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Financial Inclusion and Wages: Theory and Evidence from Agriculture and Industry in India

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data from more than 300 districts observed over the period 1990 to 2020, we find robust evidence in support of the key prediction. District level estimates of the effects of financial depth (credit and savings) on wages indicate robust positive effect (USD 0.14/day). This is further reinforced by matching estimates of the effects of Pradhan Mantri Jan-Dhan Yojana (PMJDY) on agricultural wages (USD 0.30/day) at the district level. Note that PMJDY is the largest financial inclusion programme in the world. Finally, we find positive effects of PMJDY on the wages of industrial workers using the Consumer Pyramids Household Survey (CPHS) longitudinal dataset for the period 2014-2020 with 211,228 households and about 3 million observations.

JEL codes: G21, G28, J3, O16

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2nd March 2026

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1 Introduction

A large literature examines the effect of financial development on economic growth. Levine (2005, 2018) and Panizza (2014) presents excellent reviews of this literature. It is now largely axiomatic that modern market economies are heavily financialised and they use finance as the main instrument to aid investment and increasingly consumption expenditure. The rationale for financial development is that it assists in reducing risk and transaction costs associated with savings mobilization and investment. Indeed, nearly all economies in the world have adopted a combination of bank and market base financial systems and evidence suggests that on balance this has aided economic expansion and poverty reduction (Levine, 2005; Beck et al., 2007). Studies have also explored the merits and demerits of alternative financial structures in terms of growth (Levine, 2002; Tadesse, 2002) and their political origins (Bhattacharyya, 2013).

Despite the large volume and significance of this literature, its focus has primarily been on financial depth measured by the 'private credit-to-GDP' ratio. Such a seemingly narrow focus invariably led to far less scrutiny of the general equilibrium effects of financial access and inclusion.

In this paper, we address the financial inclusion and development question. We specifically focus on wages as a measure of development at the district and household levels. We follow the following methodology to analyse the effect of financial inclusion on development. First, we build a two-period general equilibrium model to analyse the effect of banking access (financial inclusion) on wages. In this model, agents (households) vary by the degree of financial access and we compare households with and without banking access. We calibrate this model by matching the parameters with key parameters of the Indian economy. We also augment the two-period model with sharecropping and interlinked contracts – two very specific features of the agricultural labour market in India and other emerging markets. Our general equilibrium results survive even under such a scenario. We then extend the standard two-period model to N-periods and demonstrate that the key simulation results hold. In the N-period model, we allow for heterogeneous agents (households) by their access to banking with a proportion of the population remaining financially excluded due to the deposit fee charged by the banks. We model financial inclusion through a waiver of the deposit fee paid for by a government subsidy (fiscal intervention). Second, we take our general equilibrium results to the data and estimate the reduced form effects of total credit and total savings on agricultural wages in India at the district level. The estimated effects are sizeable and is of the order of USD 0.14 per day. Our baseline sample covers more than 300 districts observed over the period 1990 to 2020. Total credit and total savings are crude measures

of financial inclusion and we are unable to assign causality with GMM and fixed effects estimates. Therefore, we utilise the predominantly rural uptake of India's largest financial inclusion programme, the Pradhan Mantri Jan-Dhan Yojana (PMJDY) as an identifier and use matching estimators. Again the effects are positive and sizeable. Finally, we estimate the effect of PMJDY on the wages of industrial workers using the Consumer Pyramids Household Survey (CPHS) longitudinal dataset.

Our findings can be summarised as follows. First, we find that in general equilibrium financial inclusion through a reduction in the policy parameter of required reserve ratio expands banking and credit access that aids investment and consumption smoothing. Investment and consumption smoothing thereby contributes to wage growth. Financial inclusion is also found to be welfare improving and the results are consistent across the two-period, interlink contract augmented, and N-period models. Second, we find strong positive effects of the aggregate credit and savings on agricultural wages using district level data. Third, we present the matching estimates and find that PMJDY indeed contributed to the expansion of agricultural wages. Finally, using the CPHS dataset we find that PMJDY had a positive effect on the wage income of industrial workers. Therefore, we find strong evidence in support of the general equilibrium effects of financial inclusion on agricultural wages and wage income of the industrial workers.

Our definition of financial inclusion both in the theoretical models as well as empirical estimation is closely guided by PMJDY. We focus on deposit bank account access as an indicator of financial inclusion which is largely the aim of the PMJDY scheme. However, we do recognise alternative ways of capturing financial inclusion. For example, Besley et al. (2024) approach financial inclusion from the perspective of contract theory, credit market expansion and their consequences on the labour market and entrepreneurship. They present a micro founded model of financial contracts with moral hazard. Broader motivation of their paper is to understand the trade off between empowerment and financialisation in the US economy. They also explore general equilibrium effects with financial frictions, endogenous default, varying contracting environment, and wealth inequality. They parametrise their model using US data. In contrast, our model focuses on rollout of deposit bank accounts to the unbanked and studying its general equilibrium effect on productivity and welfare in the context of PMJDY and the Indian economy. Since our focus is on the extreme poor and their access to basic deposit bank account in predominately rural areas of an emerging market economy, we abstract away from contracting frictions and assets as collateral. Furthermore, we parametrise our model based on the Indian economy and PMJDY as opposed to credit markets in an advanced economy such as the US. Finally, we also present econometric estimates of the effects of PMJDY on agricultural and industrial wages in India.

Our paper relates to the classical literature on finance and development that go back to at least Bagehot (1873) and Schumpeter (1911). Bagehot (1873) emphasizes resource allocation function of finance in generating economic growth. Schumpeter (1911) highlights how finance aids scale economy which is an integral part of innovation, creative destruction and economic growth. Hicks (1969) in his analysis of the industrial revolution in Britain demonstrate the significance of maturity transforming and fixed cost absorbing role of finance especially in investment projects involving large fixed capital formation. Patrick (1966) takes the view that finance guides supply and follows demand in aiding economic expansion. In a similar vein, Gurley and Shaw (1955) and Goldsmith (1969) take the view that finance assists in mobilizing resources from the low-return traditional sector to the fast growing high-return modern sector. On the demand side, Robinson (1952) and Kuznets (1955) observes that the demand for external finance from firms and consumers expand rapidly with the steady expansion of economic activities. However, Lucas (1988) remains unconvinced by the argument that finance exerts strong positive effect on growth and renders it to be often overstated. Other notable contributions in this literature are McKinnon (1973), Shaw (1973), and Reinhart and Rogoff (2009). Reinhart and Rogoff (2009) observe that more countries transitioned away from a planning-based model towards a market-based model of finance since the 1970s which has contributed towards increased financialization.

More recent econometric studies of the finance growth nexus include King and Levine (1993), Levine (1998; 1999; 2005), La Porta et al. (1998), Levine et al. (2000), Beck et al. (2000), and Demirguc-Kunt and Levine (2008). They typically follow the instrumental variable approach using legal origin as an instrument for financial development or use the dynamic GMM on cross-country panel datasets to estimate the effect of financial development on growth in GDP per capita. In contrast, Rajan and Zingales (1998) and Aghion et al. (2005) focus on the effect of finance on industrial growth and economic convergence.

Our paper also relates to the literature on the distributional consequences of finance. Rajan and Zingales (2003) find that finance benefits only those from the upper income segment of the society whereas Banerjee and Newman (1993), Galor and Zeira (1993), Beck et al. (2004), Beck et al. (2007), and Beck and Demirgüç-Kunt (2008) emphasize the pro-poor effects of financial intermediation especially in low income countries. Ayyagari et al. (2020), Kochar (2011), and Burgess and Pande (2005) offer further evidence on the pro-poor effects specifically related to India.

Finally, our paper relates to a literature on financial structure and development. Boyd and Smith (1998) present a general equilibrium model demonstrating expansion of market-based finance with modernization as total demand for finance can no longer be serviced by banks alone. Larger firms and corporations then finance their investments externally

through a combination of debt and equity. Given brand recognition of these large firms, they are in a position to issue both debt and equity contracts directly via financial markets without intermediation from the high street banks. Chakraborty and Ray (2007) in a general equilibrium model illustrate expansion of market-based finance with modernization as moral hazard related monitoring cost for the wealthy clients decline for financial institutions.

Despite the large volume of literature cited above broadly assessing the effect of finance on growth and development, it is noteworthy that the focus has been on financial depth rather than financial access or inclusion. General equilibrium effects of financial access and inclusion has not been studied extensively which is what we set out to do here by building a model and also testing the model predictions in a reduced form by conducting an impact analysis of the largest financial inclusion programme in the world, the PMJDY.

The remainder of the paper is structured as follows: Section 2 presents the general equilibrium models. First, it introduces a two-period model and associated simulations. It is then followed by an augmented model to capture idiosyncratic characteristics of the Indian agricultural labour market such as interlinked contracts. Finally, it presents an N-period model. Section 3-5 takes the key predictions of the model to reduced form econometrics. It introduces data, methods and district level estimates of the effects of financial depth measured by aggregate credit and savings on agricultural wages. This is then followed by matching estimator estimates of the effects of PMJDY on agricultural wages at the district level. Finally, it also presents the estimated effects of PMJDY on industrial worker wage income using the CPHS household dataset. Section 6 concludes.

2 Financial Inclusion and Wages: Two-period, N-period and Interlinked Contract Augmented Models

We build general equilibrium models to examine the mechanism through which financial inclusion affects wage. We present first a two-period model to derive closed form analytical solutions and clear economic intuition. We then augment the two-period model with interlinked contracts, a specific feature of agricultural labour market in developing countries. We then extend the model to N-periods by incorporating phased roll-out of a financial inclusion program and fiscal intervention by the government. Restricting the model to N-periods assists in keeping the model tractable in deducing analytical solutions.

We define two states according to the availability of financial services. Although imperfect, this simple two-period framing implicitly captures heterogeneity of households by financial access under the two states. State 1 is the state with no financial services. In

state 1, workers are hand-to-mouth households who only consume what they earn within the period while firms use existing stocks of capital for production. State 2 is the one with financial services thanks to the promotion of the financial inclusion program. In State 2, banks provide financial services to workers (in form of deposits) and firms (in form of loans).

2.1 The Basic Two-period Model

There are households, firms, banks and the government/central bank in the model. Households are heterogeneous under the two states with state 1 characterising absolute financial exclusion and state 2 financial inclusion.

2.1.1 Households

The representative household/worker chooses C_1, C_2, S_1 to maximizes their utility in both periods:

$$U_0 = u\left(C_1\right) + \beta u\left(C_2\right)$$

subject to the following budget constraints[1]:

$$C_1 + S_1 = w_1 L_1 + \left(1 + r_{d,0}\right) S_0,$$

and

$$C_2 + S_2 = w_2 L_2 + \left(1 + r_{d,1}\right) S_1.$$

C_t and S_t denotes consumption and saving of the household. w_t is the real wage rate in period t. $r_{d,t}$ denotes the deposit rate and $\beta \in (0, 1)$ is the subjective discount factor.

The transversality condition indicates $S_2 = 0$. Assume zero initial savings: $S_0 = 0$. Assume also $L_1 = L_2 = \bar{L}$. That is, households provide inelastic labour supply to firms, reflecting the facts of a large population size and abundant agricultural labour supply which is a common feature in many developing countries. Utility maximization yields the familiar consumption Euler equation:

$$\frac{u'\left(C_1\right)}{u'\left(C_2\right)} = \beta\left(1 + r_{d,1}\right). \tag{1}$$

2.1.2 Firms and Production

We assume that at the beginning of period 1 firms are endowed with K_0 stock of capital. Firms take the initial stock of capital as given and put it into production without external

[1]Note that in the simple model with perfectly competitive markets, representative firm profit is zero and thus there is no dividend payment by firms to households in the budget constraints.

financing. Firms use this capital stock and hire labour to produce output as follows:

$$Y_1 = A_1 K_0^{\alpha} L_1^{1-\alpha}.$$

A_1 is the level of technology set exogenously and L_1 is the level of employment of workers. Assuming a perfectly competitive labour market, the real wage rate is equal to the marginal product of labour (MPL):

$$w_1 = (1-\alpha)\frac{Y_1}{L_1}. \tag{2}$$

After completion of production in period 1, firms obtain loans from banks to invest in capital accumulation. Denote I_1 as the investment, which is equal to the amount of loans. K_1 is the stock of capital at the end of period 1. The capital accumulation schedule is given by

$$K_1 = (1-\delta)K_0 + I_1,$$

where δ is the capital depreciation rate.

