003)	
Δ Mean Nightlights _{t-2}		0.002** (0.001)	
Δ Mean Nightlights _{t-3}		-0.004* (0.002)	
Δ Mean Nightlights _{t-4}		0.003** (0.001)	
Δ Mean Nightlights _{t-5}		-0.004* (0.002)	
Δ Mean Nightlights _{t-6}		0.005** (0.002)	
Δ Mean Nightlights _{t-7}		0.002* (0.001)	
Δ Mean Nightlights _{t-8}		0.001*** (0.0003)	
Δ Mean Nightlights _{t-9}		0.001 (0.001)	
Male			0.028* (0.015)
Female			0.011 (0.015)
Slum type (1=Legal)			0.202*** (0.041)
Social group: others			0.087* (0.048)
Social group: scheduled caste			-0.194*** (0.053)
Social group: scheduled tribe			-0.088 (0.118)
Constant	4.295*** (0.072)	4.391*** (0.075)	4.047*** (0.094)
State Fixed Effects	Yes	No	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	5,039	5,039	4,338
R ²	0.385	0.282	0.387
Adjusted R ²	0.380	0.280	0.380
F Statistic	84.446***	141.164***	62.945***
F Statistic	(df = 37; 5001)	(df = 14; 5024)	(df = 43; 4294)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
(standard errors are clustered at the state level.)

Slum settlements not only provides proximity to the place of work but also provides a social network amongst the similar sections of society.

Slums living in houses with proper structure pay more rent as compared to ones living in improper structures, as suggested in Table 2.6¹⁰. In addition, slums households using their dwelling unit both for commercial and residential purpose pay 23%, approximately less real rents on average than the others. Often, such dwellings are of not so good quality which affects the price of the property.

In Table 2.7¹¹, I further present a robust argument in advocacy of the policy coefficient by stating an explicit control experiment. I take a subsample of six¹² states in India that had stringent rent control reforms in place before the implementation of the IHSDP policy. As anticipated, the policy coefficient for a sample of these states is negative and is not statistically different from zero. This implies that the policy had no effect on real house rents for this cohort of treated districts. The policy coefficient for a sample of treated districts excluding districts from the above mentioned six states is statistically significant, positively related and sizeable in economic terms. The coefficients in column (1) and (3) are similar and ranges from 0.35 to 0.43.

¹⁰I additionally mention year fixed effects in table 2.6. The results do not change in magnitude and direction after adding year fixed effects.

¹¹I additionally mention year fixed effects in table 2.7. The results do not change in magnitude and direction after adding year fixed effects.

¹²six states are namely, Karnataka, Nagaland, Rajasthan, Manipur, Mizoram, Odisha.

Table 2.5: Policy Effect on Real Rents: Controls

	<i>Dependent variable:</i>	
	Log Real Rents	
Treated	-0.173*** (0.058)	-0.161*** (0.059)
Time	1.278*** (0.068)	1.325*** (0.069)
Policy	0.182** (0.073)	0.171** (0.074)
<i>Distance to work</i>		
not required to travel		-0.213*** (0.067)
less than 1 k.m.		-0.148** (0.060)
5 k.m. to 10 k.m.		0.038 (0.047)
10 k.m. to 15 k.m.		0.167*** (0.055)
15 k.m. to 30 k.m.		0.144** (0.065)
30 k.m. or more		0.111 (0.088)
Constant	4.295*** (0.072)	4.279*** (0.075)
State Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	5,039	5,022
R ²	0.385	0.394
Adjusted R ²	0.380	0.389
F Statistic	84.446*** (df = 37; 5001)	75.227*** (df = 43; 4978)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
(standard errors are clustered at the state level.)

Table 2.6: Policy Effect on Real Rents: Controls

	<i>Dependent variable:</i>		
	Log Real Rents		
Treated	-0.173*** (0.058)	-0.176*** (0.059)	-0.368*** (0.055)
Time	1.278*** (0.068)	1.294*** (0.068)	1.218*** (0.070)
Policy	0.182** (0.073)	0.166** (0.074)	0.171** (0.072)
Residential-cum -commercial		-0.213*** (0.066)	
Residential-cum -others		0.547** (0.218)	
Independent house			0.371*** (0.041)
Apartment			0.423*** (0.050)
Constant	4.295*** (0.072)	4.312*** (0.072)	3.977*** (0.053)
State Fixed Effects	Yes	Yes	No
Year Fixed Effects	Yes	Yes	Yes
Observations	5,039	5,037	5,036
R ²	0.385	0.387	0.266
Adjusted R ²	0.380	0.382	0.265
F Statistic	84.446*** (df = 37; 5001)	80.755*** (df = 39; 4997)	303.702*** (df = 6; 5029)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
 (standard errors are clustered at the state level.)

Table 2.7: Policy Effect on Real Rents:
State-wise Policy Adoption

	<i>Dependent variable: Log Real Rents</i>		
	<i>All States</i> (1)	<i>States before JNNURM</i> (2)	<i>States in JNNURM</i> (3)
Treated	-0.506*** (0.082)	0.212 (0.281)	-0.564*** (0.086)
Time	1.298*** (0.079)	2.170*** (0.246)	1.192*** (0.083)
Policy	0.355*** (0.094)	-0.490 (0.301)	0.435*** (0.099)
Constant	4.247*** (0.073)	3.717*** (0.235)	4.294*** (0.077)
Observations	5,039	598	4,441
R ²	0.250	0.243	0.244
Adjusted R ²	0.250	0.239	0.244
Residual S.E.	1.324	1.219	1.333
F Statistic	560.060*** (df = 3; 5035)	63.556*** (df = 3; 594)	478.313*** (df = 3; 4437)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
(robust standard errors are reported in the paranthesis.)

2.7.3 Effect on Homeownership and Household Head

I, estimate equation 2.5 with a linear probability model for the probability of a slum household becoming a homeowner or having a female as the head of the household.

$$y_{ijk} = \alpha + \beta T_i + \gamma D_{ijk} + \delta(T_i * D_{ijk}) + \chi z'_i + \eta r_j + a_{jk} + \mu_{ijk} \quad (2.5)$$

where, y_{ijk} , is the outcome dummy for homeownership or female as the household head for an individual slum household i residing in district j and if exposed to the IHSDP policy area k . T_i 'policy period dummy' indicating a value of 0 for households in 2002 and 1 for households in 2008 and 2012. D_{ijk} is the 'treatment dummy', which denotes a slum households exposure to the policy. As mentioned in the section above, household's exposure to the policy is the function of their residence of district and the urban area of the district that received the policy. α and μ_{ijk} denotes the constant and the idiosyncratic error term, respectively. The z'_i is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{jk} , is the region specific effect. δ is the parameter of the interest that captures the intended effect.

In Table 2.8¹³, I present the estimates of equation 2.5 when the outcome variable is homeownership. Columns (1)-(3) are based on an unbalanced panel.

¹³I additionally mention year fixed effects in table 2.8. The results do not change in magnitude and direction after adding year fixed effects.

The estimate in Table 2.8, suggests that the policy increases the probability of becoming a homeowner significantly by 16.7 percentage points. In economic terms, the policy had a considerable successful impact of providing housing to the slums households. However, for a legal slum household the probability to become a homeowner is 3.8 percentage points more compared to the illegal slums. This finding is in line with the fact that the legal identity of households acts as an eligibility-incentive to avail of various government social schemes.

Table 2.9¹⁴, shows the estimates of equation 2.5 when the outcome variable is a dummy which take value 1 if a female is the household head . Columns (1)-(2) are based on an unbalanced panel.

One of the benefits accruing to the IHSDP scheme was that the female head of the household was entitled to be the owner of the dwelling constructed. Since, the data availability does not capture a direct variable to measure the effect of the policy on this front, I therefore, use a variable which can be suggestive of the above fact. A household was asked to report the gender of the head of the household. As evident from Table 2.9, the policy increased the probability of a female being the head of the household by 2.4 percentage points. Moreover, this effect does not vary with the legal status of the slum household.

The impact of the policy is statistically different from zero at 5% significance level for both homeownership and women empowerment.

¹⁴I additionally mention year fixed effects in table 2.9. The results do not change in magnitude and direction after adding year fixed effects.

Table 2.8: Policy Effect on Tenure

	<i>Dependent variable: Tenure</i>		
	<i>(1= Homeowner)</i>		
	(1)	(2)	(3)
Treated	-0.078*** (0.014)	-0.078*** (0.014)	-0.137*** (0.022)
Time	-0.178*** (0.014)	-0.178*** (0.014)	-0.317*** (0.021)
Policy	0.167*** (0.016)	0.168*** (0.016)	0.251*** (0.025)
Slum type (1=Legal)		0.038*** (0.008)	-0.118*** (0.023)
Legal*Time*Treated			-0.131*** (0.033)
Legal*Treated			0.089*** (0.028)
Legal*Time			0.220*** (0.027)
Constant	0.672*** (0.017)	0.639*** (0.018)	0.741*** (0.022)
State Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Observations	18,370	18,370	18,370
Log Likelihood	-12,131.510	-12,118.660	-12,075.170
Akaike Inf. Crit.	24,339.020	24,315.330	24,234.340

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
 (standard errors are clustered at the state level.)

Table 2.9: Policy Effect on Gender of the hhd head

	<i>Dependent variable: Gender of hhd head</i>	
	<i>(1= Female)</i>	
	(1)	(2)
Treated	-0.007 (0.009)	-0.007 (0.009)
Time	0.041*** (0.010)	0.041*** (0.010)
Policy	0.024** (0.011)	0.024** (0.011)
Slum type (1=Legal)		0.003 (0.005)
Constant	0.133*** (0.012)	0.130*** (0.013)
State Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	18,366	18,366
R ²	0.019	0.019
Adjusted R ²	0.017	0.017
Residual Std. Error	0.325	0.326
F Statistic	9.642*** (df = 37; 18328)	9.395*** (df = 38; 18327)

*Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
(standard errors are clustered at the state level.)*

2.7.4 Effect on Quality of Dwelling

I estimate equation 2.6 with a linear model to test for the improvement in the quality of dwelling of a slum household.

$$y_{ijk} = \alpha + \beta T_i + \gamma D_{ijk} + \delta(T_i * D_{ijk}) + \chi z'_i + \eta r_j + a_{jk} + \mu_{ijk} \quad (2.6)$$

where, y_{ijk} , is the outcome variable logarithm of 'Quality of Dwelling Deprivation Score' (QODDS) for an individual slum household i residing in district j and if exposed to the IHSDP policy area k . T_i 'policy period dummy' indicating the a value of 0 for households in 2002 and 1 for households in 2008 and 2012. D_{ijk} is the 'treatment dummy', which denotes a slum households exposure to the policy. As mentioned in the section above, household's exposure to the policy is the function of their residence of district and the urban area of the district that received the policy. α and μ_{ijk} denotes the constant and the idiosyncratic error term, respectively. The z'_i is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{jk} , is the region specific effect. δ is the parameter of the interest that captures the intended effect.

The initially constructed QODDS score ranges from 0 to 24.5 where a lower values score indicates an improvement in the overall quality and higher score indicates, otherwise. The overall score is constructed using 15 most important indicators¹⁵ of quality of dwelling. Each of the indi-

¹⁵15 important indicators are namely, source of drinking water, availability of bath-room, availability of toilette, type of electric wire, type of drainage, method of garbage

cator is assigned a value of 0 to 2, in a similar decreasing manner. The methodology adopted corresponds to Nolan et al. (2018) [21]. To create a final QODDS score which is the outcome variable used in equation 2.6, I divide the initial score of each household by 24.5 and multiply with 100.

In Table 2.10¹⁶, I present the estimates of equation 2.6. The results in the column (1) are based on an unbalanced panel. The policy did not improve the overall quality of dwelling score. The policy deteriorates the quality of the dwelling score by 8.5%. The policy coefficient is statistically significant at 1% significance level and is sizeable in economic terms. In addition, being a legal slum household improves the quality of dwelling by 23% approximately, an estimate of significantly sizeable economic impact. This result corresponds to the finding of Nolan et al. (2018) [21], using slum level dataset for the same time period arguing in the same direction. However, being a homeowner also significantly improves the quality of dwelling by 2.4%.

Another interesting finding in Table 2.10, shows that an ownership of the land given by the variable, 'land possessed'¹⁷ by a household signifi-

disposal, if the household experienced a flood, condition of the approach road to the dwelling, type of ventilation, floor type, wall type, roof type, structure type and the type of kitchen.

¹⁶I additionally mention year fixed effects in table 2.10. The results do not change in magnitude and direction after adding year fixed effects.

¹⁷As defined by statistical office (NSSO) - "Land possessed is given by land owned (including land under owner like possession) + land leased in - land leased out + land held by the household but neither owned nor leased in (e.g., encroached land). However, from the survey data it is not clear if the land owned takes care of the valuation of the dwelling.

cantly improves the quality of the dwelling by a range of approximately, 8% to 42%, depending on the size of land owned. Ownership of the land can provide incentives to an individual household to voluntarily invest in the quality of their dwelling over and above the government social incentives. Such a finding highlights the importance of tenure security which can enhance the voluntary participation required by the slum households to ensure the success of social reforms. It also act as a strong catalyst in upgrading the standard of living of the urban poor.

I further investigate the improvement in the quality score at individual indicator level. The results are presented in Table ¹⁸ 2.11, 2.12 and 2.13. For an individual slum household the policy has a positive and statistically significant impact on indicators concerning bathroom, own kitchen and infrastructural facilities like flood status of the household, improvement in the type of approach road to the slum household and location of the household.

The estimates for the average score ranges from -1.2% to -9.3%. This indicates a partial success of the policy for all kinds of slum households and is suggestive of underlying various political and administrative hurdles in the implementation of the policy. However, a legal slum household on average has much better conditions of dwelling on all indicators with statistically significant and economically sizeable impact. The reason for the macro and micro success of the dwellings in the legalized

¹⁸I additionally mention year fixed effects in table 2.11, 2.12 and 2.13. The results do not change in magnitude and direction after adding year fixed effects.

slums is their status authorization. Legal slums are the front runners to avail any kind of government policies and schemes.

Table 2.10: Policy Effect on
Quality of Dwelling

	<i>Quality of Dwelling Deprivation Score</i> ¹
	(1)
Treated	-0.035** (0.016)
Time	-0.242*** (0.017)
policy	0.085*** (0.019)
Slumtype (1=Legal)	-0.229*** (0.009)
Tenurial status (1=Homeowner)	-0.024*** (0.009)
Land possessed (0.02-0.21h)	-0.131*** (0.021)
Land possessed (0.21-0.41h)	-0.080** (0.036)
Land possessed (0.41-1.01h)	-0.051 (0.035)
Land possessed (1.01-2.01h)	-0.259*** (0.053)
Land possessed (2.01-3.01h)	-0.404*** (0.064)
Land possessed (3.01-4.01h)	-0.420*** (0.094)
Land possessed (4.01-6.01h)	-0.374*** (0.135)
Land possessed (6.01-8.01h)	-0.249* (0.147)
Land possessed (>=8.01h)	-0.641*** (0.157)
Land possessed (<0.005h)	0.121*** (0.010)
Constant	3.432*** (0.023)
State Fixed Effects	Yes
Year Fixed Effects	Yes
Observations	18,334
R ²	0.182
Adjusted R ²	0.180
F Statistic	82.944*** (df = 49; 18284)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

(robust standard errors are reported in the paranthesis.)

¹ 'h' means hectares. The deprivation score ranges from 0 to 100.

The quality of dwelling improves as the score approaches towards 0.

Table 2.11: Policy Effect on Quality of Dwelling:
By Individual Characteristic

	Quality of Dwelling Deprivation Score ¹				
	Source of drinking water (1)	Bathroom (2)	Toilette (3)	Electric wire (4)	Drainage (5)
Treated	-0.090*** (0.011)	0.054*** (0.013)	-0.041*** (0.011)	-0.033*** (0.008)	-0.010 (0.008)
Time	-0.020* (0.011)	-0.107*** (0.013)	-0.076*** (0.011)	-0.128*** (0.008)	-0.162*** (0.008)
Policy	0.088*** (0.012)	-0.050*** (0.015)	0.069*** (0.013)	0.080*** (0.009)	0.115*** (0.009)
Slum type (1=Legal)	-0.044*** (0.005)	-0.116*** (0.007)	-0.030*** (0.005)	-0.053*** (0.004)	-0.125*** (0.004)
Constant	0.318*** (0.014)	0.791*** (0.016)	0.161*** (0.012)	0.340*** (0.010)	0.557*** (0.010)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	18,368	18,369	12,832	16,663	18,369
R ²	0.145	0.112	0.139	0.201	0.172
Adjusted R ²	0.143	0.110	0.136	0.199	0.170
F Statistic	81.650*** (df = 38; 18329)	60.991*** (df = 38; 18330)	54.343*** (df = 38; 12793)	110.042*** (df = 38; 16624)	99.897*** (df = 38; 18330)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

(standard errors are clustered at the state level.)

¹ The deprivation score ranges from 0 to 100.

The quality of dwelling improves as the score approaches towards 0.

Table 2.12: Policy Effect on Quality of Dwelling:
By Individual Characteristic

	Quality of Dwelling Deprivation Score ¹				
	Garbage disposal (1)	Flooded (2)	Approach road (3)	Ventilation (4)	Floor (5)
Treated	-0.067*** (0.010)	0.007 (0.007)	0.042*** (0.012)	-0.0002 (0.012)	-0.043*** (0.014)
Time	-0.011 (0.010)	0.040*** (0.007)	-0.041*** (0.012)	-0.058*** (0.012)	-0.115*** (0.013)
Policy	0.115*** (0.011)	-0.003*** (0.008)	-0.039*** (0.014)	-0.012 (0.013)	0.116*** (0.016)
Slum type (1=Legal)	-0.112*** (0.005)	-0.030*** (0.004)	-0.092*** (0.006)	-0.065*** (0.006)	-0.081*** (0.007)
Constant	0.299*** (0.012)	0.096*** (0.009)	0.326*** (0.014)	0.722*** (0.015)	0.285*** (0.015)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	18,368	18,367	18,366	18,365	18,367
R ²	0.178	0.102	0.116	0.073	0.114
Adjusted R ²	0.177	0.100	0.115	0.071	0.112
F Statistic	104.800*** (df = 38; 18329)	54.487*** (df = 38; 18328)	63.544*** (df = 38; 18327)	37.804*** (df = 38; 18326)	61.845*** (df = 38; 18328)

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$
(standard errors are clustered at the state level.)
¹ The deprivation score ranges from 0 to 100.
The quality of dwelling improves as the score approaches towards 0.

Table 2.13: Policy Effect on Quality of Dwelling:
By Individual Characteristic

	Quality of Dwelling Deprivation Score ¹				
	Wall (1)	Roof (2)	Structure cond. (3)	Structure type (4)	Kitchen (5)
Treated	0.027** (0.012)	0.006 (0.010)	-0.023* (0.012)	-0.027 (0.044)	0.004 (0.006)
Time	-0.079*** (0.011)	-0.098*** (0.010)	-0.056*** (0.012)	-0.041 (0.050)	-0.038*** (0.006)
Policy	0.042*** (0.013)	0.026** (0.011)	0.005 (0.014)	-0.016 (0.063)	-0.012* (0.007)
Slum type (1=Legal)	-0.100*** (0.006)	-0.108*** (0.005)	-0.099*** (0.006)	-0.174*** (0.029)	-0.024*** (0.003)
Constant	0.242*** (0.013)	0.422*** (0.013)	0.474*** (0.015)	0.454*** (0.058)	0.560*** (0.008)
State Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	18,369	18,368	18,366	925	18,364
R ²	0.112	0.110	0.106	0.172	0.079
Adjusted R ²	0.111	0.108	0.105	0.142	0.077
F Statistic	61.111*** (df = 38; 18330)	59.818*** (df = 38; 18329)	57.463*** (df = 38; 18327)	5.793*** (df = 32; 892)	41.113*** (df = 38; 18325)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

(standard errors are clustered at the state level.)

¹ The deprivation score ranges from 0 to 100.

The quality of dwelling improves as the score approaches towards 0.

2.8 Concluding Remarks

The JNNURM-IHSDP policy of housing and service provisioning to slum dwellers significantly increased the probability of homeownership rate by 16.7 percentage points. As envisaged by the policy, a female was 2.4 percentage points more likely to be the head of the household after the reform. However, the estimates suggests the rental reform aspect of the program increased the real rents by 18.2%. This was contrary to objective of the mission. Hence, the analysis provide a strong support for evidence of market failures that act as an impediment to an efficient functioning of housing markets in slum areas. The results further lends support to the heterogeneous impact of the policy across different types of slums, where slums with legal identity benefit more than the ones without the legal identity. Variations in socio economic status of a slum household can also explain the heterogeneity of the impact.

However, there are certain limitations that needs to be further addressed in the empirical investigation. Stable Unit Treatment Value Assumption should be tested empirically. I would in future test the validity of the results by using other datasets e.g., census and panel census IHSDS. Controlling for other district level variables like slum population, social amenities, regional proportion of social groups is an important exercise that needs to be further carried out.

Another issue that may arise is that the presence of other state level pro poor policies might effect the validity of the results. However, such

an empirical investigation needs an exhaustive data which is hard to attain at this level. Moreover, all the prior national and subnational policies were subsumed under the umbrella of JNNURM. Hence, this gives confidence in the results.

References

- [1] Angelini, Viola, Brugiavini, Agar, and Weber, Guglielmo. “The dynamics of homeownership among the 50+ in Europe”. In: *Journal of Population Economics* 27.3 (2014), pp. 797–823.
- [2] Azariadis, Costas and Drazen, Allan. “Threshold externalities in economic development”. In: *The Quarterly Journal of Economics* 105.2 (1990), pp. 501–526.
- [3] Banerjee, Abhijit V, Gertler, Paul J, and Ghatak, Maitreesh. “Empowerment and efficiency: Tenancy reform in West Bengal”. In: *Journal of political economy* 110.2 (2002), pp. 239–280.
- [4] Banerjee, Abhijit and Duflo, Esther. “More than 1 billion people are hungry in the world”. In: *Foreign Policy* 186 (2011), pp. 66–72.
- [5] Barnhardt, Sharon, Field, Erica, and Pande, Rohini. “Moving to opportunity or isolation? network effects of a randomized housing lottery in urban india”. In: *American Economic Journal: Applied Economics* 9.1 (2017), pp. 1–32.
- [6] Bourassa, Steven C et al. “Determinants of the homeownership rate: An international perspective”. In: *Journal of Housing Research* 24.2 (2015), pp. 193–210.

- [7] Chakravarty, PRAVEEN and Dehejia, Vivek. “India’s Income Divergence: Governance or Development Model?” In: *Briefing paper* 5 (2017).
- [8] Cutler, David M and Glaeser, Edward L. “Are ghettos good or bad?” In: *The Quarterly Journal of Economics* 112.3 (1997), pp. 827–872.
- [9] Davis, Mike. “Planet of slums”. In: *New Perspectives Quarterly* 23.2 (2006), pp. 6–11.
- [10] De Soto, Hernando. *The mystery of capital: Why capitalism triumphs in the West and fails everywhere else*. Civitas Books, 2000.
- [11] Durand-Lasserve, Alain et al. “Social and economic impacts of land titling programmes in urban and peri-urban areas: a review of the literature”. In: *World Bank Urban Research Symposium, Washington DC, May*. 2007.
- [12] Durlauf, Steven N. “Neighborhood effects”. In: *Handbook of regional and urban economics*. Vol. 4. Elsevier, 2004, pp. 2173–2242.
- [13] Elvidge, Christopher D et al. “The Night Light Development Index (NLDI): a spatially explicit measure of human development from satellite data”. In: *Social Geography* 7.1 (2012), pp. 23–35.
- [14] Feng, Xiaopi, Flowerdew, Robin, and Feng, Zhiqiang. “Does neighbourhood influence ethnic inequalities in economic activity? Find-

- ings from the ONS Longitudinal Study”. In: *Journal of Economic Geography* 15.1 (2013), pp. 169–194.
- [15] Glaeser, Edward L, Kahn, Matthew E, and Rappaport, Jordan. “Why do the poor live in cities? The role of public transportation”. In: *Journal of urban Economics* 63.1 (2008), pp. 1–24.
- [16] Henderson, J Vernon, Storeygard, Adam, and Weil, David N. “Measuring economic growth from outer space”. In: *American economic review* 102.2 (2012), pp. 994–1028.
- [17] Katz, Lawrence F, Kling, Jeffrey R, and Liebman, Jeffrey B. “Moving to opportunity in Boston: Early results of a randomized mobility experiment”. In: *The Quarterly Journal of Economics* 116.2 (2001), pp. 607–654.
- [18] LeRoy, Stephen F and Sonstelie, Jon. “Paradise lost and regained: Transportation innovation, income, and residential location”. In: *Journal of Urban Economics* 13.1 (1983), pp. 67–89.
- [19] Marx, Benjamin, Stoker, Thomas, and Suri, Tavneet. “The economics of slums in the developing world”. In: *Journal of Economic Perspectives* 27.4 (2013), pp. 187–210.
- [20] Murphy, Kevin M, Shleifer, Andrei, and Vishny, Robert W. “Industrialization and the big push”. In: *Journal of political economy* 97.5 (1989), pp. 1003–1026.

- [21] Nolan, Laura B, Bloom, David E, and Subbaraman, Ramnath. “Legal Status and Deprivation in Urban Slums over Two Decades”. In: *Economic and political weekly* 53.15 (2018), p. 47.
- [22] Oreopoulos, Philip. “The long-run consequences of living in a poor neighborhood”. In: *The quarterly journal of economics* 118.4 (2003), pp. 1533–1575.
- [23] Rosenzweig, Mark R and Wolpin, Kenneth I. “Heterogeneity, intrafamily distribution, and child health”. In: *Journal of human resources* (1988), pp. 437–461.
- [24] Saiz, Albert. “The geographic determinants of housing supply”. In: *The Quarterly Journal of Economics* 125.3 (2010), pp. 1253–1296.
- [25] Tendulkar, Suresh D, Radhakrishna, R, and Sengupta, Suranjan. “Report of the expert group to review the methodology for estimation of poverty”. In: *Government of India, Planning Commission* 32 (2009).
- [26] UNDP, UN. “Human Development Report 2009 Overcoming Barriers: Human Mobility and Development”. In: *United Nations Development Programme* (2009).

Urbanisation and Slum Growth: Evidence from India

Slums are an integral part of urban spaces in India. Using state level nighttime light intensity as a measure of urbanization I empirically evaluate the impact of urbanization on slum growth from 1993 to 2012. In the process, I also exploit a large scale 'big-push' national policy reform in India between 2005 and 2012 to further examine if such a policy was efficient in curbing the slum growth. Combining a novel pooled cross-sectional household survey data and nighttime lights activity at state level, I find the likelihood of being a slum household is 14.2 percentage points more in states lying within the third quartile of nighttime light intensity. After the introduction of the policy the likelihood decreases for all quartiles, where the effect for the 3rd quartile is reduced by 3.9 percentage points. The results are preliminary and highlights the role of underlying social phenomenon linked to migration and middle tier urbanized spaces.

3.1 Introduction

Urbanization is the process by which cities and towns grow and develop. Urbanization in the developing world is among the most important social phenomena globally. It is also characterized by the pockets of poverty and neighborhood decay, called as slums. Most of the world's largest slums are located across the developing world e.g., slums of Dharavi in Mumbai, India. In developing countries, about a third of urban inhabitants live in impoverished slums and squatter settlements (UN-Habitat, 2012 [12]). Urban poverty degrades both the physical and social environment. Slums are obstacles in the way of achieving sustainable development goals.