The newly accumulated capital is then used in period 2 production. Note that this refers to the "time to build" framework which states that it takes one period to transform investment into productive capital. Output in period 2 is thus given by

$$Y_2 = A_2 K_1^{\alpha} L_2^{1-\alpha},$$

with A_2 and L_2 are defined analogously.

Assuming perfectly competitive labour and credit markets, the wage rate and the loan rate are equal to the MPL and the marginal product of capital (MPK), respectively:

$$w_2 = (1-\alpha)\frac{Y_2}{L_2}. \tag{3}$$

$$1 + r_{l,1} = \alpha\frac{Y_2}{K_1}. \tag{4}$$

As assumed previously, $L_1 = L_2 = \bar{L}$.

2.1.3 Banking Sector

In this simple two-period model financial services in state 2 are accessible only in period 1. Households deposit D_1 into banks after receiving their wages from the firms. Banks then utilize the deposits and extend loans I_1 to firms after setting aside the required reserves RR_1

as stipulated by the central bank. In period 2, firms pay back the principle and interest of the loans to the bank and households withdraw the deposits with interest from the bank. There are no further saving or lending in period 2.

The balance sheet of a representative bank consists of assets and liabilities. In the simplest case, liabilities of the bank are deposits from households, D_1, the assets are loans to firms, I_1, and required reserves RR_1. We assume $RR_1 = \rho D_1$, where $0 < \rho < 1$ is the reserve requirement ratio set by the central bank.

The accounting identity of the balance sheet indicates that

$$D_1 = I_1 + RR_1,$$

or as

$$I_1 = (1 - \rho) D_1. \tag{5}$$

The bank's profit maximization problem is given by

$$\max \Pi_1^b = r_{l,1} I_1 - r_{d,1} D_1$$

s.t. equation (5). This profit maximization yields

$$r_{l,1} = \frac{1}{1 - \rho} r_{d,1}. \tag{6}$$

Note that the loan rate is higher than the deposit rate in the presence of reserve requirement, even in the simple setting. Furthermore, ρ can be regarded as a proxy for measuring the degree of financial inclusion. The smaller the RRR, the more credit (and deposit) is available in the financial market, the more financially inclusive the economy is. As ρ approaches 1, no fund is available in the market, workers and firms are effectively cut off from financial access.

2.1.4 Equilibrium Conditions

In the labour market, labour demand and supply are both equal to the labour endowment $L_t = \bar{L}$ and the wage rate reflects the marginal product of labour at a given level of technology, capital stock and labour endowment.

In the capital market, the cost of investment (loan) is equal to the return on capital in production as in equation (4).

In the financial market, households' saving is equal to the bank deposit:

$$D_1 = S_1.$$

2.1.5 Analytical Solutions

Assume that the utility function takes the following form:

$$u\left(C_t\right) = \log C_t.$$

We solve the model for $C_1\ C_2\ S_1\ D_1\ I_1\ K_1\ Y_1\ Y_2\ r_{d,1}\ r_{l,1}\ w_1\ w_2$ given $K_0\ L_1\ L_2\ A_1\ A_2$. Details of solutions are presented in Appendix A.

2.1.6 Comparative Statics

Before we present simulation results, it is useful to examine the wage response to financial inclusion using comparative statics. Specifically, taking a partial derivative of equation (3) with respect to D_1 we get.

$$\frac{\partial w_2}{\partial D_1} = \alpha\left(1-\alpha\right) A_2 K_1^{\alpha-1} L_2^{-\alpha} \frac{\partial K_1}{\partial D_1} = \alpha\left(1-\alpha\right) A_2 K_1^{\alpha-1} L_2^{-\alpha}\left(1-\rho\right) > 0.$$

That is, getting access to financial services such as bank deposits increases the worker's wage in the next period. Increased deposits expand the bank's lending capacity to firms. This is evident from equation (5):

$$\frac{\partial I_1}{\partial D_1} = 1 - \rho > 0.$$

With increased loans from the bank, firms are able to invest more to accumulation of capital for production in the next period. Crucially increased capital raises labour productivity and thus wage.

2.1.7 Two-State Equilibrium

State 1: No Financial Access

In State 1 workers do not have access to bank deposits and firms do not have access to bank credit.

$$D_1 = 0$$
$$I_1 = 0.$$

Without savings or investment,

$$K_1 = (1 - \delta) K_0.$$

$$Y_1 = A_1 K_0^{\alpha} L_1^{1-\alpha}$$
$$Y_2 = A_2 K_1^{\alpha} L_2^{1-\alpha}.$$

$$C_1 = w_1 L_1$$
$$C_2 = w_2 L_2$$

The household becomes a hand-to-mouth agent, consuming what the wage income can afford. And the wage is determined by

$$w_1 = (1 - \alpha) A_1 K_0^{\alpha} L_1^{-\alpha}$$
$$w_2 = (1 - \alpha) A_2 K_1^{\alpha} L_2^{-\alpha}.$$

State 2: With Financial Access

State 2 is the financially inclusive state. We have specified this state of the economy in earlier sections. In particular,

$$S_1 = D_1 > 0$$
$$I_1 = (1 - \rho) D_1 > 0.$$

With access to financial services, households are able to optimally intertemporally smooth consumption via financial instruments such as deposits. This enables firms to invest more and accumulate more capital for production via financial instruments such as loans, which in turn raises labour productivity and wages, as demonstrated by equations (2) and (3). This is the first-order effect. With higher wage income, households are able to deposit more in the banks in the next period, ceteris paribus. This then sets in motion another round of financial inclusion promoting growth and income.

In the N-period model which is introduced below, this positive loop consisting of the first-, second- and higher-order effects of the financial inclusion leads to permanent increase in household wage income that catapults the economy to improved living standards.

2.1.8 Calibration and Simulation

We calibrate the parameters such that it matches some of the key parameters of the Indian economy. The calibration values are reported in Table 1.

We use MATLAB to solve the model numerically. The model is under perfect foresight with no uncertainty. Figure 1 plots the evolution of deposit, credit, and wages in response to change in the degree of financial inclusion, i.e. ρ takes values from the range [0, 1). As introduced while discussing the two-period model, we can use RRR as a proxy indicator of financial inclusion. The larger the RRR, more deposits are required to be set aside and less are available for bank lending to the firms. Therefore, less new capital is accumulated for subsequent use in production. Labour productivity slackens given technology and the level of labour supply, and wages stagnate. Figure 1 illustrates the mechanism through which financial inclusion affects wages. In summary, as ρ declines (moving from left to right on the X-axis), the extent of financial inclusion increases and so does deposit, loans and wages.

Figure 2 plots the percentage change in welfare in State 2 (with financial access) relative to the same in State 1 (no financial access) as a function of ρ. We notice that relative welfare gain of state 2 increases as the extent of financial inclusion deepens.

2.2 An Augmented Two-Period Model with Interlinked Contracts

Subsistence farming is a common feature of the rural economy in emerging markets. Households located in the rural areas of such an economy are also typically unbanked. In the absence of access to formal banking services, these households often use informal credit markets characterised by interlinked contracts with informal moneylenders. Moneylenders are usually land owners with strong ties to the local community. Subsistence farmers work in these lands and also borrow from the landowner to meet input cost and reduce consumption volatility. Landowners frequently use sharecropping contracts with the subsistence farmers to mitigate lending risk. The lending rate levied under sharecropping is often very high in order to cover the cost of lending and the risk of borrowing.

With the introduction of financial inclusion, these farmers can access safer and cheaper bank credit. Note that bank credit is cheaper than informal borrowing because of scale economies and lower operational cost.

Next we set up an interlinked contract augmented two-period model to demonstrate the mechanism through which financial inclusion improves income and welfare of the unbanked households.

Period 1 Informal Credit from a Moneylender

The representative unbanked household maximizes her utility

$$U_1 = \log(C_1)$$

subject to the budget constraint:

$$C_1 = (1-\theta) Y_1 - r_m K_1$$

and

$$Y_1 = A_1 K_1^{\alpha}.$$

where C_1 Y_1 K_1 are consumption, output and credit of the household in period 1. Without loss of generality, we assume that labour input is fixed and normalized to unity. Nevertheless, wage rate is still equal to the marginal product of labour. Importantly, since the agent is a subsistence worker, they use labour for subsistence production but do not receive wage income. θ is the rate of sharecropping with the moneylender and r_m is the corresponding lending rate.

Given θ and r_m the subsistence agent optimally chooses K_1 to maximize the following indirect utility function:

$$\max_{K_1} \log\left[(1-\theta) A_1 K_1^{\alpha} - r_m K_1\right].$$

It yields

$$\alpha (1-\theta) A_1 K_1^{\alpha-1} - r_m = 0.$$

That is,

$$K_1 = \left[\frac{\alpha (1-\theta) A_1}{r_m}\right]^{\frac{1}{1-\alpha}}. \tag{7}$$

The representative moneylender maximizes her profit

$$\Pi_1 = \theta Y_1 + r_m K_1 - \delta_m K_1$$

subject to the choice of credit of the subsistence agent in equation (7). The optimal choice of θ^* and r_m^* is obtained from the profit maximization with the expression K_1 substituted in.

$$\max_{\theta, r_m} \Pi_1 = \theta A_1 \left[\frac{\alpha (1-\theta) A_1}{r_m}\right]^{\frac{\alpha}{1-\alpha}} + (r_m - \delta_m) \left[\frac{\alpha (1-\theta) A_1}{r_m}\right]^{\frac{1}{1-\alpha}}$$

That is

$$\text{FOC 1 with respect to } \theta = 0$$
$$\text{FOC 2 with respect to } r_m = 0$$

We now have two equations with two unknowns and we use numerical methods to derive solutions.

Period 2 Formal Banking Credit under Financial Inclusion

In period 2, the subsistence agent receives access to formal banking due to the financial inclusion initiative.

The representative agent then maximizes her utility

$$U_2 = \log(C_2)$$

subject to the budget constraint:

$$C_2 = Y_2 - r_b K_2$$

and

$$Y_2 = A_2 K_2^{\alpha},$$

where r_b is the bank lending rate. The rest of the variables are defined analogously to that of period 1.

The optimality condition with respect to bank credit K_2 is given by

$$K_2 = \left[\frac{\alpha A_2}{r_b}\right]^{\frac{1}{1-\alpha}}. \tag{8}$$

Note that the subsistence agent do not need to share any output to banks. The representative bank's profit is given by

$$\Pi_2 = r_b K_2 - \delta_b K_2.$$

Discussion

Banks face lower lending cost relative to the moneylenders ($\delta_b < \delta_m$), which allows banks to offer cheaper credit to the agent. The effective interest rate of the bank is also likely lower than that of the moneylender, $r_b < r_m$.

In addition, banks require zero sharecropping so farmers obtain the whole output. Equations (7) and (8) indicate that $K_1 < K_2$.

With increased volume of credit, farmers are able to produce more and with higher labour

productivity, $Y_1 < Y_2$ and $w_1 < w_2$ notionally. Farmers enjoy higher consumption $C_1 < C_2$ and utility, $U_1 < U_2$, due to formal lending and financial inclusion.

Calibration and Simulation

Table 2 reports calibration results in the two-period model with interlinked contracts. The simulations show that if the moneylender optimally choose both sharecropping and lending rates to maximize profit, then they would choose $\theta = 1$ which is reflective of absolute bargaining power of the moneylenders in this model. To address this, we fix θ at a empirically reasonable level, in order to demonstrate the impact of informal borrowing on credit and consumption. Note that, higher credit and output implies higher labour productivity and wages.

In figure 3, sharecropping rate is fixed at $\theta = 0.2$, which implies the optimal lending rate by moneylenders is $r_m^* = 0.3$.

In figure 4, sharecropping rate is increased to $\theta = 0.5$. We find that profit-maximizing moneylenders set a lower lending rate $r_m^* = 0.14$ due to the large share of output they receive from the subsistence agent. However, compared to formal bank lending, credit and output under interlinked contract is still sufficiently low resulting into lower consumption and welfare.

2.3 An Extended N-period Model

In this section, we extend the simple two-period model to an N-period model, incorporating a number of important features observed in the data. The extension to N periods allow us to incorporate the additional features that we were not able to accommodate in a two-period model. The important features of the N-period model are as follows. First, heterogeneity of households by financial access is only implicit in the two-period model. Whereas we model heterogeneity of households (agents) explicitly in the N-period model by including a deposit fee and modelling only a fraction of the total population to be financially included in the initial period. Second, the financial inclusion program, i.e., the PMJDY program (whose effect we study empirically in section 3), was rolled out incrementally at a time-varying rate. There was a Phase 1 in 2014-15 and a Phase 2 in 2015-18. After the two phases, the Indian government announced the program would continue indefinitely until the entire population gets access to basic financial services. The two-period model cannot capture it but this feature is modelled explicitly in the N-period model.

Third, prior to the PMJDY program, there was already a small fraction of the population with access to financial services. The PMJDY program was designed to include the remaining

population in a timely manner. This feature is not captured in the two-period model which assumes that the population has zero access in the beginning and then full access in the second period. However, this is explicitly modelled in the N-period model.

Fourth, banks incur operational costs when hosting household deposit accounts. Therefore, they charge a deposit fee. This feature is nor included in the two-period model but is included in the N-period model.

Fifth, the government utilise fiscal policy tools to incentivise expansion of deposit accounts or financial inclusion. Government can offer subsidy to banks in exchange for no deposit fee for previously unbanked customers. This additional feature is also introduced in the N-period model.

2.3.1 Population Dynamics

Suppose the government plans to provide financial services to a targeted population $\bar{L}$ in N periods. Assume that in the beginning of the roll-out, there is x_0 share of the targeted population that is already financially included. For any given time $t \in [1, N]$, the share of the population that newly enrols into the financial inclusion program is x_t. x_t is predetermined by data and captures the dynamic pace of the government's grant plan.

Denote L_t^i be the size of the population that is financially included at time t. We have

$$L_t^i = L_{t-1}^i + x_t \bar{L},$$

or as

$$L_t^i = \left(x_0 + \sum_{j=1}^{t} x_j \right) \bar{L}.$$

Denote L_t^e be the financially excluded population, and it is given by

$$L_t^e = \bar{L} - L_t^i.$$

2.3.2 Households

Households with Financial Access

The representative household with financial access maximizes welfare:

$$\max U_1^i = \sum_{t=1}^{N} \beta^t u\left(C_t^i\right)$$

subject to the budget constraint:

$$C_t^i + S_t = w_t + (1 + r_{d,t-1}) \frac{L_{t-1}^i}{L_t^i} S_{t-1} (1 - \theta)$$

for any $t \in [1, N]$ and a transversality condition

$$\lim_{t \to \infty} \beta^t S_t = 0.$$

S_t is what the household saves and deposits in the bank in period t.[2] There is no saving or lending in the final period. The ratio L_{t-1}^i / L_t^i is the size of the financially included households over time.

$\theta \in [0, 1)$ is the banking fee parameter which is a share of the deposit that the bank charges when the household makes a deposit. Therefore, when $\theta = 0$, there is no banking fee. Further details are introduced in the Banking Sector section.

Optimization yields the following familiar Euler equation:

$$\frac{u'(C_t^i)}{u'\left(C_{t+1}^i\right)} = \beta (1 + r_{d,t}) (1 - \theta) \frac{L_{t-1}^i}{L_t^i}.$$

Households with No Financial Access

The representative household/worker with no financial access is a hand-to-mouth consumer. That is, she consumes all that her wage income can afford. Her welfare is given by

$$U_1^e = \sum_{t=1}^{N} \beta^t u(C_t^e)$$

and the budget constraint is

$$C_t^e = w_t.$$

We assume each representative household provides a constant and unitary level of labour to firms regardless of their financial inclusiveness status. Thus, the wage rate is determined by the marginal product of labour only. We argue that despite the difference in financial access, the two types of households have the same labour endowment. Note that accessing financial services is almost exclusively because of policy and is not related to the household's own preference for work or skills. Also note that it is households in remote or rural areas

[2]Note that we do not explicitly model asset. Households save in their deposit account and earn interest income. Assets either in the form of stocks or in the form of bonds could be modelled with government as an optimising agent. This will not qualitatively alter the model results.

who are underserved by financial services. Labour supply in these areas are often plentiful.

Aggregate Welfare

The aggregate welfare of the country is defined as the population weighted average of utilities of the included and excluded households:

$$U_1 = \sum_{t=1}^{N} \beta^t \left[L_t^i u\left(C_t^i\right) + L_t^e u\left(C_t^e\right) \right].$$

2.3.3 Firms and Production

Output is produced according to the following Cobb-Douglas production function:

$$Y_t = A_t K_{t-1}^{\alpha} L_t^{1-\alpha},$$

where Y_t is the output, A_t is exogenously set technology, K_t is the stock of capital at the end of time t, and L_t is labour supply. We have assumed $L_t = \bar{L}$. Note that even though the relative size of the two types of households is time-varying, the total labour supply is fixed and equal to the population $\bar{L}$.

Given the production function, the MPK and the MPL is respectively

$$\begin{aligned} MPK_{t-1} &= \alpha A_t K_{t-1}^{\alpha-1} L_t^{1-\alpha} = \alpha Y_t / K_{t-1} \\ MPL_t &= (1-\alpha) A_t K_{t-1}^{\alpha} L_t^{-\alpha} = (1-\alpha) Y_t / L_t. \end{aligned}$$

The representative firm hires workers and borrows from banks for investment in accumulating new capital for production. It pays workers real wage rate w_t and the bank net loan rate $r_{l,t}$. Assuming perfectly competitive labour and credit markets, we have

$$w_t = MPL_t.$$

and

$$1 + r_{l,t} = MPK_t.$$

The capital accumulation condition is given by

$$K_t = (1-\delta) K_{t-1} + I_t.$$

2.3.4 The Banking Sector

We start with the balance sheet accounting identity of a representative bank. The liabilities of the bank are deposits from the financially included households,

$$D_t = L_t^i S_t.$$

Suppose that the commercial bank charges a fee F_t when handling the deposits. The fee is assumed to be proportional to the amount of the deposits, $F_t = \theta D_t$, $0 \leq \theta < 1$. It contributes to the bank's revenue when deposit transactions occur, so the actual interest bearing deposit that the representative household deposits into the bank is $(1-\theta) D_t$.

As in the two-period model, the assets of the bank include loans to firms, I_t, and required reserves, RR_t. Note that, $RR_t = \rho (1-\theta) D_t$ since the total amount of deposit reduces proportionally due to the fee charged.

The accounting identity of the balance sheet is given by

$$(1-\theta) D_t = I_t + RR_t.$$

The rationale behind the bank fee is that there are transaction costs for managing deposits under financial inclusion. Unbanked clients would come to the bank to open a savings account for the first time incurring staff and non-staff costs. We denote the transaction cost as E_t and assume it is directly proportional to the scale of the deposit, $E_t = c (1-\theta) D_t$, $0 < c < 1$.

- **With No Fiscal Intervention**

The bank's profit maximization problem is given by

$$\max \Pi_t^b = r_{l,t} I_t + F_t - r_{d,t} (1-\theta) D_t - E_t$$

s.t.

$$\begin{aligned} (1-\theta) D_t &= I_t + RR_t, \\ RR_t &= \rho (1-\theta) D_t \\ F_t &= \theta D_t \\ E_t &= c (1-\theta) D_t. \end{aligned}$$

The optimality condition with respect to D_t and I_t gives the following condition:

$$r_{l,t} = \frac{r_{d,t} (1-\theta) + c (1-\theta) - \theta}{(1-\rho)(1-\theta)},$$

or as

$$r_{d,t} = r_{l,t}\,(1-\rho) - c + \frac{\theta}{1-\theta}.$$

Note that when $\theta = 0$ and $c = 0$, the condition collapses to equation (6) of the two-period model.

- **With Fiscal Intervention**

In order to support a financial inclusion scheme, the government could offer subsidy to banks if they refrain from charging deposit fees to households. This is targeted to incentivise financial inclusion.

Note that T_t is the government subsidy and it is assumed to be a function of the total deposit, $T_t = \tau D_t$, $0 < \tau < 1$. Upon receiving government subsidy, banks do not charge the deposit fee, $F_t = 0$, but still incur the cost of handling deposits, $E_t > 0$. In particular, the balance sheet of a representative bank reduces to

$$D_t = I_t + RR_t,$$

where $RR_t = \rho D_t$. The profit function of the bank is

$$\max \Pi_t^b = r_{l,t} I_t + T_t - r_{d,t} D_t - E_t$$

s.t.

$$\begin{aligned} D_t &= I_t + \rho D_t \\ E_t &= c D_t \\ T_t &= \tau D_t \end{aligned}$$

The optimality condition from profit maximization is

$$r_{l,t} = \frac{r_{d,t} + c - \tau}{1-\rho}.$$

Again in the absence of transaction cost and government subsidy, the optimality condition reduces to be equation (6) of the two-period model.

2.3.5 Market Clearing Conditions

Analogous to the two-period model, labour demand and supply are equal to labour endowment $L_t = L_t^i + L_t^e = \bar{L}$. Furthermore, wages are equal to the marginal product of labour in a perfectly competitive labour market given technology, capital stock and labour endowment.

In the capital market, the cost of investment (loan) is equal to the return on capital and in the financial market, bank deposits are equal to the savings of the financially included households:

$$D_t = L_t^i S_t.$$

2.3.6 System of Equations at Equilibrium

There are 12 equations and 12 unknowns (C_t^i C_t^e S_t w_t L_t^i L_t^e Y_t K_t I_t D_t $r_{l,t}$ $r_{d,t}$) for any period t in the extended N-period model. There are two versions of this system of equations subject to the presence or absence of fiscal intervention.

Version 1: With no fiscal intervention, $\theta > 0$, $\tau = 0$.

$$L_t^i = L_{t-1}^i + x_t \bar{L}.$$

$$L_t^e = \bar{L} - L_t^i.$$

$$C_t^i + S_t = w_t + (1 + r_{d,t-1}) \frac{L_{t-1}^i}{L_t^i} S_{t-1} (1 - \theta)$$

$$\frac{(C_t^i)^{-\sigma}}{\left(C_{t+1}^i\right)^{-\sigma}} = \beta (1 + r_{d,t}) (1 - \theta) \frac{L_{t-1}^i}{L_t^i}$$

$$C_t^e = w_t$$

$$Y_t = A_t K_{t-1}^{\alpha} \bar{L}^{1-\alpha}$$

$$w_t = (1 - \alpha) Y_t / \bar{L}$$

$$1 + r_{l,t-1} = \alpha Y_t / K_{t-1}$$

$$K_t = (1 - \delta) K_{t-1} + I_t$$

$$D_t = L_t^i S_t$$

$$I_t = (1 - \theta)(1 - \rho) D_t$$

$$r_{d,t} = r_{l,t} (1 - \rho) - c + \frac{\theta}{1 - \theta}.$$

Version 2: With fiscal intervention, $\tau > 0$, $\theta = 0$ only the last equation changes:

$$r_{l,t} = \frac{r_{d,t} + c - \tau}{1 - \rho}.$$

As in the two-period model, there are two states regarding financial access. In State 1, there is no financial inclusion program. Therefore, the share of the financially included

households remain constant over time and is the same as the initial period. In State 2, the gradual roll-out of the financial inclusion program expands the size of the financially included households and reduces that of the financially excluded households.

2.3.7 Calibration and Simulation

Table 3 presents the calibration results for the N-period model. As in the two-period model, they are calibrated to match some key features of the Indian economy which is a subject of this study in the empirical sections.

Figure 5 illustrates how the key variables respond to financial inclusion. It also shows how they evolve over time with the financial inclusion program rolling out at a variable rate over time but uniformly across districts. The gradual roll-out of the program is evident from the top left panel of Figure 5 which plots the proportion of financially included over the sample period. This proportion grows at a variable rate.

3 Data

3.1 Data and Data Sources

General equilibrium models presented in section 2 demonstrates that financial inclusion induces wage growth. To assess the extent of such impact we estimate the effect of financial depth (credit and deposits) on agricultural wages in India. Agricultural wages at the district level are good proxies of wages of the unbanked population. We use unbalanced panel data from 391 out of 741 Indian districts observed annually over the period 1990 to 2020.[3]

Agricultural wages

Agricultural wages are sourced monthly at the village/centre level from various issues of the Agricultural Wages in India (AWI) and then aggregated at the district, state and national levels. It captures three categories of wages, namely, field labour (ploughing, sowing, weeding, and reaping); skilled labour (carpenter, blacksmith, and cobbler); and other agricultural (watering fields, digging wells, and cleaning silt from waterways). AWI reports nominal wages and we convert them to real wages following Berg et al. (2018). We also aggregate the AWI monthly data to annual series and convert them to a log scale. Other recent studies that used AWI and examined its reliability are Kurosaki and Usami (2016), Usami et al. (2020) and Prakash (2023). Despite some challenges with reliability Kurosaki and Usami (2016) confirms that AWI can be used for district-level comparative analysis.