After the financial reforms of 1991, India has been growing at a very fast pace. The growth is driven by cities. 31.16% of India is already urbanized with four metropolitan cities namely, Delhi, Mumbai, Chennai and Kolkata and further urbanizing at a faster pace, creating mega cities like Hyderabad and Bangalore (Census, 2011). These cities provide pull factors for migrants from rural to urban spaces. The Economic Survey of India (2017) [14] estimates that the magnitude of inter-state migration in India is approximately 9 million annually between 2011 and 2016. According to Census 2011, employment opportunities itself accounted for 14.7% of the migration in the country. Rural to urban migration creates slums (Katz et al., 2001 [15]). Many low-income families gravitate to these informal settlements that proliferate in and around towns.

Roughly 13.4% of Indian population lives under international poverty line (USD1.90 at 2011 PPP per day per capita) and has a vivid income gap between the rural and urban incomes (World Bank, 2019). The economic opportunity provided by the cities leads to the slums clusters around residential locations, major office centers, industrial areas or touristic locations (Barnhardt et al., 2017 [4]). Yet, in order to accommodate the huge inflow of people there are costs associated at the city level in the form of regional inequality that picks pace with the increased level of industrialization and urbanization (Cutler and Glaeser, 1997 [8]). The limited availability of urban land space restricts spatial planning, creates additional need for housing and puts pressure on land and stress on civic amenities like health, education, water, sanitation etc. Underdeveloped infrastructures, lack of effective policy like service provisioning and dilapidated housing for poor households, lack of tenure and market failures lead to social and economic disparities among the lives of slum residents.

The research question contributes to the field of urban economics literature by investigating the impact of urbanization on the growth of the slum dwellers over years and how is the growth impacted when the 'governance gap' void is filled by an acute governance reform at all levels of administrative functioning. I exploit a national policy intervention, the JNNURM program from year 2005-2012 to empirically estimate the above mentioned research question.

Drawing on a novel pooled cross sectional slum household survey

data from National Sample Survey Organization of India and state level nighttime lights from NOAA-DMSP, I empirically investigate the above claim. The study addresses an important research gap by empirically investigating the growth in the slum dwellers as a result of urbanization. On average, increase in nighttime light intensity over years significantly increases the probability of being a slum household. States that are categorized in the third quartile of the nighttime light intensity have the highest likelihood of having more slum households compared to non slum households at 14.2 percentage points. Such a finding reveals the importance of an underlying social phenomenon linked to urbanization. The estimated likelihood decreases, but still remains positives for all quartiles after the JNNURM policy was implemented suggesting a partial success of the policy. The remainder of this paper is organized as follows. In Section 3.2, I summarize the related literature. In Section 3.3, I present in detail the definition of institutional aspects of slums in India. In section 3.4, I present various data sources and the final dataset constructed for the purpose of analysis. In section 3.5, I present the JNNURM policy intervention framework. In Section 3.6, I present the identification strategy. Section 3.7 discusses the empirical findings. Section 3.8 concludes the paper.

3.2 Literature Review

Chauvin et. al., (2017) [7] empirically compares urbanization in United States to that of the developing countries at geographic units. The authors tests for Gibrat's Law and Zipf's Law in U.S., Brazil, China and India. Testing further for spatial hypothesis the authors find similarity of urbanization between U.S. and Brazil. The correlation between density and earnings is strong in China and India than in the U.S. Moreover, the authors argue for India that even though the correlation between the city size and earnings is modest but the gap between urban and rural wages is considerably large. As compared to the U.S. the correlation between area-level skills and both earnings and area-level growth are stronger in the developing world. They find evidence of agglomeration economies and human capital externalities in all four countries. The authors advocates that the spatial equilibrium in different countries eventually evolves over time especially in developing countries like India where social linkages to home communities are strong.

The 'Modernization Theory' states the importance of urbanization in lives of the poor. The theory argues that slums represent a transitory phase in the life cycle of a rural migrant. (Marx et. al., 2013 [17]). Eventually over years, the households move into the formal housing paving way for generations to reap the benefits of a city life. Slums acts as a platform for a typical rural migrant to seize the economic opportunities of urban and economic growth by providing geographical proximity to

the city.

Ooi and Phua (2007) [19] argues that even though rapid urbanization should not necessarily lead to slum formation but the evidence of large slums populations in developing countries and rapidly urbanizing regions like Asia suggests otherwise. They attribute the proliferation of the slums to the incapacity of the city authorities to cope with the diverse economic and social needs. City governments lack the planning to establish the required link between economic development, urban growth, and housing. The authors empirically examine various Asian countries to provide support to their argument.

However, the slum dwellers find themselves trapped in poverty for generations because of multiple factors. Such factors include market failures, lack of acute governance and coordination problems that not only worsens the conditions of living for slum dwellers but also acts as an impediment to boost investment inertia to develop in social and human capital. Azariadis and Drazen (1990) [2] argues that a lack of investment inertia in the slums, gives rise to a 'low skill-low equilibrium' situation for slum inhabitants. Low skilled slum labor force often do not meet the critical threshold to compete adequately in the labor market.

In a seminal paper by Murphy et. al., (1989) [18], slum upgradation requires large private investments. The marginal returns from small upgradations are quite small. Moreover, there is a lack of general willingness on account of slum dwellers to pay for improved public goods in poor urban areas. Highly illiquid, informal property rights, lack of tenure

and land titles provides disincentives for a typical slum household to improve the quality of dwellings. Such disincentives lead to decline in the quality of neighborhood around the slums.

Davis (2006) [9], using the example of Mumbai slums argues that an extreme coordination failures and a presence of 'governance gap' makes life in slums difficult. Governance mechanism are intrinsic to a slum dwellers life and often their absence is filled by private actors, bureaucratic entrepreneurs, gangs, and local agents which can lead to more entrenched tenancy rights. The non-government actors pursue a self interest of maintaining the status-quo of the slums. Slums often presents an opportunity for rent extraction. Proximity to the city life, comes at a cost of unjustified high rent premiums extracted by slum landlords, non-state actors in absence of a formal public allocation mechanism.

I contribute to the research gap at multiple levels firstly, by investigating empirically whether urbanization leads to more slum proliferation and can the growth of the slums be curbed in the presence of an effective slum policy? For this purpose, I use a proxy measure of urbanization with the nighttime lights. Additionally, I study the effect of the nationwide urban poor housing policy (JNNURM) of Government of India from 2005-2012. This was the largest standalone single policy framework of the decade 2000 with a national coverage for all urban areas of the country. In addition, all existing national policies were subsumed under this policy. Secondly, the advantage of such an analysis is that the unit of analysis is a slum household versus a non slum household

at a finer geographic level. Investigation of urban spaces in developing countries like India are not only limited in academic understanding but also often is constrained by scarcity of the data. Therefore, the use of satellite data and the level of slum data disaggregation is an important contribution to the urban economics literature.

Barnhardt et al. (2017) [4] argue that the option of taking refuge in slums in the city is rather a choice. Demonstrating a case for public housing in the city of Ahmedabad (India) the authors argues that relocation of slums is a welfare loss that rips them off their social capital, namely informal social insurance and ties. 34% of slum dwellers continued living in public housing and the remaining part returned back to the slums after fourteen years of the housing assignment.

The JNNURM policy employed to investigate the research question addresses major hurdles to public policy intervention that negatively affects the welfare returns from the development process of the slum life. The policy overcomes the conflict of interest between central government and municipal authorities, high transaction costs, opaque governance mechanism, enumerative hurdles of a representative slum population, genuine political commitment, legal recognition of informal/illegal slum squatters for an inclusive urban planning, encouragement of public-private partnership, enabling efficient functioning of land markets. Such factors are by definition different from market failures.

Using 2001 National Household Transportation Survey for US, Glaeser et al. (2008) [11] puts forward the linkages between the transportation

networks and costs, as well as the centralization of poverty in urban areas or inner cities. The argument was also advocated by LeRoy and Sonstelie (1983) [16]. The authors argue that the income elasticity of demand for land is significantly lower for poor people than for the richer class. Hence, the authors validate the puzzle regarding the existence of urban poor in central cities. For the purpose of the study, I use a novel comprehensive national sample household survey for years 1993, 2002, 2008 and 2012 conducted by national statistical office in India. The survey covers all types of households in India at village level but the information available to researchers is restricted to district level. However, for the purpose of analysis I restrict the geographic unit at the state level. The dataset is measured on various socio-economic variables of a household. The survey explicitly states the location area of the household. I consider households living in notified and non-notified slums and other areas (non slum areas). These households constitute as a typical slum household and non-slum household for this study. The advantage of the data set is that the unit of survey is a household. Often such nation-wide repeated surveys are difficult to achieve. To the best of my knowledge, I have not come across any empirical studies that uses the same survey data. Most of the studies uses another slum survey data which does not cover household characteristics and the unit of survey is a slum cluster instead of a household.

3.3 Slums in India

Slums are a global but surprisingly, an urban phenomenon. Slums in urban areas particularly, in big cities like Delhi, are a source of cheap labor supply for activities like, chauffeur, vegetable vendors, domestic help etc.

According to the Slum (Improvement and Clearance) Act of 1956 a slum is a compact settlement with a collection of poorly built tenements, mostly of temporary nature, crowded together usually with inadequate infrastructure, inadequate sanitary and drinking water facilities in unhygienic conditions in that compact area (commonly known as Jhuggi Jhopri (JJ)). These slums are segmented into various categories. The categorization of slums and minimum number of households required to be labeled as slum varies according to different agencies in India.

According to one of the national survey organization a slum pocket is defined as a cluster of minimum 20 households and is categorized as a notified or a non-notified slum. *Notified slums* are all areas subsumed under the slum act of 1956 as 'slums' or areas recognized as slums by State, UT Administration or Local Government, Housing and Slum Boards, which may have not been formally notified as slum under any act. For e.g., majority of Old Delhi (famously known as walled city) falls under this category. On the other hand, *non-notified slums* are squatter settlements called as Jhuggi Jhopri Clusters (JJC) and are considered to be an illegal encroachment on land (DUSIB 2010). Usually, over the

years the government legalizes these slums by either rehabilitating or by providing In-situ upgradation of these slums.

78% of slums are not located on private, but built on public land owned by municipal bodies (54%), railways (14%), state government, or other public entities. Approximately 64% of slums are surrounded by residential areas (Government of the National Capital Territory of Delhi 2010, UNDP 2009 [22]). Census 2001 estimated that 16.3% of population in Delhi was located in urban slums, which is higher than the national average of 14.8%. Other cities like Mumbai, Kolkata, Hyderabad, Bangalore, and Chennai are also witnessing an increase in the slum population. 66% of all statutory towns in India have slums, 17.4% of total urban households live in slums (Census of India 2011). Over a quarter of urban population is poor with consumption below poverty line (Tendulkar 2009 [21]).

3.4 Data

In order to analyze the impact of urbanization and JNNURM policy on slum households, I construct a comprehensive repeated cross section of households dataset for year 1993, 2002, 2008, 2012 at the state level combining multiple datasets as listed below.

3.4.1 Slum Household Data

National Sample Survey Office (NSSO) is an organization of the Ministry of Statistics and Program Implementation of the Government of India (MoSPI). NSSO conducts nationwide detailed household surveys on various socio-economic indicators in successive rounds for an assessment of housing stock and formulation of housing policies and programs. The collection of the data on housing condition of the dwelling units and basic housing amenities is available since 7th round (October 1953 - March 1954) to the 69th round (July 2012-December 2012).

The survey covers indicators of (i) household characteristics for e.g., household size, occupation, religion, social group, household type, endowments, tenurial type, dwelling location in which the dwelling unit is located, distance to work, monthly per capita consumer expenditure, etc. (ii) particulars of living facilities, such as major source of drinking water, availability of bathroom, use of latrine, type of latrine, electricity for domestic use, etc. (iii) housing characteristics and micro environment, such as plinth area of the house, plinth level, use of house, period since built, condition of structure, drainage arrangement, etc. (iv) particulars of dwelling such as number of rooms, floor area of the dwelling, ventilation of the dwelling, total number of married couples in the household, kitchen type, floor type, wall type, roof type, etc. (v) particulars of construction and repair, undertaken by the households during the last 365 days, for residential purpose.

For the purpose of the study, I extract the information on households living in notified and non notified slum areas and other areas (non slum area) excluding the homeless and squatter population. The district-wise location of a household is only known from year 2002 onwards. Hence, this narrows the scope of the analysis period. Therefore, I take the state level location of each household which is also available for an additional year 1993.

3.4.2 Nighttime Light Activity Data

The official estimates for urbanization are only available as a national decadal change from year 2001-2011 which makes it harder to investigate the research question over time and at a granular geographic level. Therefore, in order to measure urbanization at granular level of states, I use a set of Nighttime Lights (NTL) as a proxy for urbanization.

The US Air Forces (USAF) Defence Meteorological Satellite Program (DMSP) operates a series of satellites, which carry sensors that detect light emission from the earth's surface at night. A value of light intensity from 0 (darkest) to 63 (bright) is for every pixel of around 1 square k.m. around the globe.

Nighttime lights is a reliable measure of not only urbanization but also for various socio-economic indicators e.g., poverty, income, spatial development, economic activity etc. (Elvidge et. al., 2012 [10]; Chakravarty and Dehejia, 2017 [6]; Henderson et. al., 2012 [13]). I cre-

ate a Nighttime Light Intensity dataset for 36 states from year 1992 to year 2013 by spatial overlay of the nighttime lights with the shape files of states of India to obtain an average value of the illuminated pixels at the state level.

The matrix plot in Figure 3.1 shows the distribution of average nighttime lights intensity over the period 1992-2013 separately for each state. Each grid on the horizontal axis measures the nighttime lights intensity of a particular state over different years. The vertical grid represents different states in a particular year. The value of the nighttime light intensity lies in the range of 0-63, in an increasing order. If the progression of a state is towards the yellow color category then that particular state is becoming more illuminated over years. Most of the states except for North Eastern region can be clearly seen as progressing towards brighter illumination over years. Chandigarh and Delhi are the brightest cities in the sample. I further merge both the datasets by states to construct a final dataset for the empirical investigation.