[3]Choice of districts is solely dependent on data availability.

Credit, Deposits and PMJDY

We source district-level credit and deposits data from the Reserve Bank of India's (RBI) Basic Statistical Returns (BSR) of scheduled commercial banks. This comprehensive dataset provides detailed information on the distribution of credit and deposits across various population groups and districts. For our analysis, we aggregate rural, semi-urban, urban and metropolitan credit as total credit by district. Similarly, we also aggregate total deposits by district.

We also use PMJDY as an identifier in our suite of matching estimators (see section 4.2). PMJDY was rolled out across the country in stages. It was first launched in 2014 and it is the largest financial inclusion initiative in the world (Agarwal et al., 2017). Even though the programme was rolled out in stages, it did not have any stage-wise spatial targetting rendering standard district level treatment and control strategy unfit for purpose. Table B.1 presents an analysis of PMJDY accounts per bank type which demonstrates the important role of the Public Sector Banks (PSBs) in the roll-out of the financial inclusion programme. Appendix B1 describes the institutional context in detail.

Control variables

In our baseline model we control for log real GDP per capita, literacy rate, crop intensity, irrigation intensity, and government labour market support policy. Log real GDP per capita controls for the size of the economy at the district level which is an important predictor of wages. Literacy rate measured by the proportion of individuals who can both read and write with understanding in any language among population aged 7 years and above in a particular district is a proxy for human capital. Education and human capital is a predictor of wages and therefore the literacy variable is a legitimate control. Cropping intensity measured by the number of times a crop is planted per year in a district is also a valid control as the intensity of agricultural activities can also predict wages. Similarly, irrigation intensity measured by the ratio of net irrigated area to net sown area is also a valid control of agricultural activities in a district and thus wages. Finally, government workfare programmes can also have significant impact on wages and therefore following Berg et al. (2018) we include the Mahatma Gandhi National Rural Employment Guarantee Scheme (NREGS) dummy variable as a control in alignment with the district level phase-wise rollout of the programme.[4] The choice of controls is guided by the literature on the determinants of agricultural wages in India. See Berg et al. (2018) for a summary of this literature. Table 4 summarizes the data and data sources.

[4]The NREGS provides at least 100 days of guaranteed wage employment in a financial year to adult members of every rural household who agree to do unskilled manual work.

4 Empirical Specification

4.1 Fixed Effects and System Generalized Method of Moments

We estimate the following reduced form model using Fixed Effects (FE) and Generalised Method of Moments (GMM) estimators to test the key prediction of our general equilibrium models that financial inclusion boosts wages.

$$Y_{it} = \delta_t + \eta_i + \beta X_{it} + \varepsilon_{it} \tag{9}$$

Where Y_{it} is log real agricultural wages in district i at time t, η is district fixed effects, δ is time varying common shocks, and X is a matrix of explanatory variables (credit and deposits) as well as control variables. βs are the corresponding coefficients, and ε denotes the error term. The coefficients on credit and deposit are our coefficients of interest.

While FE estimators in equation 9 can be consistent with large N and T (Baltagi and Liu, 2016), however, they are biased with lagged dependent variables (Caselli et al., 1996). To address these issues we also estimate equaltion 9 using dynamic panel estimators.

4.2 Matching Estimators

Aggregate credit and savings are direct measures of financial depth and are only indirect measures of financial inclusion. Therefore, we use nearest neighbour matching (NNM), bias-adjusted NNM, propensity score matching (PSM), and entropy balancing (EB) matching estimators to estimate the effect of financial inclusion proxied by PMJDY on wages. Rosenbaum and Rubin (1983) and Abadie and Imbens (2006) presents theoretical and practical summary of these estimators.

PMJDY was rolled out incrementally but was implemented in all districts at the same time. This implies that there is no clear-cut treatment and control districts. However, the stated objective of targetting the financially excluded offers a window of opportunity for identification. Financially excluded population mostly live in the rural areas. Therefore, we could allocate districts into treatment and control on the basis of their exposure to the financially excluded. We compute the ratio of rural to total population in a district. If this ratio in a particular district is above the median value for the entire sample, then we classify that district as treatment taking the value 1. Otherwise, the district is classified as control taking the value 0.

The control districts are those where PMJDY is implemented with high intensity whereas the treatment districts are low intensity. Our identification strategy thus leverages on the

variation in PMJDY implementation intensity. We also test robustness of our results by using mean ratio of rural to total population as an alternative measure.

Our analysis involves matching a sample of over 300 districts over the period 1990-2020 based on a set of observable characteristics that are theoretically expected to influence both agricultural wages and the likelihood of accessing financial services under PMJDY. We first estimate a logistic equation to identify the control variables that influence the likelihood of PMJDY treatment in a district as well as agricultural wages. This is then followed by the estimation of treatment effects using the significant control variables and the matching estimators. Covariates used in the matching estimator include deposits, credit, NREGS, literacy rates, net sown area, and GDP per capita.

To assess the quality of matching, we examine the balance of covariates between treated and control groups before and after matching using standardized mean differences and variance ratios. We also conduct visual inspections of the distributions of propensity scores and key covariates. We use robust standard errors that mitigates estimation error in the propensity scores for PSM, NNM and Bias-adjusted NNM (Abadie and Imbens (2006)) as well as EB. We also use Rosenbaum (2002)'s R-bounds test to assess robustness against potential unobserved bias.

5 Results

5.1 Credit, Deposits and Agricultural Wages

Table 5 presents summary statistics. Note that the urban areas consistently register higher average value for both credit and deposits relative to the rural and semi-urban areas. This indicates a higher concentration of financial services in the urban areas.

Table 6 presents a correlation matrix and we observe that total credit and deposits are positively correlated with field labour wages. We also observe that the correlation coefficient for rural credit and deposits on the three types of agricultural wages are comparably higher than the correlation coefficients between their urban counterparts. This is perhaps indicative of a larger marginal effect of finance on wages in financially excluded rural areas further justifying the merit of our identification strategy.

Table 7 presents FE and systems GMM results on the effect of credit on agricultural wages. Panels A to C report results for field wages, skilled wages, and other agricultural wages respectively. Columns 1 and 2 present FE and systems GMM estimates without control variables whereas columns 3 to 4 include control variables. Overall, the results in Table 7 reveal a consistent, robust positive relationship between total credit and field labour wages,

even after controlling for additional controls. Under the FE models, a 1 percent increase in credit is associated with a 5.6 percent to 6.7 percent increase in field labour wages. To put this into perspective, a 5.6 percent increase in the average daily wage from a base of Rs 250 (USD 2.5) in a particular district would translate into Rs 14 (USD 0.14) increase. The systems GMM estimates are smaller but still significant.

Panels B and C of Table 7 reports estimates of the impact of credit on the skilled labour and other agricultural labour wages respectively. The estimates are generally positive but not robustly significant across specifications.

Following examination of the effects of credit on wages, in Table 8 we examine the effects of savings measured by total deposits. Credit could be considered a proxy of the investment channel whereas deposit primarily represent consumption smoothing. Panel A reports a robust and positive relationship between deposits and field labour wages with the magnitude ranging from 1.3 percent to 5.8 percent for the FE estimates. For the systems GMM estimates, the estimated effect ranges between 0.7 to 6.3 percent. Similar to Table 7 the estimated effects are not robust for skilled and other agricultural labour.

All GMM estimates reported in Tables 7 and 8 conduct AR(1), AR(2), and Hansen J tests. Roodman (2009) offers an analytical summary of these tests.

In Table 9 we investigate potential heterogeneous effects of credit and deposits on agricultural wages by rural and urban locations. The rural and urban distinction is significant given that majority of the financially excluded population is expected to reside in the rural areas. Indeed we find substantially bigger and robust effects of rural credit and rural deposits on field labour wages. The effects of urban credit and deposits are not statistically significant. Table 9 reports standardised coefficients and one standard deviation in rural credit translates into 16.3 percent increase in field labour wages for the GMM estimates.

Table 10 reports on the impact of rural and urban credit and deposits on skilled labour wages. We find strong and robust positive effects of rural credit on skilled wages with the magnitude of the standardised coefficients ranging from 1.2 to 20.3 percent. The effect of rural deposit on skilled wages is also positive in the majority of the specifications but is not as robust as the effect of rural credit. Unsurprisingly, urban credit and urban deposit appears to have no significant effect on skilled labour agricultural wages.

Table 11 presents estimates of the effects of rural and urban credit and deposits on other agricultural labour wages. The effect of urban credit is also found to be positive and robust but not all specifications meet the diagnostic test criteria for validity.

Overall, the results are consistent with Burgess and Pande (2005) who found increased credit access in rural India due to the rural bank branch expansion policy. They are also consistent with Parida and Roy Chowdhury (2021) who found that availability of banking

facilities leads to higher agricultural wages. The observed positive effects of rural credit on skilled wages is perhaps indicative of the entrepreneurship channel as emphasised by **?**.

5.2 PMJDY and Agricultural Wages

Figure 6 plots real field labour agricultural wages over time by treatment and control groups and before and after PMJDY implementation in 2014. We observe a generally upward trend in real wages for both groups, although the levels are different. Unsurprisingly, wages for the control group (financially included) are consistently higher than those for the treated group (financially excluded). The parallel trends assumption is met if the slopes (i.e. growths rates of wages across the two groups) are similar. Although the pre-2014 trends are visually not perfectly parallel but they do follow a reasonably similar pattern. We also observe that after PMJDY implementation, both groups continue to show wage growth. The wage gap narrows slightly but remains persistent.

Next, we use matching estimators to assess the impact of PMJDY on all three categories of agricultural wages. Table 12 presents the results of the Average Treatment Effect on the Treated (ATET), which in this case is the average effect of impact of PMJDY in districts with higher rural population compared to districts with lower rural population. Columns 1 and 2 present results using NNM with 1 neighbour and 4 neighbours respectively, whereas columns 3 and 4 are results using bias-adjusted NNM with 1 and 4 neighbours. Columns 5 and 6 reports PSM results and column 7 reports entropy balancing. Overall, the matching estimates indicate significant and positive average treatment effects of PMJDY across all categories of agricultural wages. This implies that, on average, districts with a high rural population ratio have relatively higher agricultural wages as a result of the PMJDY, ceteris paribus. In particular, the magnitude of the effect ranges between 4.7 percent and 10.7 percent for field labour; 6.2 percent and 9.9 percent for skilled labour; and between 5.3 percent and 11.5 percent for other agricultural labour. To put this into perspective, a 10.7 percent increase in field labour wages[5] would translate into Rs 27 (USD 0.30) increase in daily wages and Rs 675 (USD 7.50) increase in monthly income.

Note that, bias-adjusted NNM estimates are consistently smaller than NNM estimates likely due to bias correction in the NNM estimates. Finally, the PSM and EB estimates also reaffirm positive and robust impacts of PMJDY across all three categories of wages.

To validate the results of matching estimators presented in Table 12, we conduct four diagnostic tests. First, balance tests are conducted to ensure that the matching procedure

[5]Assuming average daily wage at Rs 250. Note that daily agriculture wage rate varies across districts and states.

has created comparable treated and control groups. In Figure B.1 we find that the balance condition is satisfied as the bias after matching is within the 25 percent threshold.

Second, we assess the overlap (common support) condition to ensure that there is sufficient overlap in propensity scores between the treatment and control groups. Figure B.2 demonstrates that the overlap condition is met.

Third, to assess robustness to potential hidden bias, we conduct a sensitivity analysis using Rosenbaum (2002)'s R-bounds test. This analysis assists in determining how strong an unobserved confounding factor would need to be to alter the conclusions of our findings. We report the critical γ values at which the treatment effect becomes insignificant. Higher gamma values indicate greater robustness to potential hidden bias. A common rule of thumb on robustness threshold is that the treatment effect remains significant up to γ =1.25 or γ= 1.5. Table B.2 present R-bounds test results and the estimates appear to be robust to unobserved confounding factors. Panel A for field labour wages and Panel C for other agricultural labour wages show that the effect remains significant up to $\gamma = 1.5$ and becomes insignificant at γ =1.75. Panel B indicates that for skilled labour wages the effect remains significant up to $\gamma = 1.25$ but becomes insignificant at γ =1.5.

Fourth, in Table B.3 we subject the matching estimators to entropy balancing. Panel A reports initial differences between the treatment and control districts without weighting. We observe notable differences in means and variances of several variables. Thus, in Panel B we apply entropy balancing as a weighting variable to adjust the control group to match the treatment group at the first moment (mean) for all variables. We observe that balancing of the treatment and control groups at the first moment is achieved at two decimal places. This further improves reliability of the estimates.

Finally, one criticism of our matching estimators is that it conducts matching over 1990–2020 and includes variables such as credit and deposits, which PMJDY itself could affect after 2014 and thereby contaminate the treated–control comparison. Therefore, as a robustness check we construct the matching covariates using pre-treatment 2010-2013 averages. Table B.4 presents these results and they are robust.

5.3 PMJDY and Wage Income of Industrial Workers

The effect of a financial inclusion programme such as PMJDY may not be confined to the agricultural sector alone. Therefore, we complement our analysis with Consumer Pyramids Household Survey (CPHS) dataset complied by the Centre for Monitoring the Indian Economy (CMIE) to analyse the effect of PMJDY on wage income of industrial workers. CPHS offer longitudinal data. It commenced in January 2014 and it collects data from over 100,000

households across the country in every 4 months. Therefore, there are three waves in a year and for each wave, the entire sample is split into four such that in each month around 25 percent of the total households are surveyed. This implies that every year a household is surveyed three times. Every time a household is surveyed, they are asked to provide information for the past four months. Thus, we have monthly data on each household and we construct a panel of households over the months of 2014 and 2020, thus covering household-level data for the first 21 waves of the survey. The income from wages data is adjusted for inflation using CPI estimates from the RBI. To address attrition, we only use data for households which entered the sample at the beginning of the survey.

We do not observe the type of bank accounts that these households hold. Therefore, we have to adopt an indirect method to identify the effects of PMJDY on wage income of industrial workers. We construct a measure of financial exclusion based on the percentage of individuals with a bank account in each district. We then compute the national median of this percentage[6]. We define financial exclusion as a binary variable that takes the value 1 for districts where the proportion of bank account holders is below the national median or 0 otherwise. These districts are rendered financially excluded and therefore are prime targets for government intervention on financial inclusion. Table 13 illustrates how the mean of the proportion of bank account ownership has evolved within a household pre and post PMJDY implementation. Although the dataset does not identify the type of bank account opened, it indicates a clear surge in the number of bank accounts immediately after the launch of PMJDY in August 2014 which was during wave 2 of CPHS.

We use a standard difference-in-difference (D-i-D) design to estimate the effect of PMJDY on wage income of industrial workers using monthy data. We compare the differences in outcomes between financially excluded and financially included districts before and after the PMJDY implementation in August 2014. A trend comparison presented in Figure 7 show consistently higher wage income in financially included (control) districts than in financially excluded (treated) districts both before and after implementation of PMJDY.

We estimate the following equation:

$$\begin{aligned} \ln wages_{hm} = \beta_0 + \beta_1 \cdot Post + \beta_2 \cdot \text{financially excluded} \\ + \beta_3 \cdot Post \cdot \text{financially excluded} + \beta_4 \cdot Y_{hm} \\ + FE_h + FE_m + u_{hm} \end{aligned} \tag{10}$$

[6]To define financial exclusion, we use median and not mean to mitigate the influence of outliers and skewness in the distribution of financial access. For example, some districts, especially in urban areas would have high levels of bank account penetration which would disproportionately increase the national mean. In contrast, the median would provide a more robust threshold to classify districts into financially included or excluded groups.

The dependent variable is $lnwages_{hm}$, the log of real income from wages for household h in month m. Given that PMJDY was implemented in August 2024, we define Post-PMJDY as a dummy variable that takes the value of 1 if the month falls after August 2014 and 0 otherwise. Financially excluded is another dummy variable that takes the value of 1 if a household is in a financially excluded district and 0 otherwise. β_3, is our coefficient of interest which captures whether the impact of PMJDY on wage income in the financially excluded districts is different from the financially included districts. To address potential bias and endogeneity concerns, we incorporate a set of household-level control variables Y_{hm} such as size group, age group, education group, gender group and region type. We also control for month (FE_m) and household fixed effects (FE_h) and use robust standard errors clustered at the district-level. These results are presented in Table 14. Our coefficient of interest is positive and statistically significant. The finding implies that financially excluded districts show a relatively greater increase in wage income for industrial workers as a result of the implementation of PMJDY.

6 Conclusion

Finance is the vital artery that nourishes modern economies. It allows economic agents to hedge against risks associated with consumption, investments, government expenditure, and international trade. Yet a large number of economic agents mostly located in low income and emerging market economies are often excluded from access to finance. Remoteness, technology and policy bottlenecks, and weak contracting institutions are often presented as constrains restricting financial access.

A large literature studies the effect of financial depth on productivity growth. However, general equilibrium effects of financial inclusion on productivity is studied far less despite its significance for economic development. In this paper, we specifically focus on financial inclusion and study its general equilibrium effects on productivity and welfare. We construct three general equilibrium models. First, we draw inference from a two-period model, analytical solutions and associated simulations. The model demonstrates productivity improving effects of financial inclusion through consumption smoothing and investment channels. Introduction of banking to the unbanked assists them to smooth their consumption that generates additional demand. Furthermore, additional deposits mobilized by the banks from the previously financially excluded facilitates capital accumulation by the firms which then generates output growth. These mechanisms improve labour productivity and wages. We also demonstrate that financial inclusion is welfare improving.

Second, we take this baseline intuition to an N-period model and find that it holds in such

an environment. The N-period model is able to accommodate features such as incremental take up of a financial inclusion programme, bank deposit fee, and government subsidy to banks for participating in the programme. The subsidy element allows us to study the role of fiscal policy in this general equilibrium environment.

Third, the financially excluded in an emerging market economy is often exposed to informal moneylenders. To study and capture this feature, we augment the two-period model with interlinked contracts where the informal moneylender is also the landlord. The baseline intuition of financial inclusion being wage and welfare improving survives in this environment.

We then take the baseline intuition to the data and estimate a reduced form model. We use district level data from 391 districts in India observed over the period 1990 to 2020 and find that credit and deposits have sizeable positive effects on agricultural field wages. We then test the impact of PMJDY on agricultural wages using matching estimators and the conclusions remain unchanged. PMJDY has a sizeable impact on wages in the treatment districts.

Finally, we estimate the impact of PMJDY on wage income of the industrial workers using longitudinal household data, the CPHS. The positive effect of PMJDY on wages is also observed in this DiD environment.

What are the potential implications of our model and results? Financial inclusion unambiguously improves wages and the general equilibrium effects are both from the demand and supply sides. The effect is sizeable in the Indian context which is up to USD 0.30 per day. This is almost a third of the notional global poverty line of a dollar a day. Therefore, there is a strong case for implementing financial inclusion programmes such as the PMJDY in low income countries in order to address Sustainable Development Goal (SDG) 1: No Poverty.

Financial inclusion incontrovertibly mitigates liquidity constraints for the poor. Formalisation and expansion of banking access unambiguously extends scale economy which generates demand and investments. Therefore, expansion of finance not just in terms of depth but also access is essential for modernisation and economic transformation of societies.

Financial inclusion invariably has implication for other outcome variables which we have not studied here. It can have heterogeneous impact by space, identity, and governance. Therefore, understanding distributional consequence of financial inclusion policies would also be vital for the ultimate success of inclusion in addressing current and future global challenges.

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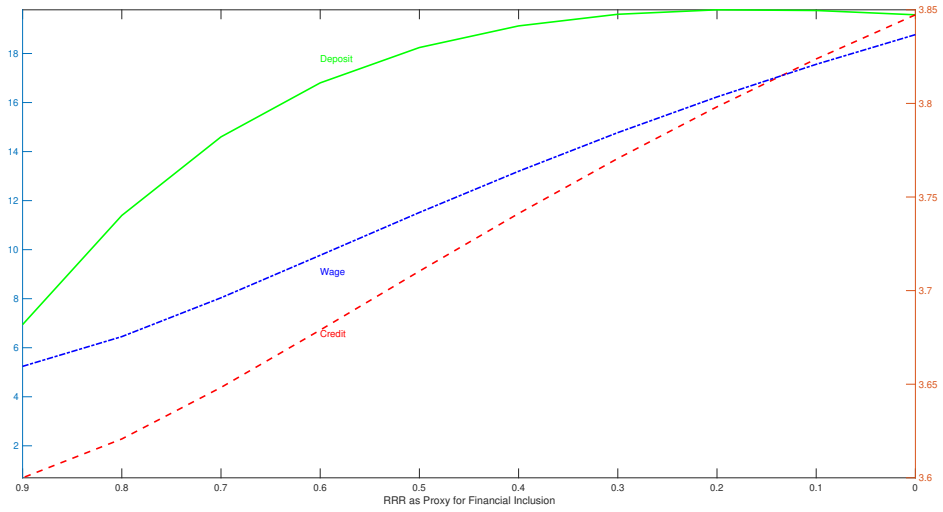
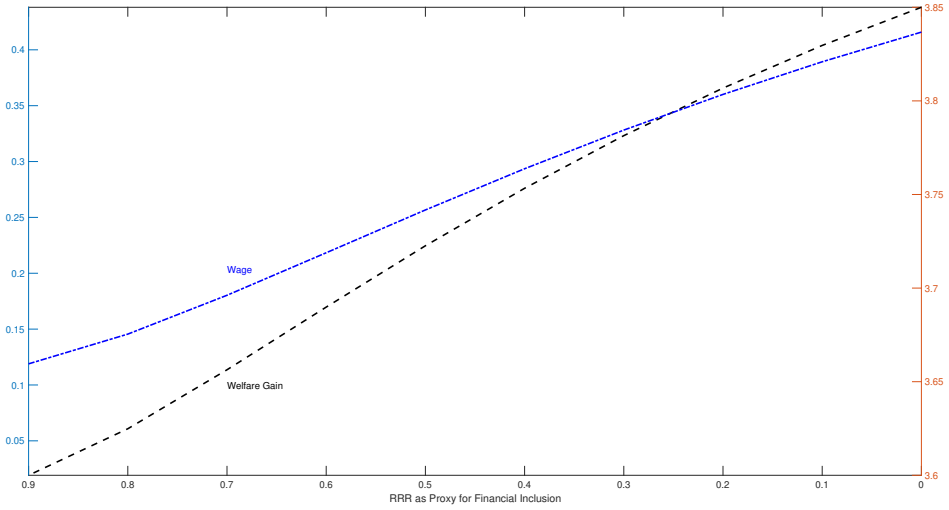
Figure 1: Responses of Deposit, Loans, and Wage to Increasing Financial Inclusion in Two-period Model



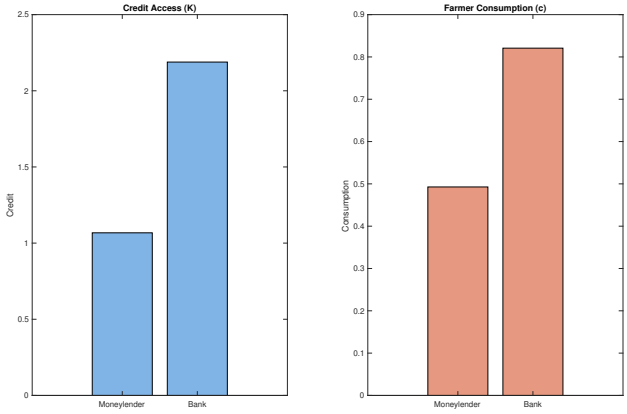
As reserve ratio ρ declines from left to right (increased FI), deposits and credit expand, enabling higher capital accumulation. This raises labour productivity and wages in period 2.

Figure 2: Welfare Gains in Response to Increasing Financial Inclusion in Two-period Model



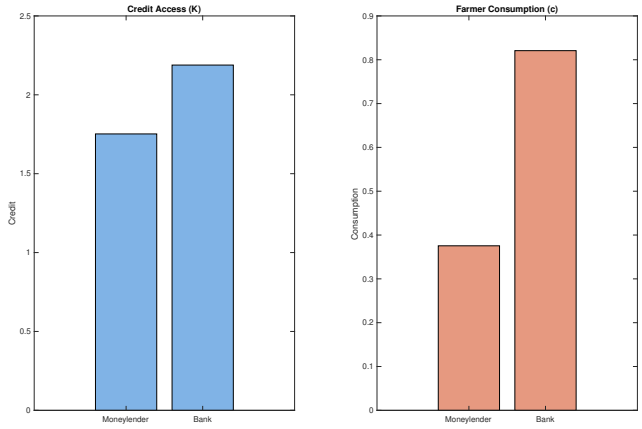
The graph shows welfare gains from FI (State 2) relative to financial exclusion (State 1). As the reserve ratio ρ declines, households enjoy greater welfare through consumption smoothing and higher lifetime income.