3.5 The JNNURM Program

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in 2005 as the single largest governance reform-driven initiative of the Government of India (GOI) for a planned development of Indian cities and towns. The mission was implemented in conjunction with Ministry of housing and Urban Poverty Alleviation (MoHUPA) along

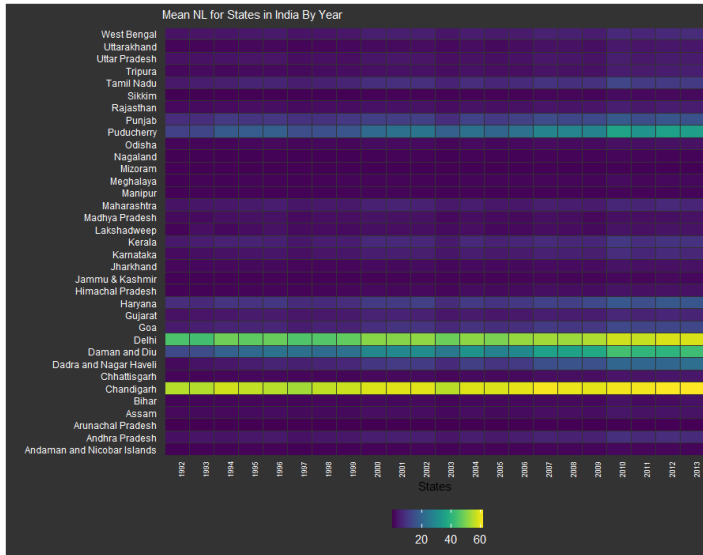


Figure 3.1: Nighttime Light Distribution of States in India

Source: Author's own calculation. The figure depicts the distribution of average nighttime lights intensity over the period 1992-2013 at state level. The data is retrieved from NOAA-DMSP.

with the respective state governments, Urban Local Bodies (ULB's), city-level institutions and private partnerships.

The mission initially covered seven-year period i.e. up to March 2012 which was extended up to March 2014 for completion of the already approved projects. During March 2013, the Mission period was extended by one more year i.e. up to March 2015 to complete.

To create economically productive, efficient, equitable and responsive cities, the Urban Renewal Mission focused on (i) improving and augmenting the economic and social infrastructure of cities; (ii) ensuring basic services to the urban poor including security of tenure at affordable prices; (iii) initiating wide-ranging urban sector reforms whose primary aim is to eliminate legal, institutional and financial constraints that have impeded investment in urban infrastructure and services; and (iv) strengthening municipal governments and their functioning in accordance with the provisions of the Constitution (seventy-fourth) Amendment Act, 1992. It provides for public disclosure of local spending decisions together with earmarking of budgetary allocations for basic services to the poor.

The mission comprised of two components e.g. Basic Services for Urban poor (BSUP) and Integrated Housing and Slum Development Program (IHSDP) which aimed at integrated development of slums through projects for providing shelter, basic services and other related civic amenities with a view to providing utilities to the urban poor with governance reform as an overarching third component. Under both the components, the participatory state governments and the ULB's were mandated to

implement a set of (i) mandatory (ii) optional reforms in order to access financial help from the central ministry.

The first component i.e. BSUP was implemented in 65 Mission Cities/Urban Agglomerations with more than four million population (Census 2001). These cities are at the forefront of economic importance (E.g, Mumbai, Delhi), cultural, religious and tourist importance (Eg, Varanasi, Amritsar). The second component i.e. IHSDP covered the remaining 887 cities/urban areas/small towns, relatively less developed than the identified 65 mission cities. The two components of JNNURM were mandated to pursue 3 key pro-poor reforms, namely (a) earmarking of 25% of municipal budget for the urban poor for provision of basic services including affordable housing to the urban poor; (b) implementation of 7- Point Charter, namely provision of land tenure, affordable housing, water, sanitation, education, health and social security to the poor in a time-bound manner ensuring convergence with other programs and (c) reservation of 25% of developed land in all housing projects, public or private, critical for slum improvement.

Under the program, the already existing pro- poor schemes like VAMBAY and NSDP were subsumed in order to implement a single comprehensive program nationwide designed to explicitly target urban slum dwellers from all sections of the society with the objective to provide a holistic slum development. Urban slum dwellers comprise of urban poor, Economically Weaker Section (EWG) and Low-Income Groups, (LIG)

The scheme applied to towns and urban areas with elected local bod-

ies and was implemented through a State level nodal agency, as appointed by the State Government. In addition, the State government were authorized to prioritize towns and cities on the basis of their existing infrastructure, economically and socially disadvantaged sections of the slum population and difficult areas. However, the selection of the beneficiaries was made by the State level nodal agency or ULB's.

Detailed Project Reports (DPRs) were to be prepared by the implementing agencies for funding in order to access Central assistance (grant). Release of Central share to nodal agency was dependent on availability of State share and submission of utilization certificates in accordance with the provisions of General Financial Rules (GFRs).

The sharing of funds was distributed as 80:20 between Central Government and State Government/ULB/Parasatal. The funds from the central ministry were allocated to the States on the basis of the States urban slum population to total urban slum population in the country.

States/Implementing Agencies were also allowed to raise their contribution from their own resources or from beneficiary contribution/ financial institutions. For special category States, the funding pattern between Center and the States will be in the ratio of 90:10.

The State Governments, ULBs and para-satal agencies were required to execute a Memorandum of Agreement (MoA) with the Government of India committing to implement an agenda of reform program¹ both at the state level and ULB level. MoA laid down specific milestones to

¹ refer to appendix 3.9.3

be achieved for each item of reform. Signing of this tripartite MoA was a necessary condition to access Central assistance.

3.6 Identification Strategy

I investigate whether urbanization leads to increase in slum households over years in India and whether the exposure to JNNURM program was successful in curbing the slum growth.

In the process, I study directly the affect of the policy precisely, on the growth of slum households. First, in purview of increase in urbanization in India : *Does Urbanization leads to the growth of slums?* Second, *Did the JNNURM policy help in curbing the growth of the slums in the urban areas?*

For identification, I exploit a linear probability model given by equation 3.2 to identify the parameter of interest, δ_q and γ_q that allows for the effect.

Chakravarty and Dehejia (2017) [6], the nighttime light intensity dataset is a good measure of economic activity. The level of economic activity influences. Alternatively, nighttime lights is also a good measure of urbanization. The more the light intensities, the higher is the urbanization rate. To the best of my knowledge, state wise data on level of urbanization is not available for the slum household survey years. However, the information on urbanization is available publicly only as a decadal growth between 2001-2011 for 25 states in India. Hence, this

further justifies the use of nighttime lights as a proxy variable for urbanization.

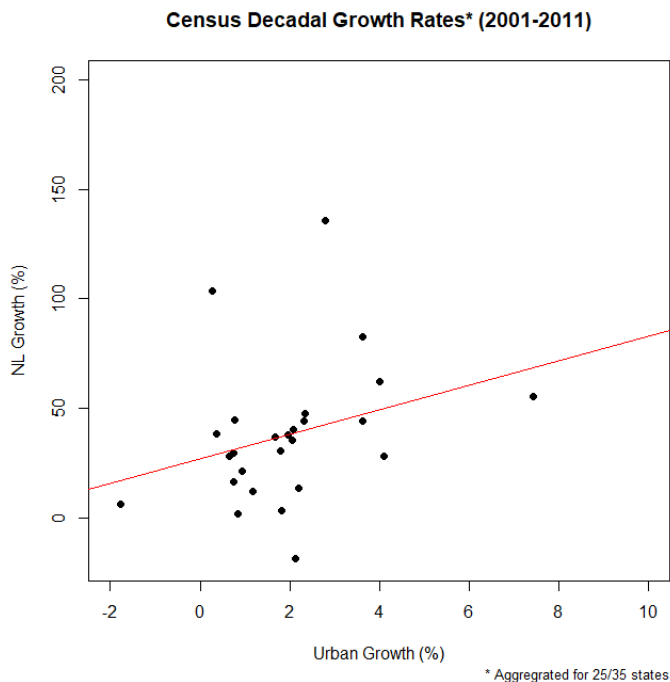


Figure 3.2: Urban Growth Rate and Nighttime Lights

Source: Author's own calculation. The data for urban growth rate is retrieved from the census of India and NOAA for nighttime lights. The figure depicts the relationship between decadal growth rate of urbanization and nighttime lights from 2001-2011.

A graphical visualization of relation between a decadal change in urbanization and nighttime light growth rate from 2001-2011 is illustrated in Figure 3.2². The available data for the urban growth rate is aggre-

²The descriptive figure 3.2 plots the census decadal growth rate of urbanization

gated at the state level for 25 states out of 35 as represented on the horizontal axis. The nighttime light growth rate is then calculated for the same states and represented on the vertical axis. The graph demonstrates that a higher urban growth rate is positively associated with a higher growth rate in nighttime lights of a particular state. Therefore, the positive relationship between urban growth and nighttime lights gives further support to the choice of night time lights as a proxy variable for urbanization.

I define, the Time (T) as the pre/post policy period as follows:

$$T = \begin{cases} 1 & \text{if } t = 2008, 2012 \\ 0 & \text{if } t = 1993, 2002 \end{cases} \quad (3.1)$$

I test the following regression equation:

$$y_{ij} = \alpha + \beta T + \gamma_q D_{qij} + \delta_q (T * D_{qij}) + \chi z'_i + \eta r_j + a_{ij} + \mu_{ij} \quad (3.2)$$

In equation 3.2, y_{ij} , is the binary outcome variable which takes the value 1 if a household i in state j is a slum household and 0 if the household is non-slum household.³ α and μ_{ij} denotes the constant and the idiosyncratic error term, respectively. D_{qij} is a quartile q dummy

and night time lights for 25 states. Each dot in the graph represents a state. Since, the growth rates are decadal therefore, there are very few observations to perform the state wise regressions.

³The survey states explicitly if a household is located in a slum area or a non slum area. It does not state if a particular household transitioned from being a slum to a non slum household.

of the nighttime light in state j in which individual households i are located.⁴ The dummy D_{qij} takes a value between 1-4. The z'_i is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{ij} , is the region specific effect.

The δ_q captures the intended effect of the policy i.e., if urbanization increases the probability of more slums in urban areas post policy period. The parameter could strongly suggest the success of the policy. Whereas γ_q captures the effect of urbanization on slum growth relative to the non slum growth irrespective of the policy period. Moreover, γ_q also measures the heterogeneous effect of urbanization on slum growth i.e., the level of urbanization as indicated by nighttime lights at which the slum growth is the strongest.

The parameter γ_q can explain various underlying social phenomenon linked to urbanization in unequal and developing countries like India. Growing pace of urbanization is a result of two key factors namely, increase in population and rural to urban migration. Such a migration is often the result of pull factors like better employment opportunities, improved infrastructure, education and health along with ease of living offered by urban areas especially bigger cities. Negative spillovers from rapid migration also has a potential to create an unplanned urban

⁴Luminosity is a continuous variable but I categorize the luminosity data into 4 quartiles in order to capture what kind of urban areas (as measured by luminosity) are more likely to have slum formations. The time dummy is used specifically to analyze the effect of the JNNURM policy on slum growth by quartiles of luminosity. Since the policy was launched in 2005-06, therefore, I have a time dummy for pre and post policy period.

sprawl putting further pressure on economic, social, infrastructure and environmental resources. Unplanned urban sprawl often leads to sub standard housing especially squatter settlements and slums, where low income migrants gravitate to.

Moreover, the pattern of rural to urban migration is not homogeneous across the country. With development and economic prosperity, different tiers of urban spaces are created. Therefore, the migrant population is unevenly distributed among these different tiers with varying levels of economic activity. As less urbanized spaces become more urbanized, the pattern of migration shifts from saturated/overburdened cities to gradually developing urban spaces, creating more slums in the lower tier urban spaces/towns. Nighttime lights are reflective of such different tiers of urbanization. Hence, the parameter γ_q can explain such a shift. The estimates can be affected by individual household level characteristics like the type of slum area, social identity of the household, migration status, electricity availability etc. Thus, I control for some of these characteristics in the regression equation 3.2. Empirical test of the assumption for each state (controlling for state level characteristics e.g., population, education enrollment, socioeconomic characteristics) is left for a future investigation.

3.7 Empirical Results

3.7.1 Descriptive Results

In Table 3.1 and Table 3.2, I present the summary statistics of the important variables that helps in building the identification. The number of male and females in a typical slum household is balanced. However, according to the Census of India 2011, the gender ratio is skewed towards male, accounting for 947 females per 1000 males.

On average, the slum households incur a monthly rental expenditure of approximately 50% less than the non slum households. The average basket of consumption for the non slums households is also higher in proportion to the average basket of goods consumed by slum households. The rationale behind such a pattern was inspected by the consumption puzzle in economics arguing a declining trend in consumption in urban India. Banerjee and Duflo (2011) [3], on the contrary attributed the decline in the trend as change in priorities of consumption good.

The slums and non slum households are both located in the urban areas. Slum households located in areas with similar economic perspectives are consuming on average less than the non slum households located in the same area with same economic development. The consumption disparity among the urban slum and non slum households is considerably large. This consumption inequality is suggestive of the poor conditions of standard of living in a slum. The possible reasons for this dispar-

ity can be further examined with item-wise analysis of the consumption expenditure data which is out of the scope of this study.

The average floor area of a typical dwelling unit constructed is also lower for slum households compared to non slum households. Availability of land and other supply side measures influences house price dynamics (Saiz, 2010 [20]). Moreover, urban slum by definition, is a congested group of dilapidated houses/shelters either on a public or private land. Hence, the constructed floor area of the dwelling is suggestive of this.