Figure 3: Credit and Consumption of Farmers in Informal Borrowing and Formal Borrowing, $\theta = 0.2$



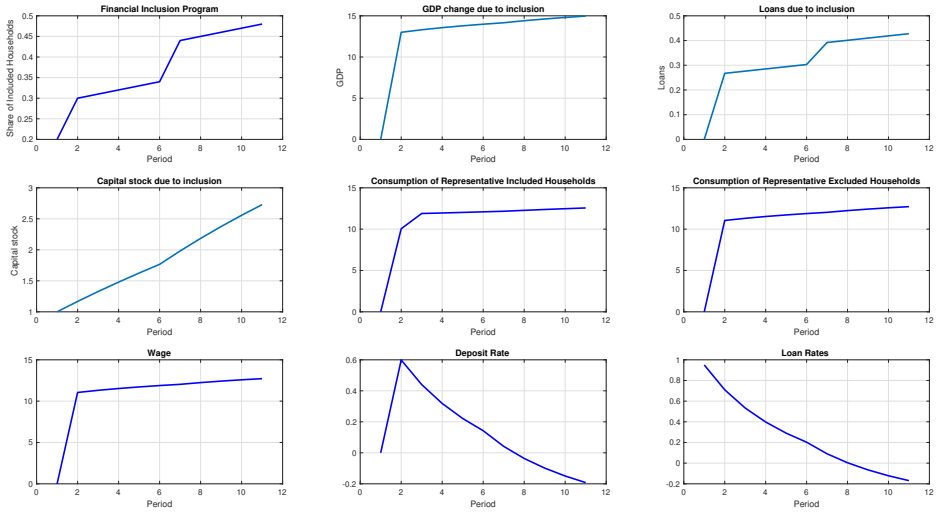
With sharecropping rate $\theta = 0.2$, moneylenders optimally set lending rate $r_m^* = 0.3$. Formal bank credit substantially dominates informal borrowing, enabling higher credit access, output, and consumption for farmers previously reliant on interlinked contracts.

Figure 4: Credit and Consumption of Farmers in Informal Borrowing and Formal Borrowing,



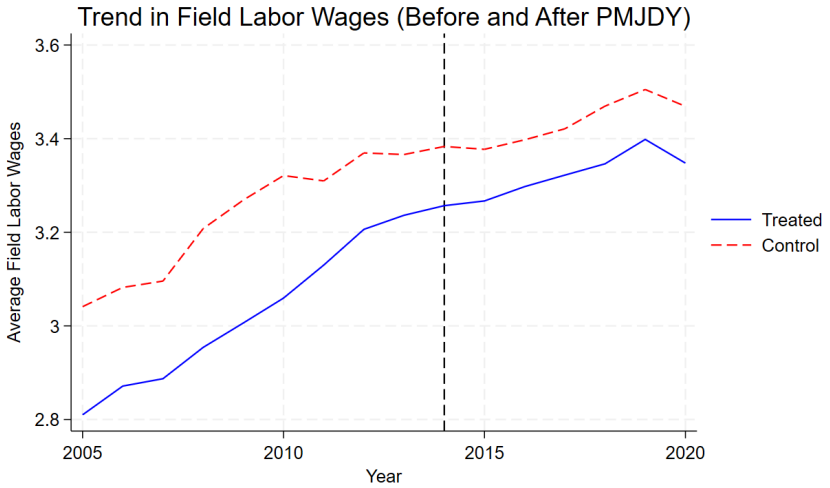
When sharecropping increases to $\theta = 0.5$, moneylenders extract more output but charge lower interest ($r_m^* = 0.14$) due to the large share of output they receive. Even under this arrangement, formal banking access delivers substantially higher credit and consumption compared to informal borrowing.

Figure 5: Impulse Responses of Key Variables as Financial Inclusion Program Rolls Out Gradually in N-period Model



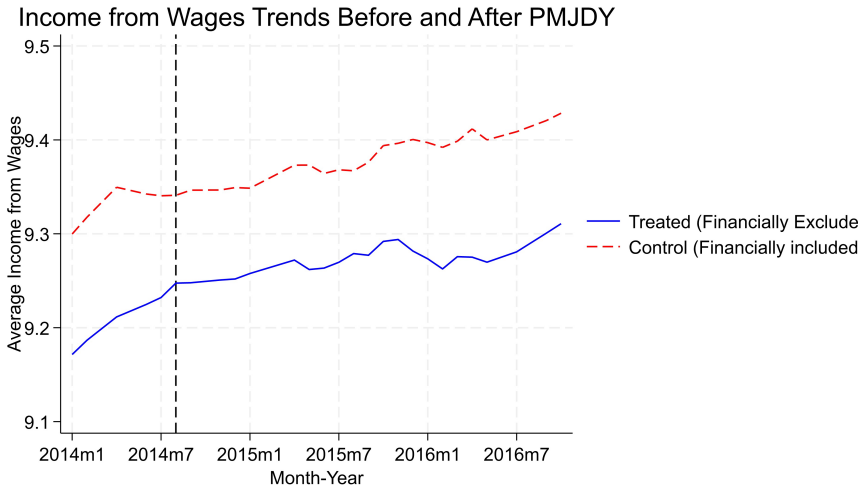
The IRFs show the evolution of key variables as FI expands over time. The proportion of financially included households rises gradually, triggering positive responses in deposits, credit, capital, and wages. The positive effects persist and amplify through feedback loops.

Figure 6: Trend in real field labour wages: Before and after PMJDY (AWI data



Note: Field labour wages in logs. Treated districts are those with rural population share above the median (high PMJDY intensity). Control districts have rural population share below the median (low PMJDY intensity). The vertical dashed line indicates PMJDY implementation in August 2014. Pre-treatment trends are reasonably parallel, supporting the parallel trends assumption.

Figure 7: Trends in Income from Wages before and after PMJDY: CPHS Data



Note: Average income from wages in logs (CPHS household survey data, 2014-2020). Treated districts are those with proportion of bank account holders below the national median (financially excluded). Control districts have bank account penetration above the median (financially included). The vertical dashed line indicates PMJDY implementation in August 2014. Pre-treatment trends are broadly parallel, supporting the identifying assumption for the difference-in-differences analysis. Control districts consistently show higher wage income.

Table 1: Calibration of Model Parameters and Predetermined Variables in the Two-period Model

Name	Description	Value
β	Subjective discount factor	0.98
α	Share of capital in production	0.25
δ	Capital depreciation rate	0.1
ρ	Reserve requirement ratio	0.1
A_1	Level of technology in period 1	5
A_2	Level of technology in period 2	5
$\bar{L}$	Total labour population	100
K_0	Initial stock of capital in period 0	100

Table 2: Calibration of Model Parameters and Predetermined Variables in the Two-period Model with Interlinked Contract Component

Name	Description	Value
α	Share of capital in production	0.4
δ_m	Cost of funds of moneylenders	0.2
δ_b	Cost of funds of banks	0.1
A_1	Level of technology in period 1	1
A_2	Level of technology in period 2	1
θ	Sharecropping rate of moneylenders	0.2

Table 3: Calibration of Model Parameters and Predetermined Variables in the N-period Model

Name	Description	Value
β	Subjective discount factor	0.95
σ	Risk aversion in N-period model	10
α	Share of capital in production	0.15
δ	Capital depreciation rate	0.1
ρ	Reserve requirement ratio	0.1
N	Total periods of financial inclusion program	10
A_1	Level of technology in period 1	13
A_2	Level of technology in period 2	13
$\bar{L}$	Total labour population	1
K_0	Initial stock of capital in period 0	100
x_0	Initial share of financially included population	0.2
θ	Parameter related to depositing fees	0.01
c	Parameter related to banks' operational costs	0.05
τ	Parameter related to the subsidy to banks	0.01

Table 4: List of variables

Variable notation	**Description**	**Source**
field labour	Log of real field labour wages in Indian Rupee (INR) per day (ploughing, sowing, weeding and reaping)	Agricultural Wages in India (AWI) data from Ministry of Agriculture and Farmers Welfare
Skilled labour	Log of real skilled labour wages in INR per day (carpenter, blacksmith and cobbler)	AWI data from Ministry of Agriculture and Farmers Welfare
other agricultural labour	Log real Other agricultural wages in INR/day (watering fields, digging wells and cleaning silt from waterways)	AWI data from Ministry of Agriculture and Farmers Welfare
Tota credit	Log of total credit (all types of credit facilities such as cash credit, overdrafts, demand loans, term loans & bills discounted/purchased and factored receivables)	Reserve Bank of India (RBI)'s Basic Statistical Returns (BSRs) of scheduled commercial banks
Total deposits	Log of total deposits (current deposits, savings bank deposits and term deposits)	BSRs from RBI
rural credit	Log of rural and semi-urban credit	BSRs from RBI
rural deposits	Log of rural and semi-urban deposits	BSRs from RBI
Urban credit	Log of urban and metropolitan credit	BSRs from RBI
Urban deposits	Log urban and metropolitan deposits	BSRs from RBI
Percapita gdp	Log of real GDP per capita	National Statistical Office, Ministry of Statistics and Programme Implementation
litrate	Literacy rate (%). proportion of persons who can both read & write with understanding in any language among population aged 7 years and above	Office of the Registrar General and Census Commissioner, Ministry of Home Affairs
MNREGA	National employment program implemented from 2007. Takes the value of 1 if MNREGA was active in a district, and 0 otherwise.	Ministry of Rural Development
Cropping intensity	Number of times a crop is planted per year in each agricultural area	Land Use Statistics- At a Glance, Ministry of Agriculture and Farmers' Welfare
Irrigation intensity	Ratio of net irrigated area to net sown area	Land Use Statistics- At a Glance, Ministry of Agriculture and Farmers' Welfare

Table 5: Summary statistics in logs for various categories of labour, credit, and deposits

	Mean	SDev	Min	Max	Obs
Field labour	3.02	0.55	-2	7	8117
Skilled labour	3.53	0.41	1	7	8375
Other agric labour	3.10	1.04	-4	23	7692
Total Credit	5.18	1.42	0	10	7891
Rural credit	4.66	1.19	-1	8	8165
Urban credit	4.82	2.97	-11	61	5849
Total Deposits	5.88	1.27	2	10	7896
Rural deposits	5.35	1.03	2	9	8165
Urban deposits	5.51	1.57	-8	20	5914

Note: Total Credit is the sum of rural, semi-urban, urban and metropolitan credit. The same applies for Total Deposits. Rural credit/deposits is the summation of rural & semi-urban credit/deposits while urban comprise of Urban and Metropolitan credit/deposits.
Field labour include activities such as ploughing, sowing, weeding, and reaping while carpenter, blacksmith, and cobbler fall under skilled labour category and other agric labour includes such activities as digging.

Table 6: Correlation Matrix

	Field	Skilled	Other Agric	Total Credit	Rural Credit	Urban Credit	Total Deposits	Rural Deposits	Urban Deposits
Field Labour	1.00								
Skilled Labour	0.72***	1.00							
Other Agric Labour	0.53***	0.43***	1.00						
Total Credit	0.52***	0.44***	0.25***	1.00					
Rural Credit	0.54***	0.44***	0.26***	0.84***	1.00				
Urban Credit	0.41***	0.37***	0.19***	0.80***	0.57***	1.00			
Total Deposits	0.51***	0.43***	0.26***	0.91***	0.72***	0.74***	1.00		
Rural Deposits	0.53***	0.43***	0.28***	0.72***	0.85***	0.50***	0.81***	1.00	
Urban Deposits	0.38***	0.32***	0.20***	0.77***	0.51***	0.72***	0.83***	0.54***	1.00

Note: *** indicates statistical significance at the 1% level.