Changes in household demographic can also explain housing dynamics (Angelini et. al., 2014 [1]; Bourassa et. al., 2015 [5]). The survey defines the household as a group of people living together under the same roof and sharing a common kitchen. Therefore, these group of people constitute as the members of the household. The descriptive statistics in the Table 3.1 indicates the change in the composition of the household over a period of one year both in a slum and a non slum household. The results are suggestive of the findings from many empirical and theoretical studies advocating slums as a social trap (Marx et. al., 2013 [17]). Slums act as avenues of escape from rural poverty but suffers from low equilibrium social and human capital. The slums on average stay for a lesser duration in one place than the non slum households which further aligns to the literature. On average the exposure of slum households to nighttime lights is relatively more as compared to the non slum households. This not only corroborates with the definition of slums as an urban concept but is also suggestive of the rapid growth of slums in

more urbanized spaces compared to non slum households.

Table 3.1: Descriptive Statistics I

	group	n	mean	median	trimmed	sd	min	max
household composition								
male	0	117769	2.4	2	2.2	1.4	0.0	22.0
male	1	18259	2.4	2	2.3	1.4	0.0	16.0
female	0	114949	2.3	2	2.2	1.4	0.0	58.0
female	1	17630	2.4	2	2.2	1.4	0.0	17.0
household expenditure <i>(INR)</i>								
nominal avg cons(monthly)	0	158090	5102.8	3500	4175.2	6003.8	0.0	1220000.0
nominal avg cons(monthly)	1	24853	3609.0	2900	3060.7	3574.7	0.0	200000.0
House Rent	0	75232.0	643.9	200.0	375.6	1272.4	0.0	35000.0
House Rent	1	11308.0	298.1	70.0	178.9	536.1	0.0	10000.0
construction								
floorarea (sqft)	0	158163	460.7	370.0	406.6	367.8	0.0	15870.0
floorarea (sqft)	1	24856	254.6	193.8	217.3	233.7	0.0	11050.0
Δhousehold composition <i>(last365days)</i>								
members moved in	0	60652	0.1	0.0	0.0	0.4	0.0	11.0
members moved in	1	9002	0.1	0.0	0.0	0.4	0.0	8.0
members moved out	0	98986	0.1	0.0	0.0	0.3	0.0	8.0
members moved out	1	15317	0.0	0.0	0.0	0.3	0.0	9.0
stayduration_presentarea	0	36833	25.2	20.0	23.3	20.8	0.0	90.0
stayduration_presentarea	1	17100	20.9	17.0	18.9	17.0	0.0	99.0
mean nighttime lights								
nl-t	0	158170	7.1	4.7	4.6	11.1	0.0	61.9
nl-t	1	24857	7.6	4.9	5.0	11.1	0.0	61.9
nl-t-1	0	158170	6.9	4.1	4.4	11.0	0.0	61.3
nl-t-1	1	24857	7.4	5.0	4.8	11.2	0.0	61.3
nl-t-2	0	120421	7.8	4.6	5.0	11.8	0.1	61.0
nl-t-2	1	18646	8.0	4.9	5.2	11.6	0.1	61.0

It could also be a cause of concern that the proportion of slum households to non-slum households can differ significantly in survey years. However, this concern is addressed in Table 3.2. The proportion of slum households surveyed remains between 12%- 14% of the total households

surveyed. The exposure of slum households and the non slum household to regional factors other than the policy exposure could also bias the result. Since both kind of households live in the same state the exposure to regional variations are same for both the households.

Table 3.2: Descriptive Statistics: NSSO

	Slum Households (%)	Non-Slum Households (%)
1993	14.1	85.8
2002	14.0	85.0
2008	13.5	86.5
2012	12.6	87.3

In Figure 3.3, I plot the decadal change in urban growth rate against the decadal change in slum growth rate. The graph suggests a positive relation between urban growth rate and slum growth during the years 2001-2011. This provides further support in favor of the empirical investigation. However, the relatively flatter curve is also suggestive of the fact that certain states in India have witnessed a negative growth in slums. The potential reason for this could be the differential success of the slum policy amongst states.

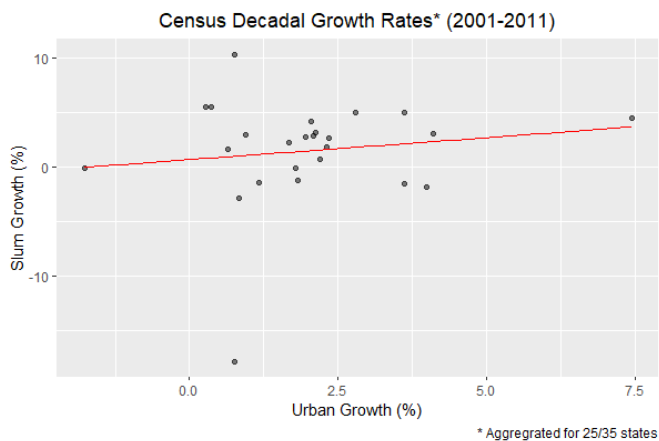


Figure 3.3: Urban Growth and Slum Growth

Source: Author's own calculation. The data for urban and slum growth rate is retrieved from the census of India. The figure depicts the relationship between decadal growth rate of urbanisation and slums from 2001-2011.

3.7.2 Urbanisation and the Probability of a Slum

I estimate equation 3.3 with a linear probability model.

$$y_{ij} = \alpha + \beta T + \gamma_q D_{qij} + \delta_q (T * D_{qij}) + \chi z'_i + \eta r_j + a_{ij} + \mu_{ij} \quad (3.3)$$

In equation 3.3, y_{ij} , is the binary outcome variable which takes the value 1 if a household i in state j is a slum household and 0 if the household is non-slum household. α and μ_{ij} denotes the constant and the idiosyncratic error term, respectively. D_{qij} is a quartile q dummy of the nighttime light in state j in which individual households i are located. The dummy D_{qij} takes a value between 1-4. The z'_i is a vector of household level controls. The vector r_j specifies region specific controls: GDP and a_{ij} , is the region specific effect.

The δ_q captures the intended effect of the policy i.e., whether the urbanization increases the probability of more slums in urban areas post policy period. The parameter could strongly suggest the success of the policy.

In Table 3.3⁵, I present the estimates of equation 3.3. Columns (1)-(3) are based on an unbalanced panel. The result in Table 3.3 suggests that nighttime lights as a proxy for urbanization significantly increases the probability of being a slum household over years. The effect is the strongest for a household in the states where the intensity of the night-

⁵I additionally mention year fixed effects in table 3.3. The results do not change in direction and do not vary much in magnitude after adding year fixed effects.

time lights is in 50th – 75th quartile. On average, a household in a state categorized in the third quartile of the intensity of the nighttime lights is 14.2 percentage points more likely to be a slum household than a non slum household.

This is suggestive of the increase in slum households in the dim lighted urban areas or small towns over the years. As urbanization begins in tier 2 or 3 towns, it is quite likely that such areas become financially lucrative for nearby villagers leading to slum formations.

However, within the policy implementation years the probability estimate reduces by 3.9 percentage points for households in the states in the third quartile of the nighttime light intensity. This is strongly suggestive of the partial success of the JNNURM policy. Decrease in the probability across all quartiles of nighttime light intensity indicates a strong possibility of benefits reaching the slum households all across the country.

Further, the results could be biased due to the affect of electricity usage in the household. An increased usage of electricity in slum households could be strongly correlated with the nighttime lights instead of urbanization. However, the estimates in Table 3.3 suggests otherwise. A household that is electrified is 17.6 percentage points less likely to be a slum household than a non slum household. This gives strong support to the hypothesis. The results are suggestive of the disparity in living conditions between a slum and a non slum household within the same state. The nighttime lights are being derived from the cumulative

growth of urban areas and non slum households. The results of the logit model specification in Table 3.4 remains unchanged.

Table 3.3: Urbanization and Slum Household

	<i>Slum Household (=1)</i>		
	OLS (1)	OLS (2)	OLS (3)
Post Policy	0.020*** (0.003)	0.007*** (0.002)	0.194*** (0.005)
Mean NL _{25-50q}	0.038*** (0.003)	0.076*** (0.003)	0.036*** (0.003)
Mean NL _{50-75q}	0.142*** (0.003)	0.177*** (0.004)	0.138*** (0.004)
Mean NL _{75-100q}	0.118*** (0.003)	0.115*** (0.003)	0.100*** (0.003)
Post Policy*Mean NL _{25-50q}	-0.027*** (0.004)	-0.017*** (0.004)	0.009* (0.005)
Post Policy*Mean NL _{50-75q}	-0.039*** (0.005)	-0.031*** (0.005)	-0.017*** (0.006)
Post Policy*Mean NL _{75-100q}	-0.036*** (0.004)	-0.025*** (0.004)	-0.039*** (0.005)
electricity (domestic use=1)			-0.176*** (0.004)
migrated (present area_last1year)			-0.021*** (0.004)
Constant	0.056*** (0.002)	-0.005*** (0.001)	0.165*** (0.004)
State Fixed Effects	N	Y	Y
Year Fixed Effects	N	Y	Y
Observations	183,027	183,027	127,264
R ²	0.020	0.192	0.211
Adjusted R ²	0.020	0.192	0.211
Residual Std. Error	0.339	0.331	0.328
F Statistic	542.548*** (df = 7; 183019)	1,063.465*** (df = 41; 182986)	810.932*** (df = 42; 127222)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the state level

Table 3.4: Urbanization and Slum Household

	<i>Slum Household (=1)</i>	
	Logit (1)	Logit (2)
Post Policy	0.336*** (0.044)	0.418*** (0.053)
Mean NL _{25-50q}	0.565*** (0.043)	0.569*** (0.043)
Mean NL _{50-75q}	1.429*** (0.039)	1.452*** (0.039)
Mean NL _{75-100q}	1.271*** (0.038)	1.395*** (0.038)
Post Policy*Mean NL _{25-50q}	-0.411*** (0.056)	-0.142** (0.069)
Post Policy*Mean NL _{50-75q}	-0.457*** (0.050)	-0.337*** (0.062)
Post Policy*Mean NL _{75-100q}	-0.448*** (0.049)	-0.597*** (0.061)
electricity		-1.146*** (0.023)
migrated (present area_last1year)		-0.234*** (0.047)
Constant	-2.833*** (0.034)	-1.931*** (0.039)
Observations	183,027	127,264
Log Likelihood	-70,722.340	-48,024.750
Akaike Inf. Crit.	141,460.700	96,069.510

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the state level

3.8 Concluding Remarks

Increase in nighttime light intensity over years significantly increases the probability of being a slum household. States that are categorized in the third quartile of the nighttime light intensity have the highest likelihood of having more slum households compared to other quartiles by approximately, 14 percentage points. The likelihood decreases but still remains positives for all quartiles after the JNNURM policy was implemented suggesting a partial success of the policy. Hence, the analysis provides a strong support in favor of the evidence of urbanization creating more slums.

However, the results presented are very preliminary and there are certain issues that needs to be further addressed in the empirical investigation. Stable Unit Treatment Value Assumption should be tested empirically. I would test the validity of the results by using other datasets e.g., census and panel census IHSDS. Controlling for other state level variables like slum population, social amenities, regional proportion of social groups is an important exercise that needs to be carried out in the future. Other empirical methods like a propensity score matching, analysis of neighborhood effect can be useful for future empirical investigation. Other state level policies might effect the validity of the results. This needs to be empirically investigated. The data on town level can be merged which will allow for finer geographic analysis and more convincing results.

References

- [1] Angelini, Viola, Brugiavini, Agar, and Weber, Guglielmo. “The dynamics of homeownership among the 50+ in Europe”. In: *Journal of Population Economics* 27.3 (2014), pp. 797–823.
- [2] Azariadis, Costas and Drazen, Allan. “Threshold externalities in economic development”. In: *The Quarterly Journal of Economics* 105.2 (1990), pp. 501–526.
- [3] Banerjee, Abhijit and Duflo, Esther. “More than 1 billion people are hungry in the world”. In: *Foreign Policy* 186 (2011), pp. 66–72.
- [4] Barnhardt, Sharon, Field, Erica, and Pande, Rohini. “Moving to opportunity or isolation? network effects of a randomized housing lottery in urban india”. In: *American Economic Journal: Applied Economics* 9.1 (2017), pp. 1–32.
- [5] Bourassa, Steven C et al. “Determinants of the homeownership rate: An international perspective”. In: *Journal of Housing Research* 24.2 (2015), pp. 193–210.
- [6] Chakravarty, PRAVEEN and Dehejia, Vivek. “India’s Income Divergence: Governance or Development Model?” In: *Briefing paper* 5 (2017).

- [7] Chauvin, Juan Pablo et al. “What is different about urbanization in rich and poor countries? Cities in Brazil, China, India and the United States”. In: *Journal of Urban Economics* 98 (2017), pp. 17–49.
- [8] Cutler, David M and Glaeser, Edward L. “Are ghettos good or bad?” In: *The Quarterly Journal of Economics* 112.3 (1997), pp. 827–872.
- [9] Davis, Mike. “Planet of slums”. In: *New Perspectives Quarterly* 23.2 (2006), pp. 6–11.
- [10] Elvidge, Christopher D et al. “The Night Light Development Index (NLDI): a spatially explicit measure of human development from satellite data”. In: *Social Geography* 7.1 (2012), pp. 23–35.
- [11] Glaeser, Edward L, Kahn, Matthew E, and Rappaport, Jordan. “Why do the poor live in cities? The role of public transportation”. In: *Journal of urban Economics* 63.1 (2008), pp. 1–24.
- [12] Un-Habitat. *Enhancing urban safety and security: Global report on human settlements 2007*. Routledge, 2012.
- [13] Henderson, J Vernon, Storeygard, Adam, and Weil, David N. “Measuring economic growth from outer space”. In: *American economic review* 102.2 (2012), pp. 994–1028.
- [14] India, Government of. *Economic Survey 2016–17*. 2017.

- [15] Katz, Lawrence F, Kling, Jeffrey R, and Liebman, Jeffrey B. “Moving to opportunity in Boston: Early results of a randomized mobility experiment”. In: *The Quarterly Journal of Economics* 116.2 (2001), pp. 607–654.
- [16] LeRoy, Stephen F and Sonstelie, Jon. “Paradise lost and regained: Transportation innovation, income, and residential location”. In: *Journal of Urban Economics* 13.1 (1983), pp. 67–89.
- [17] Marx, Benjamin, Stoker, Thomas, and Suri, Tavneet. “The economics of slums in the developing world”. In: *Journal of Economic Perspectives* 27.4 (2013), pp. 187–210.
- [18] Murphy, Kevin M, Shleifer, Andrei, and Vishny, Robert W. “Industrialization and the big push”. In: *Journal of political economy* 97.5 (1989), pp. 1003–1026.
- [19] Ooi, Giok Ling and Phua, Kai Hong. “Urbanization and slum formation”. In: *Journal of Urban Health* 84.1 (2007), pp. 27–34.
- [20] Saiz, Albert. “The geographic determinants of housing supply”. In: *The Quarterly Journal of Economics* 125.3 (2010), pp. 1253–1296.
- [21] Tendulkar, Suresh D, Radhakrishna, R, and Sengupta, Suranjan. “Report of the expert group to review the methodology for estimation of poverty”. In: *Government of India, Planning Commission* 32 (2009).

- [22] UNDP, UN. “Human Development Report 2009 Overcoming Barriers: Human Mobility and Development”. In: *United Nations Development Programme* (2009).

Monetary Policy, User Cost
and Inequality: Homeowners
versus Renters

A.1 Variables Definition

Table A.1: Definition of Variables

Variable Name	Definition	Source
3 month CHF LIBOR	Swiss monetary policy interest rate	Swiss National Bank (SNB)
6 month CHF LIBOR	Interest rate on 6 month maturity loan	Swiss National Bank (SNB)
House prices	Yearly house price indices (base year = 1985)	Fairbairner Partner AG
Euro-Swiss futures	Futures on 3 month CHF LIBOR	Datastream
Variable interest rate for old mortgages	Variable interest rate on mortgages before 2008	Federal Statistical Office (SFSO)
Variable interest rate for new mortgages	Variable interest rate on mortgages after 2008	Federal Statistical Office (SFSO)
Rent reference rate	Hypothekarischer Referenzzinssatz to which rents are indexed. This interest rate is influenced by mortgage rates	Federal Statistical Office (SFSO)
Dlpop	Percentage change in population	Federal Statistical Office (SFSO)
Vacancy rate (v)	Percentage of vacant houses/apartments	Federal Statistical Office (SFSO)
Undevelopable land (udl)	Percentage of land not suited for habitation at N.L.S. region level	Federal Statistical Office (SFSO)
Tenurial status	Tenant or owner (l29)	SHP
Accommodation expense	Total expenses in SFr per month: Owners (l33)	SHP
Accommodation expense	Total monthly rent, including service charges: Tenants (l36)	SHP
Gross income	Gross yearly household income (lhyg)	SHP
Nationality	First nationality	SHP
Civil Status	Civil status in year of interview	SHP
Age	Age in year of interview	SHP
Education	Years of education based on ISCED classification	SHP
Family type	Type of household (PACO)	SHP
3rd pillar	Savings into 3rd pillar	SHP

A.2 Descriptive Tables

Table A.2: Average Monthly HHD Accommodation Expenditure Over Years

Years	Average Nominal Accommodation Expenses (CHF/Month)			Average Real Accommodation Expenses		
	(A)			(B)		
	Home-owners (1)	Tenants (2)	Δ expenses (owners-tenants) (3)	Home-owners (4)	Tenants (5)	Δ expenses (owners-tenants) (6)
1999	1.710,7	1.285,7	425,0	1.898,8	1.427,1	471,7
2000	1.715,5	1.303,4	412,1	1.874,8	1.424,4	450,4
2001	1.773,5	1.341,7	431,8	1.919,3	1.452,0	467,3
2002	1.720,0	1.338,1	381,9	1.849,6	1.438,9	410,7
2003	1.622,1	1.340,1	282,0	1.733,2	1.431,9	301,3
2004	1.660,7	1.357,2	303,4	1.760,3	1.438,7	321,6
2005	1.651,1	1.380,1	271,1	1.729,9	1.446,0	284,0
2006	1.657,6	1.397,5	260,1	1.718,5	1.448,8	269,7
2007	1.784,3	1.431,0	353,3	1.836,3	1.472,6	363,6
2008	1.754,0	1.454,9	299,1	1.762,2	1.461,7	300,5
2009	1.695,9	1.482,9	213,1	1.712,1	1.496,9	215,1
2010	1.660,7	1.488,5	172,2	1.665,1	1.492,4	172,6
2011	1.695,8	1.499,4	196,4	1.696,4	1.500,0	196,4
2012	1.604,9	1.504,0	100,9	1.616,8	1.515,2	101,6
2013	1.662,2	1.539,7	122,6	1.678,2	1.554,5	123,7
2014	1.597,3	1.552,6	44,7	1.612,9	1.567,8	45,1

A.3 Descriptive Graphs

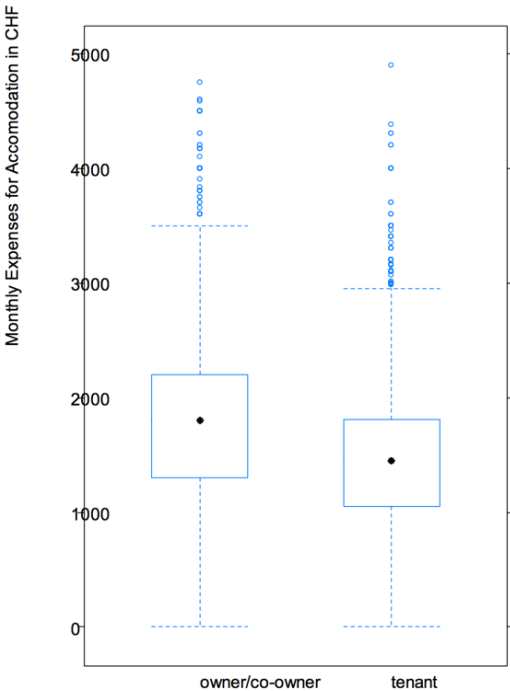


Figure A.1: Distribution Monthly Expenditures:
By Housing Tenure

Figure A.1 shows the distribution of monthly user cost expenses for accommodation for households that started as tenants and then became home owners. While tenants, households paid on average CHF 1,496 per month while as owners their monthly expenses increased only slightly to CHF 1,799. This shows that the financial burden from owning a house is comparable to renting.

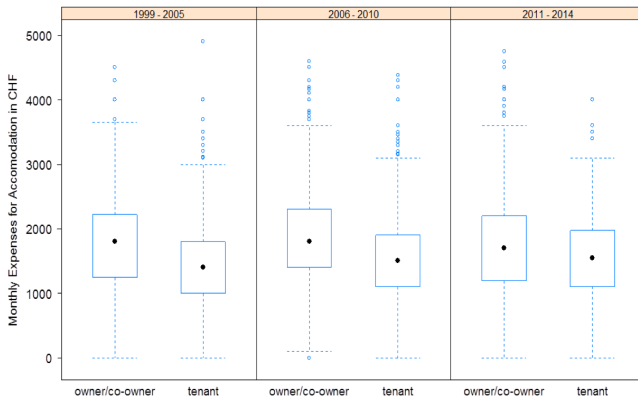


Figure A.2: Distribution of Monthly Housing Expenditures: By Year

Figure B.1 shows the same distribution of monthly expenses across time. Even though in absolute prices homeowners pay more CHF per month on average compared to the renters but this difference in average monthly accommodation expenses has gradually declined over the years making homeownership more attractive.

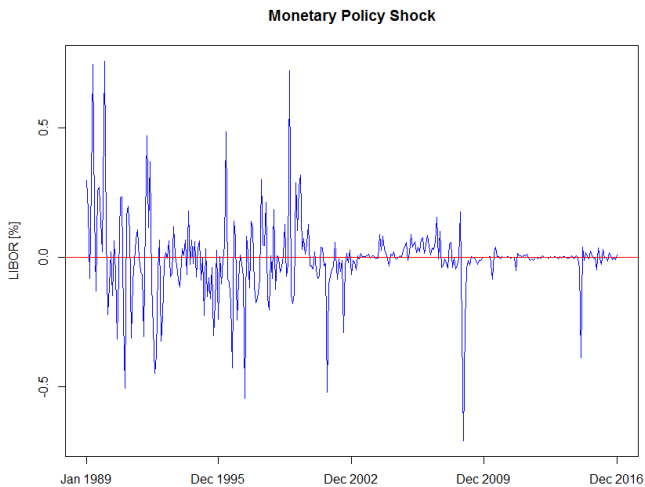


Figure A.3: Monthly Monetary Policy Shock

Source: Author’s own calculation. The figure depicts the monthly shock to the Swiss monetary policy i.e., 3-month CHF LIBOR from 1999-2016.

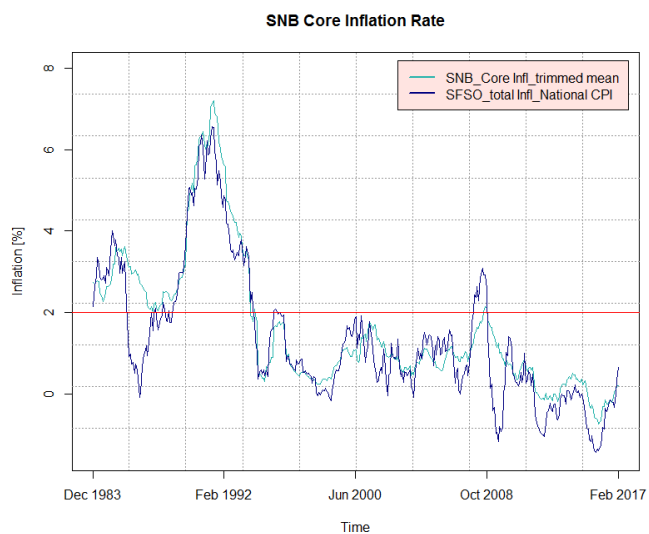


Figure A.4: SNB Inflation Rate

Source: Author's own calculation. The figure depicts the core monthly inflation rate in Switzerland from December 1983 to March 2017. The data was retrieved from SNB.

A.4 Robustness

Table A.3: Effect of Monetary Policy Shock on Accommodation Expenses

Dependent variable: Accommodation Expenses (CHF/month)									
	all hlds (1)	tenant (2)	homeowner (3)	all hlds (4)	tenant (5)	homeowner (6)	all hlds (7)	tenant (8)	homeowner (9)
Monetary Policy Shock (max)	49.998*** (11.770)	121.824*** (9.283)	-89.018*** (22.066)						
Monetary Policy Shock (sum)				25.072*** (5.241)	57.593*** (4.708)	-39.783*** (9.801)			
Monetary Policy Shock (avg)							125.444*** (19.473)	275.364*** (17.442)	-200.104*** (37.603)
Household Fixed Effects	Y	Y	Y	Y	Y	Y			
Observations	65,612	35,786	29,365	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.0003	0.008	0.0004	0.0003	0.008	0.0004	0.001	0.016	0.001
Adjusted R ²	-0.216	-0.254	-0.231	-0.216	-0.254	-0.231	-0.216	-0.244	-0.230
F Statistic	13.639*** (df = 1; 53924)	226.164*** (df = 1; 28308)	10.214*** (df = 1; 23852)	16.137*** (df = 1; 53924)	238.072*** (df = 1; 28308)	8.673*** (df = 1; 23852)	32.349*** (df = 1; 53924)	460.426*** (df = 1; 28308)	17.694*** (df = 1; 23852)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
 (standard errors are clustered at the household level)

Table A.4: Effect of Monetary Policy Shock on Accommodation Expenses

Dependent variable: Logarithm Nominal Accommodation Expenses									
	all bids (1)	tenant (2)	homeowner (3)	all bids (4)	tenant (5)	homeowner (6)	all bids (7)	tenant (8)	homeowner (9)
Monetary Policy Shock (max)	0.037** (0.007)	0.084** (0.006)	-0.039** (0.010)						
Monetary Policy Shock (sum)				0.012** (0.004)	0.036** (0.003)	-0.026** (0.005)			
Monetary Policy Shock (avg)							0.084** (0.013)	0.190** (0.011)	-0.096** (0.021)
Household Fixed Effects	Y	Y	Y	Y	Y	Y			
Observations	65,612	35,786	29,365	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.001	0.009	0.001	0.003	0.008	0.001	0.001	0.018	0.001
Adjusted R ²	-0.216	-0.253	-0.230	-0.216	-0.254	-0.230	-0.215	-0.241	-0.230
F Statistic	29.399*** (df = 1; 53924)	256.048*** (df = 1; 28308)	14.097*** (df = 1; 23852)	14.151*** (df = 1; 53924)	224.343*** (df = 1; 28308)	25.321*** (df = 1; 23852)	56.225*** (df = 1; 53924)	322.224*** (df = 1; 28308)	28.585*** (df = 1; 23852)

Note: $p<0.1$; ** $p<0.05$; *** $p<0.01$
(standard errors are clustered at the household level)

Table A.5: Effect of Monetary Policy Shock on Accommodation Expenses

Dependent variable: Logarithm Real Accommodation Expenses									
	all hlds (1)	tenant (2)	homeowner (3)	all hlds (4)	tenant (5)	homeowner (6)	all hlds (7)	tenant (8)	homeowner (9)
Monetary Policy Shock (max)	-0.004 (0.007)	0.046** (0.006)	-0.077*** (0.011)						
Monetary Policy Shock (sum)				-0.004 (0.004)	0.023** (0.003)	-0.041*** (0.005)			
Monetary Policy Shock (avg)							-0.007 (0.013)	0.109*** (0.011)	-0.184*** (0.021)
Household Fixed Effects	Y	Y	Y	Y	Y	Y			
Observations	65,612	35,786	29,365	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.00001	0.003	0.002	0.00002	0.003	0.003	0.00001	0.006	0.004
Adjusted R ²	-0.217	-0.261	-0.228	-0.217	-0.260	-0.228	-0.217	-0.256	-0.226
F Statistic	0.408	78.519*** (df = 1; 53924)	53.302*** (df = 1; 23852)	1.145 (df = 1; 53924)	95.585*** (df = 1; 28308)	63.900*** (df = 1; 23852)	0.376 (df = 1; 53924)	174.102*** (df = 1; 28308)	104.588*** (df = 1; 23852)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$
 (standard errors are clustered at the household level)