Table 7: Fixed Effects and System GMM Estimations: Impact of credit on wages

Panel A: Impact of credit on field labour wages

	Without controls		With controls	
	FE	GMM	FE	GMM
Total Credit	0.067***	0.011**	0.056**	0.006*
	(0.021)	(0.004)	(0.022)	(0.004)
L.field labour		0.883***		0.856***
		(0.041)		(0.045)
NREGS			0.137***	0.002
			(0.020)	(0.011)
Literacy rate			0.214*	0.089***
			(0.119)	(0.029)
Cropping intensity			-0.663***	0.017
			(0.166)	(0.027)
Irrigation intensity			0.372	0.030
			(0.248)	(0.023)
GDP per capita			0.039**	0.005
			(0.019)	(0.005)
Obs	7633	6920	5381	4859
Districts	373		288	
Adjusted R-squared	0.539		0.613	
Hansen test (p-value)		0.104		0.151
AR(2) p-value		0.266		0.476
Number of instruments		61		66
District and year fixed effects	Yes	Yes	Yes	Yes

Panel B: Impact of credit on skilled labour wages

	Without controls		with controls	
	FE	GMM	FE	GMM
Total Credit	0.067***	0.008**	0.052***	-0.002
	(0.016)	(0.003)	(0.007)	(0.003)
L.skilled labour		0.855***		0.871***
		(0.043)		(0.042)
NREGS			0.078***	-0.016
			(0.012)	(0.014)
Literacy rate			0.223***	0.087***
			(0.029)	(0.029)
Cropping intensity			-0.383***	0.002
			(0.049)	(0.024)
Irrigation intensity			0.197***	0.035*
			(0.046)	(0.019)
GDP per capita			0.070***	0.011**
			(0.006)	(0.005)
Obs	7891	7172	5520	4994
Districts	379		285	
Adjusted R-squared	0.368			
Hansen test (p-value)		0.421		0.350
AR(2) p-value		0.271		0.806
Number of instruments		61.000		66.000
District, year fixed effects	Yes	Yes	Yes	Yes

Panel C: Impact of credit on other agric labour wages

	Without controls		(With controls	
	(1) FE	(2) GMM	(3) FE	(4) GMM
Total Credit	0.109	0.007*	0.100	0.007*
	(0.067)	(0.004)	(0.094)	(0.004)
L.Other agric labour		0.926***		0.928***
		(0.017)		(0.014)
NREGS			0.059	-0.011
			(0.044)	(0.019)
Literacy rate			-0.291	0.024
			(0.571)	(0.021)
Cropping intensity			-1.426***	-0.023
			(0.280)	(0.021)
Irrigation intensity			1.243***	0.002
			(0.333)	(0.018)
GDP per capita			0.068	0.002
			(0.101)	(0.007)
Obs	7211	6538	5062	4570
Districts	359		277	
Adjusted R-squared	0.111		0.143	
Hansen test (p-value)		0.002		0.050
AR(2) p-value		0.720		0.987
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes

Note: Standard errors, in parentheses, are robust and clustered at the district level. * p<0.10, ** p<0.05, *** p<0.01
Dependent variables include field labour wages in Panel A; skilled labour wages in Panel B;
& other agricultural wages in Panel C.
All variables in logs except NREGS. NREGS stands for National Rural Employment Guarantee Scheme.

Table 8: Fixed Effects and System GMM Estimations: Impact of deposits on wages

Panel A: Impact of deposits on field labour wages

	Without controls		With controls	
	FE	GMM	FE	GMM
Total Deposits	0.058	0.013**	0.063***	0.007*
	(0.038)	(0.005)	(0.025)	(0.004)
L.field labour		0.881***		0.855***
		(0.040)		(0.046)
NREGS			0.152***	0.003
			(0.022)	(0.012)
Literacy rate			0.177	0.087***
			(0.114)	(0.029)
Cropping intensity			-0.570***	0.013
			(0.161)	(0.026)
Irrigation intensity			0.310	0.032
			(0.244)	(0.022)
GDP per capita			0.041**	0.006
			(0.019)	(0.005)
Obs	7638	6924	5387	4864
Districts	373		288	
Adjusted R-squared	0.539		0.613	
Hansen test (p-value)		0.111		0.131
AR(2) p-value		0.259		0.477
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes

Panel B: Impact of deposits on skilled labour wages

	Without controls		With controls	
	FE	GMM	FE	GMM
Total Deposits	0.070***	0.010***	0.061**	-0.001
	(0.021)	(0.004)	(0.026)	(0.004)
L.skilled labour		0.857***		0.870***
		(0.041)		(0.043)
NREGS			0.071***	-0.016
			(0.020)	(0.014)
Literacy rate			0.101	0.087***
			(0.087)	(0.030)
Cropping intensity			-0.356***	0.004
			(0.105)	(0.023)
Irrigation intensity			-0.065	0.033*
			(0.152)	(0.019)
GDP per capita			0.057***	0.010**
			(0.015)	(0.005)
Obs	7896	7176	5526	4999
Districts	379		295	
Adjusted R-squared	0.367		0.434	
Hansen test (p-value)		0.433		0.354
AR(2) p-value		0.268		0.797
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes

Panel C: Impact of deposits on other agric labour wages

	Without controls		With controls	
	FE	GMM	FE	GMM
Total Deposits	0.095	0.007*	0.045	0.009**
	(0.062)	(0.004)	(0.091)	(0.004)
L.Other agric labour		0.926***		0.929***
		(0.017)		(0.014)
NREGS			0.090**	-0.011
			(0.039)	(0.019)
Literacy rate			-0.315	0.017
			(0.575)	(0.021)
Cropping intensity			-1.316***	-0.028
			(0.297)	(0.018)
Irrigation intensity			1.174***	0.003
			(0.319)	(0.016)
GDP per capita			0.076	0.003
			(0.102)	(0.007)
Obs	7216	6542	5068	4575
Districts	359		277	
Adjusted R-squared	0.110		0.142	
Hansen test (p-value)		0.002		0.046
AR(2) p-value		0.733		0.993
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes

Note: Standard errors, in parentheses, are robust and clustered at the district level. * p<0.10, ** p<0.05, *** p<0.01
Dependent variables include field labour wages in Panel A; skilled labour wages in Panel B;
& other agricultural wages in Panel C.
All variables in logs except NREGS. NREGS stands for National Rural Employment Guarantee Scheme.

Table 9: Differential Impact of credit and deposits on field labour wages

Panel A: Impact of rural credit on field labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Rural credit	0.167***	0.163***	0.040***	0.033**
	(0.0188)	(0.020)	(0.0068)	(0.0060)
Obs	7907	5519	7142	4962
Districts	373	373	288	288
Adjusted R-squared	0.555		0.624	
Hansen test (p-value)	0.088		0.100	
AR(2) p-value		0.139		0.216
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
Panel B: Impact of Urban credit on field labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Urban credit	-0.005	0.008	0.075	0.014
	(0.00527)	(0.00162)	(0.0153)	(0.00334)
Obs	5665	5133	3920	3552
Districts	270		203	
Adjusted R-squared	0.511		0.583	
Hansen test (p-value)		0.084		0.090
AR(2) p-value		0.252		0.263
Number of instruments		61.000		66.000
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel C: Impact of Rural deposits on field labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Rural deposits	0.123**	0.040***	0.159***	0.040**
	(0.0311)	(0.00794)	(0.0241)	(0.00761)
Observations	7907	7142	5519	4962
Districts	373	373	288	288
Adjusted R-squared	0.552		0.623	
Hansen test (p-value)		0.082		0.101
AR(2) p-value		0.135		0.218
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel D: Impact of Urban deposits on field labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Urban deposits	0.037	0.012	0.041	-0.010
	(0.0128)	(0.00397)	(0.0172)	(0.00549)
Obs	5730	5196	3932	3564
Districts	283	283	215	215
Adjusted R-squared	0.512		0.582	
Hansen test (p-value)		0.086		0.093
AR(2) p-value		0.249		0.266
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No

Note: Standardized betas are reported. Standard errors, in parentheses, are robust and clustered at the district level.
Control variables include: National Rural Employment Guarantees Scheme (NREGS), GDP per Capita,
Literacy rates, Irrigation intensity & Cropping intensity.
All variables in logs except NREGS.
* p<0.10, ** p<0.05, *** p<0.01

Table 10: Differential Impact of credit and deposita on skilled labour wages

Panel A: Impact of rural credit on skilled labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Rural Credit	0.159***	0.041**	0.203**	0.012*
	(0.015)	(0.0046)	(0.019)	(0.0048)
Obs	8165	7394	5658	5097
Districts	379	379	295	295
Adjusted R-squared	0.375		0.442	
Hansen test (p-value)		0.416		0.294
AR(2) p-value		0.251		0.890
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
Panel B: Impact of Urban credit on skilled labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Urban credit	0.022	0.018	0.008	0.069
	(0.0046)	(0.0018)	(0.013)	(0.012)
Obs	5849	5314	3985	3985
Districts	274		208	
Adjusted R-squared	0.356		0.416	
Hansen test (p-value)		0.168		0.000
AR(2) p-value		0.322		0.008
Number of instruments		61.000		67.000
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel C: Impact of Rural deposits on skilled labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Rural deposits	0.143***	0.131*	0.047***	-0.014
	(0.020)	(0.030)	(0.0054)	(0.016)
Observations	7907	7142	5519	4962
Districts	373		288	
Adjusted R-squared	0.552		0.623	
Hansen test (p-value)		0.082		0.101
AR(2) p-value		0.135		0.218
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel D: Impact of Urban deposits on skilled labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Urban deposits	0.053*	0.025**	0.040	-0.048
	(0.0075)	(0.0028)	(0.018)	(0.015)
Obs	5914	5377	3997	3628
Districts	287		220	
Adjusted R-squared	0.355		0.416	
Hansen test (p-value)		0.360		0.244
AR(2) p-value		0.320		0.960
Number of instruments		61		65
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No

Note: Standardized betas are reported. Standard errors, in parentheses, are robust and clustered at the district level.
Control variables include: National Rural Employment Guarantees Scheme (NREGS), GDP per Capita,
Literacy rates, Irrigation intensity & Cropping intensity.
All variables in logs except NREGS.
* p<0.10, ** p<0.05, *** p<0.01

Table 11: Differential Impact of credit and deposits on other agric labour wages

Panel A: Impact of rural credit on other agric labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Rural credit	0.203***	0.014***	0.211*	0.015**
	(0.0622)	(0.00373)	(0.0803)	(0.00434)
Observations	7482	6757	5198	4671
Districts	359		277	
Adjusted R-squared	0.126		0.157	
Hansen test (p-value)		0.001		0.034
AR(2) p-value		0.870		0.883
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel B: Impact of Urban credit on other agric labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Urban credit	-0.004	0.001	-0.039	0.010*
	(0.00616)	(0.00114)	(0.0409)	(0.00259)
Observations	5315	4819	3674	3332
Districts	258		194	
Adjusted R-squared	0.098		0.145	
Hansen test (p-value)		0.056		0.086
AR(2) p-value		0.504		0.563
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel C: Impact of Rural deposits on other agric labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Rural deposits	0.075	0.014***	0.071	0.019***
	(0.0525)	(0.00442)	(0.0627)	(0.00485)
Observations	7482	6757	5198	4671
Districts	359		277	
Adjusted R-squared	0.117		0.150	
Hansen test (p-value)		0.002		0.037
AR(2) p-value		0.885		0.877
No. of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No
Panel D: Impact of Urban deposits on other agric labour wages				
	Without controls		With controls	
	FE	GMM	FE	GMM
Urban deposits	0.032	0.002	0.195**	-0.003
	(0.0283)	(0.00276)	(0.0576)	(0.00409)
Obs	5379	4881	3685	3343
Districts	270		205	
Adjusted R-squared	0.099		0.154	
Hansen test (p-value)		0.053		0.085
AR(2) p-value		0.513		0.566
Number of instruments		61		66
District, year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	Yes	No

*Note:*Standardized betas are reported. Standard errors, in parentheses, are robust and clustered at the district level.
Control variables include: National Rural Employment Guarantees Scheme (NREGS), GDP per Capita,
Literacy rates, Irrigation intensity & Cropping intensity.
All variables in logs except NREGS.
* p<0.10, ** p<0.05, *** p<0.01

Table 12: Average Treatment Effects on the Treated: Impact of PMJDY Intervention on Agricultural Labour Wages

	(1) NNM (nn=1)	(2) NNM (nn=4)	(3) Bias-adj NNM (nn=1)	(4) Bias-adjNNM (nn=4)	(5) PSM (nn=1)	(6) PSM (nn=4)	(7) EB
Field labour	0.085***	0.124***	0.076***	0.094***	0.188***	0.173***	0.065*
	(0.018)	(0.014)	(0.018)	(0.014)	(0.028)	(0.020)	(0.038)
Observations	5381	5381	5381	5381	5381	5381	5381
Skilled labour	0.099***	0.130***	0.106***	0.115***	0.136***	0.131***	0.099***
	(0.016)	(0.013)	(0.016)	(0.013)	(0.024)	(0.018)	(0.099)
Observations	5520	5520	5520	5520	5520	5520	5520
Other agric labour	0.088***	0.147***	0.122***	0.127***	0.151***	0.123***	0.115***
	(0.027)	(0.023)	(0.027)	(0.023)	(0.043)	(0.037)	(0.036)
Observations	5062	5062	5062	5062	5062	5062	5062

Note: Standard errors, in parentheses, are robust.