Table A.6: Effect of Central Bank Policy Rate on Accommodation Expenses

	Log Nominal Accommodation Expenses				Log Real Accommodation Expenses			
	(A)				(B)			
	all hlds (1)	tenant (2)	homeowner (3)	all hlds (4)	tenant (5)	homeowner (6)		
Policy Rate (Libor 3M-CHF)	-0.004 (0.002)	-0.026*** (0.002)	0.030*** (0.004)	0.008*** (0.002)	-0.016*** (0.002)	0.041*** (0.004)		
Household Fixed Effects	Y	Y	Y	Y	Y	Y		
Observations	65,612	35,786	29,365	65,612	35,786	29,365		
R ²	0.0001	0.010	0.004	0.0003	0.004	0.007		
Adjusted R ²	-0.217	-0.251	-0.226	-0.216	-0.259	-0.223		
F Statistic	3.813* (df = 1; 53924)	300.296*** (df = 1; 28308)	89.428*** (df = 1; 23852)	15.529*** (df = 1; 53924)	117.307*** (df = 1; 28308)	167.463*** (df = 1; 23852)		

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. (standard errors are clustered at the household level)

Table A.7: Effect of Central Bank Policy Rate on Accommodation Expenses

	<i>Log Nominal Accommodation Expenses (A)</i>			<i>Log Real Accommodation Expenses (B)</i>		
	all hhds (1)	tenant (2)	homeowner (3)	all hhds (4)	tenant (5)	homeowner (6)
Policy Rate (Libor 6M-CHF)	-0.004* (0.002)	-0.026*** (0.002)	0.030*** (0.004)	0.008*** (0.002)	-0.016*** (0.002)	0.041*** (0.004)
Household Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.0001	0.011	0.004	0.0003	0.004	0.007
Adjusted R ²	-0.217	-0.251	-0.227	-0.216	-0.259	-0.223
F Statistic	4.141** (df = 1; 53924)	307.301*** (df = 1; 28308)	89.211*** (df = 1; 23852)	15.088*** (df = 1; 53924)	120.603*** (df = 1; 28308)	167.404*** (df = 1; 23852)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, (standard errors are clustered at the household level)

Table A.8: Effect of Central Bank Policy Rate on Accommodation Expenses

	Log Nominal Accommodation Expenses (A)			Log Real Accommodation Expenses (B)		
	all hlds (1)	tenant (2)	homeowner (3)	all hlds (4)	tenant (5)	homeowner (6)
Real Policy Rate (Libor 3M-CHF)	-0.0001 (0.003)	-0.016*** (0.002)	0.024*** (0.005)	0.011*** (0.003)	-0.006*** (0.002)	0.034*** (0.005)
Household Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.000	0.002	0.001	0.0003	0.0004	0.002
Adjusted R ²	-0.217	-0.262	-0.230	-0.216	-0.264	-0.228
F Statistic	0.0005	58.536***	28.608***	15.106***	10.014***	58.172***
F Statistic	(df = 1; 53924)	(df = 1; 28308)	(df = 1; 23852)	(df = 1; 53924)	(df = 1; 28308)	(df = 1; 23852)

Note: * $p<0.1$; ** $p<0.05$; *** $p<0.01$, (standard errors are clustered at the household level)

Table A.9: Effect of Mortgage Rate on Accommodation Expenses

	<i>Log Nominal Accommodation Expenses</i> (A)			<i>Log Real Accommodation Expenses</i> (B)		
	all hhds (1)	tenant (2)	homeowner (3)	all hhds (4)	tenant (5)	homeowner (6)
Mortgage Rate*	-0.020*** (0.005)	-0.087*** (0.004)	0.069*** (0.007)	0.017*** (0.005)	-0.051*** (0.004)	0.104*** (0.007)
Household Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.001	0.038	0.007	0.0005	0.013	0.016
Adjusted R ²	-0.216	-0.217	-0.222	-0.216	-0.248	-0.212
F Statistic	36.265*** (df = 1; 53924)	1,105,659*** (df = 1; 28308)	167,931*** (df = 1; 23852)	25.130*** (df = 1; 53924)	374.479*** (df = 1; 28308)	383.119*** (df = 1; 23852)

* average variable interest rate on mortgages for 24 cantonal banks

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, (standard errors are clustered at the household level)

Table A.10: Effect of Mortgage Rate on Accommodation Expenses

	Log Nominal Accommodation Expenses			Log Real Accommodation Expenses		
	(A)			(B)		
	all hlds (1)	tenant (2)	homeowner (3)	all hlds (4)	tenant (5)	homeowner (6)
Real Mortgage Rate*	-0.010*** (0.004)	-0.031*** (0.003)	0.019*** (0.005)	0.011*** (0.004)	-0.011*** (0.003)	0.037*** (0.006)
Household Fixed Effects	Y	Y	Y	Y	Y	Y
Observations	65,612	35,786	29,365	65,612	35,786	29,365
R ²	0.0002	0.005	0.001	0.0002	0.001	0.002
Adjusted R ²	-0.217	-0.258	-0.230	-0.217	-0.263	-0.229
F Statistic	8.370*** (df = 1; 53924)	138.079*** (df = 1; 28308)	12.160*** (df = 1; 23852)	10.088*** (df = 1; 53924)	16.588*** (df = 1; 28308)	48.085*** (df = 1; 23852)

* average variable interest rate on mortgages for 24 cantonal banks
Note: p<0.1; ** p<0.05; *** p<0.01, (standard errors are clustered at the household level)

Table A.11: Heterogeneous Effect of Policy Shock on Homeownership (Full Sample)

	<i>Transitioning to Homeownership (=1)</i>		
	LPM (1)	LPM (2)	LPM (3)
¹ Gross Income (CHF/Year)	0.0003 (0.000)		
Policy Shock _{t-1}	-0.012*** (0.002)	-0.011*** (0.001)	-0.005*** (0.001)
Income(>50q)		0.004*** (0.001)	
Income(>50q)*Policy Shock _{t-1}		-0.011*** (0.002)	
Income(25-50q)			0.004*** (0.001)
Income(50-75q)			0.006*** (0.001)
Income(75-100q)			0.005*** (0.001)
Income(25-50q)*Policy Shock _{t-1}			-0.010*** (0.003)
Income(50-75q)*Policy Shock _{t-1}			-0.014*** (0.003)
Income(75-100q)*Policy Shock _{t-1}			-0.019*** (0.003)
Constant		0.0004 (0.001)	-0.001 (0.001)
Household Fixed Effects	Y	Y	Y
MS Region Fixed Effects	N	Y	Y
Observations	59,945	67,859	67,859
R ²	0.001	0.005	0.006
Adjusted R ²	-0.222	0.004	0.004
F Statistic	31.561*** (df = 2; 48994)	3.307*** (df = 108; 67750)	3.520*** (df = 112; 67746)

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level
 (¹ indicates an effect of an increase in gross incomes by 50,000 CHF/Month)

Table A.12: Heterogeneous Effect of Policy Shock on Renting (Initial Homeowners)

	<i>Transitioning to Renting (=1)</i>		
	LPM (1)	LPM (2)	LPM (3)
¹ Gross Income (CHF/Year)	-0.0016*** (0.000)		
Policy Shock _{t-1}	-0.001 (0.003)	-0.013*** (0.003)	-0.017*** (0.005)
Income(>50q)		-0.003** (0.001)	
Income(>50q)*Policy Shock _{t-1}		0.007* (0.004)	
Income(25-50q)			-0.007*** (0.002)
Income(50-75q)			-0.005** (0.002)
Income(75-100q)			-0.009*** (0.002)
Income(25-50q)*Policy Shock _{t-1}			0.008 (0.007)
Income(50-75q)*Policy Shock _{t-1}			0.011 (0.007)
Income(75-100q)*Policy Shock _{t-1}			0.012* (0.007)
Constant		0.033*** (0.009)	0.037*** (0.009)
Household Fixed Effects	Y	Y	Y
MS Region Fixed Effects	N	Y	Y
Observations	25,376	28,957	28,957
R ²	0.001	0.007	0.007
Adjusted R ²	-0.217	0.003	0.003
F Statistic	5.952***	1.758***	1.898***
F Statistic	(df = 2; 20837)	(df = 108; 28848)	(df = 112; 28844)

*Note:** $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level
(¹ indicates an effect of an increase in gross incomes by 50,000 CHF/Month)

Table A.13: Heterogeneous Effect of Policy Shock on Renting (Initial Homeowners)

	<i>Transitioning to Renting (=1)</i>	
	LPM (1)	LPM (2)
3 ^r d Pillar savings	-0.012*** (0.002)	-0.012*** (0.003)
Policy Shock _{t-1}	-0.007 (0.005)	-0.007 (0.005)
Policy Shock _{t-1} *3 ^r d Pillar savings	-0.002 (0.006)	-0.002 (0.006)
Income(>50q)	0.003 (0.004)	
Income(>50q)*3 ^r d Pillar savings	-0.004 (0.004)	
Income(25-50q)		-0.006* (0.004)
Income(50-75q)		0.001 (0.004)
Income(75-100q)		-0.0004 (0.006)
Income(25-50q)*3 ^r d Pillar savings		0.002 (0.005)
Income(50-75q)*3 ^r d Pillar savings yes		-0.004 (0.005)
Income(75-100q)*3 ^r d Pillar savings		-0.005 (0.007)
Constant	0.044*** (0.010)	0.046*** (0.010)
Household Fixed Effects	Y	Y
MS Region Fixed Effects	N	Y
Observations	26,543	26,543
R ²	0.009	0.009
Adjusted R ²	0.005	0.005
F Statistic	2.225*** (df = 110; 26432)	2.207*** (df = 114; 26428)

Note:* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$, standard errors are clustered at the household level

Homeownership, Renting and Market Failures: Evidence from Indian Slums

B.1 Variables Definition

Table B.1: Definition of Variables

Variable Name	Definition	Source
Nighttime lights	Index of night time light radiation The index take a value from 0 (darkest) to 63 (brightest)	NOAA DMSP
Policy coverage	JNNIRM city wise monitoring report	MoHUA
Rents	Monthly rent	Housing Conditions Survey (NSSO)
Males	Household size: male	Housing Conditions Survey (NSSO)
Females	Household size: female	Housing Conditions Survey (NSSO)
Nominal avg. costs	Average monthly consumer expenditure (Rs. in whole no.)	Housing Conditions Survey (NSSO)
No of living rooms	Number of rooms in the dwelling: living rooms	Housing Conditions Survey (NSSO)
No of other rooms	Number of rooms in the dwelling: other rooms	Housing Conditions Survey (NSSO)
Floorarea (sqft)	Floor area of the dwelling	Housing Conditions Survey (NSSO)
Finance	Source of finance of construction during last 5 years: own	Housing Conditions Survey (NSSO)
Finance	Source of finance of construction during last 5 years: govt.	Housing Conditions Survey (NSSO)
Finance	Source of finance of construction during last 5 years: financial institutions	Housing Conditions Survey (NSSO)
Finance	Source of finance of construction during last 5 years: moneylenders	Housing Conditions Survey (NSSO)
Finance	Source of finance of construction during last 5 years: friends and relatives	Housing Conditions Survey (NSSO)
Finance	Source of finance of construction during last 5 years: others	Housing Conditions Survey (NSSO)
Move in	No. of members who moved into the household during last 365 days	Housing Conditions Survey (NSSO)
More out	No. of members who moved out of the household during last 365 days	Housing Conditions Survey (NSSO)
Stayduration	Duration of stay in the slum (years)	Housing Conditions Survey (NSSO)
Source of drinking water	Major source of drinking water	Housing Conditions Survey (NSSO)
Bathroom	Type of bathroom	Housing Conditions Survey (NSSO)
Toilette	Type of toilette	Housing Conditions Survey (NSSO)
Electric wire	Type of electric wiring	Housing Conditions Survey (NSSO)
Structure condit.	Condition of structure	Housing Conditions Survey (NSSO)
Structure type	Type of structure	Housing Conditions Survey (NSSO)
Drainage	Drainage arrangement	Housing Conditions Survey (NSSO)
Garbage disposal	Type of garbage disposal (urban) method	Housing Conditions Survey (NSSO)
Flooded last5yrs	Whether experienced any flood during last 5 years?	Housing Conditions Survey (NSSO)
Approach road	Type of approach road / lane / constructed path	Housing Conditions Survey (NSSO)

Table B.2: Definition of Variables

Variable Name	Definition	Source
Ventilation	Ventilation of the dwelling unit	Housing Conditions Survey (NSSO)
Kitchen	Kitchen type	Housing Conditions Survey (NSSO)
Floor	Floor type	Housing Conditions Survey (NSSO)
Wall	Wall type	Housing Conditions Survey (NSSO)
Roof	Roof type	Housing Conditions Survey (NSSO)
Slum type	Area type in which the house is located	Housing Conditions Survey (NSSO)
Social group	Type of social group	Housing Conditions Survey (NSSO)
Distance to work	Maximum distance (in km) to the place of work normally travelled by any member of the household	Housing Conditions Survey (NSSO)
Residential-cum-others/commercial Independent/apartment house	Use of house	Housing Conditions Survey (NSSO)
Tenure	Type of the dwelling	Housing Conditions Survey (NSSO)
Gender head	Ownership of the dwelling	Housing Conditions Survey (NSSO)
Land possessed	Gender of the head of household	Housing Conditions Survey (NSSO)
	Area of land possessed (0.00 ha)	Housing Conditions Survey (NSSO)

B.2 Descriptive Graph



Figure B.1: Tenure Choice

Source: Author's own calculation. The graph depicts the distribution of the growth rate of nighttime light intensity from year 1992-2013 in controlled and treated districts.

B.3 Survey Methods and Sample Design

NSSO adopts the similar methodology for all surveys, however, little differences might exist. The methodology of NSSO urban slum survey can be described as follows.

Outline of sample design: A stratified multi-stage design was adopted for all surveys. The first stage units (FSUs) in the urban sector were Urban Frame Survey (UFS) blocks. For the survey of slums, there was unlike the other consumption surveys, no second stage of sampling involved for the selection of households. Nevertheless, the paragraphs that follow will refer to the sampling units for the slum survey as FSUs.

Sampling Frame for First Stage Units: For the urban sector, the list of latest updated/available Urban Frame Survey (UFS) blocks was considered as the sampling frame.

Stratification in Urban sector: Within the urban areas of a district, each town with population of 10 lakhs or more as per population census 2011 formed a separate basic stratum and the remaining urban areas of the district were together considered as another basic stratum.

Sub-Stratification: Each stratum was divided into 2 sub-strata as follows:

sub-stratum 1: all UFS blocks having area type slum areas
sub-stratum 2: remaining UFS blocks

Total sample size (FSUs): A total number of 306 UFS blocks formed the state sample as against the 153 UFS blocks in the central sample.

Allocation to strata/sub-strata: Within each sector of a state/UT, the sample size was allocated to the different strata in proportion to the 12 stratum populations as per Census. Stratum allocations were distributed among the two sub strata in proportion to the number of blocks in the

sub strata. The minimum allocation for each sub strata was 2. Equal number of samples had been allotted among the two sub rounds.

Selection of UFS Blocks: The NSS urban frame survey blocks were used for all towns and cities. From each stratum/substratum (formed from UFS towns), the UFS blocks were selected using simple random sampling without replacement (SRSWOR). The FSU samples were selected in the form of two independent sub-samples and an equal number of FSU samples were allocated to the two sub-rounds. Also, an additional sample of UFS Blocks in the form of sub-sample 3, equal to the number of sample UFS blocks in each of the sub-sample 1 and 2, was allocated to the sub-stratum 1 only.

Survey on urban slums: Information on each slum, notified or non-notified, found in the entire selected FSU was collected. In case the slum was spread over more than one FSU, only the part within the selected FSU was surveyed and considered as one slums.

B.4 Urban Reforms

¹ States/ULBs will be required to implement the mandatory reforms and optional reforms within the mission period ². The States/ULBs need to choose at least two optional reforms each year for implementation. The details of reforms which have already been implemented and/or proposed to be taken up should be included in the detailed project reports.

¹ source: Guidelines for Integrated Housing & Slum Development Programme (IHSDP), Ministry of Housing and Urban Poverty Alleviation, Government of India, December 2005.

²These reforms were implemented in different stages for different states. E.g., UL-CRA 1976 was not changed in Mumbai (formerly: Bombay) and Kolkata (formerly: Calcutta). However, in the research design the IHSDP policy that I aim to quantify do not cover major metropolitan cities. It aims to cover only small urban towns and cities. Another leg of JNNURM program known as BSUP was designed to cover major metropolitan cities which forms the control group in the study. Also, the detailed data that I have used intuitively deals with the differential implementation problem.

B.4.1 Mandatory Urban Reforms: Urban Local Body Reforms

(i) Adoption of modern, accrual-based double entry system of accounting in Urban Local Bodies. (ii) Introduction of system of e-governance using IT applications like GIS and MIS for various services provided by ULBs. (iii) Reform of property tax with GIS, so that it becomes major source of revenue for Urban Local Bodies (ULBs) and arrangements for its effective implementation so that collection efficiency reaches at least 85% within the Mission period. (iv) Levy of reasonable user charges by ULBs/Parastatals with the objective that full cost of operation and maintenance is collected within the Mission period. However, cities/towns in North East and other special category States may recover at least 50% of operation and maintenance charges initially. These cities/towns should graduate to full O&M cost recovery in a phased manner. (v) Internal earmarking within local body budgets for basic services to the urban poor. (vi) Provision of basic services to urban poor including security of tenure at affordable prices, improved housing, water supply, sanitation and ensuring delivery of other already existing universal services of the government for education, health and social security.

B.4.2 Mandatory Urban Reforms: State Level Reforms

(i) Implementation of decentralization measures as envisaged in Seventy Fourth Constitutional Amendment. States should ensure meaningful association/engagement of ULBs in planning function of Parastatals as well as delivery of services to the citizens. (ii) Rationalisation of Stamp Duty to bring it down to no more than 5% within the Mission period. (iii) Enactment of community participation law to institutionalize citizen participation and introducing the concept of the Area Sabha in urban areas. (iv) Assigning or associating elected ULBs into city planning

function over a period of five years; transferring all special agencies that deliver civic services in urban areas and creating accountability platforms for all urban civic service providers in transition.

B.4.3 Optional Reforms

(i) Repeal of Urban Land Ceiling and Regulation Act. (ii) Enactment of Public Disclosure Law to ensure preparation of medium-term fiscal plan of ULBs and release of quarterly performance information to all stakeholders. (iii) Revision of bye-laws to streamline the approval process for construction of buildings, development of sites, etc. (iv) Simplification of legal and procedural frameworks for conversion of agricultural land for non-agricultural purposes. (v) Introduction of Property Title Certification System in ULBs. (vi) Earmarking at least 20-25% of developed land in all housing projects (both Public and Private Agencies) for EWS/LIG category with a system of cross subsidization. (vii) Introduction of computerized process of registration of land and property. (viii) Revision of bye-laws to make rain water harvesting mandatory in all buildings to come up in future and for adoption of water conservation measures. (ix) Bye-laws on reuse of recycled water. (x) Administrative reforms, i.e., reduction in establishment by bringing out voluntary retirement schemes, non-filling up of posts falling vacant due to retirement etc., and achieving specified milestones in this regard. (xi) Structural reforms (xii) Encouraging Public-Private partnership.

Urbanisation and Slum Growth: Evidence from India

C.1 Variables Definition

Table C.1: Definition of Variables

Variable Name	Definition	Source
Nighttime lights	Index of night time light radiation The index take a value from 0 (darkest) to 63 (brightest)	NOAA DMSP
Urban Growth	Percentage change in urbanization over a decade (2001-2011)	Census of India
Slum Growth	Percentage change in slums over a decade (2001-2011)	Census of India
Rents	Monthly rent	Housing Conditions Survey (NSSO)
Males	Household size: male	Housing Conditions Survey (NSSO)
Females	Household size: female	Housing Conditions Survey (NSSO)
Nominal avg cons	Average monthly consumer expenditure (Rs. in whole no.)	Housing Conditions Survey (NSSO)
Floor area (sqft)	Floor area of the dwelling	Housing Conditions Survey (NSSO)
Move in	No. of members who moved into the household during last 365 days	Housing Conditions Survey (NSSO)
Move out	No. of members who moved out of the household during last 365 days	Housing Conditions Survey (NSSO)
Stay duration	Duration of stay in the slum (years)	Housing Conditions Survey (NSSO)
Migrated	whether the household moved to the present area during last 365 days	Housing Conditions Survey (NSSO)
Electricity	Primary source of energy for lighting	Housing Conditions Survey (NSSO)

C.2 Survey Methods and Sample Design

NSSO adopts the similar methodology for all surveys, however, little differences might exist. The methodology of NSSOs urban slum survey can be described as follows.

Outline of sample design: A stratified multi-stage design was adopted for all surveys. The first stage units (FSUs) in the urban sector were Urban Frame Survey (UFS) blocks. For the survey of slums, there was unlike the other consumption surveys, no second stage of sampling involved for the selection of households. Nevertheless, the paragraphs that follow will refer to the sampling units for the slum survey as FSUs.

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(i) Adoption of modern, accrual-based double entry system of accounting in Urban Local Bodies. (ii) Introduction of system of e-governance using IT applications like GIS and MIS for various services provided by ULBs. (iii) Reform of property tax with GIS, so that it becomes major source of revenue for Urban Local Bodies (ULBs) and arrangements for its effective implementation so that collection efficiency reaches at least 85 (iv) Levy of reasonable user charges by ULBs/Parastatals with the objective that full cost of operation and maintenance is collected within the Mission period. However, cities/towns in North East and other special category States may recover at least 50% of operation and maintenance charges initially. These cities/towns should graduate to full O&M cost recovery in a phased manner. (v) Internal earmarking within local body budgets for basic services to the urban poor. (vi) Provision of basic services to urban poor including security of tenure at affordable prices, improved housing, water supply, sanitation and ensuring delivery of other already existing universal services of the government for education, health and social security.

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Curriculum Vitae

Education

02/2015 - 10/2020	PhD in Economics and Finance (PEF program) University of St. Gallen; supervisor Prof. Guido Cozzi, PhD; grade 5.25 Dissertation title: Essays in Real Estate and Urban Economics - Large scale national household survey data and econometrics (using R) - Policy design and empirical analysis
08/2019 - 09/2019	Advanced Doctoral Courses Study Center Gerzensee
06/2017 - 06/2017	Global School Empirical Research Methods (GSERM) University of St. Gallen
02/2015 - 06/2016	Course Phase of PhD in Economics and Finance (PEF program) University of St. Gallen; grade 4.5
09/2012 - 06/2013	Master of Arts (M2 Professional) in Risk Engineer : Finance and Insurance University of Paris 1 - Pantheon Sorbonne; focus on mathematical finance
09/2011 - 06/2012	Master of Arts (M2 Research) in Empirical and Theoretical Economics (ETE) Paris School of Economics (PSE); Ecole Normale Supérieure (ENS) Cachan; University of Paris 1 - Pantheon Sorbonne; - focus on macroeconomics
09/2010 - 06/2011	Master of Arts (M1) in Mathematical Modeling in Economics and Finance (MMEF) University of Paris 1 - Pantheon Sorbonne
08/2006 - 05/2009	Bachelor of Arts (Honors) in Economics University of Delhi, India
07/2007 - 06/2009	Diploma in French Language University of Delhi, India; Equivalent level - B2
08/2002 - 07/2007	High School Green Fields School, New Delhi, India; specialization in economics and mathematics

Work Experience

07/2018 - 12/2020	Research Assistant University of St. Gallen; chair Prof. Guido Cozzi, PhD - Design and development of lecture materials - Creating and upgrading various databases for research projects - Creating the final exam
01/2017 - Present (Spring Semester)	Teaching: Macroeconomics 1 University of St. Gallen - Exercise sessions and supervision of academic term papers
11/2014 - 12/2017	Research Assistant University of St. Gallen; chair Prof. Roland Fuess, PhD - Design, development and upgrading of lecture materials - Creating weekly exercise materials and grading the academic projects and the final exam - Creating various databases for research projects
06/2013 - 12/2013	Internship: Sovereign Credit Data Analyst AXA GIE, Paris, France - Creating large and detailed macroeconomic time series databases for Emerging Markets and U.S.A. - Creating dashboards and regular automated upgrading of the databases - Providing investment team with the analysis of the economic health of various countries to determine sovereign credit risk - Automating mechanism to consolidate and upgrade Bloomberg sovereign ratings for 64 countries
10/2008 - 10/2008	Data Collection: Field Work Centre for Development Economics, Delhi School of Economics, India - Field survey of usage of polythene bags in commercial areas - Creating survey questionnaires and conducting market interviews

Econometrics Skills

02/2015 - 06/2016	Causal Inference, Time Series Econometrics, Micro-econometrics, Macro-econometrics, Spatial Econometrics
06/2017 - 06/2017	Econometrics of Big Data

IT Skills

Software	LaTeX, Stata (<i>Intermediate</i>), EViews (<i>Intermediate</i>), R (<i>Proficient</i>)
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Language Skills

English	Proficient
French	Effective operational proficiency - Intermediate Diploma education in French
German	Beginner
Hindi	Native speaker
Sanskrit	Very good

Working Papers

2016 - 2017	Gupta, N. (2020). Monetary Policy, User Cost and Inequality: Homeowners versus Renters. <i>Working Paper</i> - Empirical analysis of the impact of an unexpected monetary policy on Swiss homeowners and renters - Policy relevance for Swiss National Bank and real estate market
2018 - 2019	Gupta, N. (2020). Homeownership, Renting and Market Failures: Evidence from Indian Slums. <i>Working Paper</i> - Empirical analysis of the impact of the national slum housing policy on urban slum dwellers - Policy relevance for national government and development organizations
2019 - 2020	Gupta, N. (2020). Urbanisation and Slum Growth: Evidence from India. <i>Working Paper</i> - Empirical analysis of evolution of slums alongside medium tier urban spaces - Policy relevance for urban planners

Grants and Publications

2015 - 2017	Projektfoerderung des Grundlagenforschungsfonds (GFF) University of St. Gallen - Analyse the impact of monetary policy on the Swiss households.
2017	Gupta, N. (2017). William N. Goetzmann: Money changes everything?how finance made civilization possible. Financial Markets and Portfolio Management, 31(4), 511-514.

Extracurricular Activities

2010 - 2011	President of the Residents Committee at Maison de l'Inde, CIUP, Paris - Member of the Governing Board chaired by the Ambassador of India to France - Representation of resident students' interests - Participation in bi yearly meetings of the governing board
2010	Consortium Scholarship of 50% fee reduction at University of Paris 1 - Pantheon Sorbonne
2007	Third position in fine arts competition ULLAS, University of Delhi.
2007	First position in creative writing competition in French, University of Delhi.
2006	Best answer award in Fresher's competition, University of Delhi.
Interests	History, politics, technology, big datasets Reading, writing, painting, skating, badminton, traveling, hiking, horse riding

Personal Particulars

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