NNM is nearest neighbour matching; Bias-adj NNM is Bias-adjusted nearest neighbour matching; PSM is Propensity score matching while EB is Entropy balancing methodology.

* p<0.10, ** p<0.05, *** p<0.01

Table 13: Proportion of Bank Accounts per Household by Wave

Wave	Mean of proportion of bank accounts per household
1	0.460
2	0.484
3	0.543
4	0.582
5	0.630
6	0.645
7	0.656
8	0.701
9	0.748

We observe an almost 6 percentage point jump in number of mean bank accounts per household from wave 2 to wave 3. This could imply that most of these accounts were as a result of the implementation of PMJDY.

Table 14: Impact of PMJDY on Income from Wages for Industrial Workers

	(1) Income from Wages	(2) Income from Wages
Post-PMJDY	-0.045**	-0.045**
	(0.020)	(0.019)
Post-PMJDY X Financially-excluded	0.079**	0.081**
	(0.036)	(0.035)
Observations	140,644	140,644
Number of Households	13,361	13,361
Household Controls	No	Yes
Years	2014-2020	2014-2020
Household & Time FE	Yes	Yes

The dependent variable is log of wage income of industrial workers.
The total sample is from January 2014 to December 2020 with 211,228 households and about 3 million observations. For this analysis, sample has been restricted to only one occupation group (income from industrial workers), comprising about 13,631 households.
Post-PMJDY indicates time periods after PMJDY implementation in Aug 2014
Financially excluded: Binary valuable that captures a district's financial exclusion
(1 for districts with the average bank account ownership below the national median or 0 otherwise.
Standard errors clustered at district level in parentheses.
Household controls include average household size, age group, education, and gender
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendices: Not for Publication

A Appendix A

A.1 Two-period model

The following is the sketch for solving the simple two-period model.

First, it is easy to see

$$Y_1 = A_1 K_0^{\alpha} L_0^{1-\alpha}$$
$$w_1 = (1-\alpha)\frac{Y_1}{L_0}.$$

Next, the household budget constraint in the two periods and the Euler equation combined build a link between deposits and deposit rate.

$$C_1 = w_1 L_0 - D_1 = (1-\alpha) Y_1 - D_1$$

$$C_2 = w_2 L_0 + (1+r_{d,1}) D_1 = (1-\alpha) A_2 K_1^{\alpha} L_0^{1-\alpha} + (1+r_{d,1}) D_1$$
$$\frac{C_2}{C_1} = \beta (1+r_{d,1})$$

$$C_1 = w_1 L_0 - D_1$$
$$\beta C_1 = \frac{w_2 L_0}{(1+r_{d,1})} + D_1$$
$$(1+\beta) C_1 = w_1 L_0 + \frac{w_2 L_0}{(1+r_{d,1})}$$

becomes

$$\frac{(1-\alpha) A_2 K_1^{\alpha} L_0^{1-\alpha} + (1+r_{d,1}) D_1}{(1-\alpha) Y_1 - D_1} = \beta (1+r_{d,1}).$$

Capital accumulation is

$$K_1 = (1-\delta) K_0 + I_1 = (1-\delta) K_0 + (1-\rho) D_1$$

and cost of credit is equal to return on capital:

$$1 + \frac{1}{1-\rho} r_{d,1} = 1 + r_{l,1} = \alpha A_2 K_1^{\alpha-1} L_2^{1-\alpha}.$$

We now have three equations for three unknowns. We can solve for K_1 D_1 and $r_{d,1}$.

Formally, we write down the three equations in a matrix form.

$$\begin{aligned}(1-\alpha)\,A_2 L_0^{1-\alpha} K_1^{\alpha} + (1+\beta)\,(1+r_{d,1})\,D_1 - \beta\,(1+r_{d,1})\,(1-\alpha)\,Y_1 &= 0\\ K_1 - (1-\rho)\,D_1 - (1-\delta)\,K_0 &= 0\\ \alpha A_2 L_2^{1-\alpha} K_1^{\alpha-1} - \left(1+\frac{1}{1-\rho} r_{d,1}\right) &= 0\end{aligned}$$

We are using MATLAB to solve for the numerical solutions.
After obtaining the solutions of K_1 D_1 and $r_{d,1}$, the rest of the model is solved as follows:

$$Y_2 = A_2 K_1^{\alpha} L_0^{1-\alpha}$$

$$w_2 = (1-\alpha)\,\frac{Y_2}{L_0}$$

$$C_1 = w_1 L_0 - D_1$$

$$C_2 = w_2 L_0 + (1+r_{d,1})\,D_1$$

$$r_{l,1} = \frac{1}{1-\rho} r_{d,1}$$

$$I_1 = (1-\rho)\,D_1$$

$$S_1 = D_1.$$

A.2 Extended two-period model

The following is the sketch for solving the extended two-period model with banking fees and the option of fiscal intervention.

With Banking Fees

First, it is easy to see

$$Y_1 = A_1 K_0^{\alpha} L_0^{1-\alpha}$$
$$w_1 = (1-\alpha)\frac{Y_1}{L_0}.$$

Next, the household budget constraint in the two periods and the Euler equation combined build a link between deposits and deposit rate.

$$C_1 = w_1 L_0 - D_1 = (1-\alpha) Y_1 - D_1$$

$$C_2 = w_2 L_0 + (1+r_{d,1})(1-\theta) D_1 = (1-\alpha) A_2 K_1^{\alpha} L_0^{1-\alpha} + (1+r_{d,1})(1-\theta) D_1$$
$$\frac{C_2}{C_1} = \beta (1+r_{d,1})(1-\theta)$$

becomes

$$\frac{(1-\alpha) A_2 K_1^{\alpha} L_0^{1-\alpha} + (1+r_{d,1})(1-\theta) D_1}{(1-\alpha) Y_1 - D_1} = \beta (1+r_{d,1})(1-\theta).$$

Bank balance sheet and capital accumulation is

$$I_1 = (1-\rho)(1-\theta) D_1,$$

$$K_1 = (1-\delta) K_0 + I_1 = (1-\delta) K_0 + (1-\rho)(1-\theta) D_1$$

and cost of credit is equal to return on capital:

$$1 + r_{l,1} = 1 + \frac{r_{d,t}(1-\theta) + c(1-\theta) - \theta}{(1-\rho)(1-\theta)} = \alpha A_2 K_1^{\alpha-1} L_2^{1-\alpha}.$$

We now have three equations for three unknowns. We can solve for K_1 D_1 and $r_{d,1}$.

Formally, we write down the three equations in a matrix form.

$$(1-\alpha) A_2 L_0^{1-\alpha} K_1^{\alpha} + (1+\beta)(1+r_{d,1})(1-\theta) D_1 - \beta (1+r_{d,1})(1-\theta)(1-\alpha) Y_1 = 0$$
$$K_1 - (1-\rho)(1-\theta) D_1 - (1-\delta) K_0 = 0$$
$$\alpha A_2 L_2^{1-\alpha} K_1^{\alpha-1} - \left(1 + \frac{r_{d,1}(1-\theta) + c(1-\theta) - \theta}{(1-\rho)(1-\theta)}\right) = 0$$

We are using MATLAB to solve for the numerical solutions.

After obtaining the solutions of K_1 D_1 and $r_{d,1}$, the rest of the model is solved as follows:

$$Y_2 = A_2 K_1^{\alpha} L_0^{1-\alpha}$$

$$w_2 = (1-\alpha)\frac{Y_2}{L_0}$$

$$C_1 = w_1 L_0 - D_1$$

$$C_2 = w_2 L_0 + (1+r_{d,1})(1-\theta) D_1$$

$$r_{l,1} = \frac{r_{d,1}(1-\theta) + c(1-\theta) - \theta}{(1-\rho)(1-\theta)}$$

$$I_1 = (1-\rho)(1-\theta) D_1$$

$$S_1 = D_1.$$

No Banking Fees and With FIF

First, it is easy to see

$$Y_1 = A_1 K_0^{\alpha} L_0^{1-\alpha}$$

$$w_1 = (1-\alpha)\frac{Y_1}{L_0}.$$

Next, the household budget constraint in the two periods and the Euler equation combined build a link between deposits and deposit rate.

$$C_1 = w_1 L_0 - D_1 = (1-\alpha) Y_1 - D_1$$

$$C_2 = w_2 L_0 + (1+r_{d,1}) D_1 = (1-\alpha) A_2 K_1^{\alpha} L_0^{1-\alpha} + (1+r_{d,1}) D_1$$

$$\frac{C_2}{C_1} = \beta(1+r_{d,1})$$

becomes

$$\frac{(1-\alpha) A_2 K_1^{\alpha} L_0^{1-\alpha} + (1+r_{d,1}) D_1}{(1-\alpha) Y_1 - D_1} = \beta(1+r_{d,1}).$$

Bank balance sheet and capital accumulation is

$$I_1 = (1-\rho) D_1,$$

$$K_1 = (1-\delta) K_0 + I_1 = (1-\delta) K_0 + (1-\rho) D_1$$

and cost of credit is equal to return on capital:

$$1 + r_{l,1} = 1 + \frac{r_{d,1} + c - \tau}{1 - \rho} = \alpha A_2 K_1^{\alpha - 1} L_2^{1-\alpha}.$$

We now have three equations for three unknowns. We can solve for K_1 D_1 and $r_{d,1}$.

Formally, we write down the three equations in a matrix form.

$$\begin{aligned}
(1-\alpha)\, A_2 L_0^{1-\alpha} K_1^{\alpha} + (1+\beta)\,(1+r_{d,1})\, D_1 - \beta\,(1+r_{d,1})\,(1-\alpha)\, Y_1 &= 0 \\
K_1 - (1-\rho)\, D_1 - (1-\delta)\, K_0 &= 0 \\
\alpha A_2 L_2^{1-\alpha} K_1^{\alpha-1} - \left(1 + \frac{r_{d,1} + c - \tau}{1-\rho}\right) &= 0
\end{aligned}$$

We are using MATLAB to solve for the numerical solutions.

After obtaining the solutions of K_1 D_1 and $r_{d,1}$, the rest of the model is solved as follows:

$$Y_2 = A_2 K_1^{\alpha} L_0^{1-\alpha}$$

$$w_2 = (1-\alpha)\,\frac{Y_2}{L_0}$$

$$C_1 = w_1 L_0 - D_1$$

$$C_2 = w_2 L_0 + (1 + r_{d,1})\, D_1$$

$$r_{l,1} = \frac{r_{d,1} + c - \tau}{1 - \rho}$$

$$I_1 = (1-\rho)\, D_1$$

$$S_1 = D_1.$$

B Appendix B

B.1 Institutional Context of PMJDY

The Pradhan Mantri Jan Dhan Yojana (PMJDY) which was launched in 2014, is one of the biggest financial inclusion initiatives in the world (Agarwal et al., 2017). The program aims at achieving universal access to basic and affordable financial services to every household, especially to financially excluded poorer households in India. The program's extensive implementation has thus broadened the scope of formal banking services to previously underserved regions in India. Before this initiative, over half of the population in India did not have access to a bank account. Specifically, in 2011, only 35 percent of the population aged 15 years and above had a bank account. By 2021, this percentage improved to 78 percent, largely attributed to PMJDY initiative. Initially, PMJDY had two phases: Phase I (Aug 2014 to Aug 2015); and phase II run from Aug 2015 to Aug 2018. Thereafter, the Program was extended indefinitely. The target for number of accounts to be opened during phase 1 was 75 million accounts. Meanwhile, by the end of August 2015, this target was surpassed by more than a twofold as a total of 179 million PMJDY accounts were opened. By the end of the second phase (August 2018), a cumulative of 325.4 million accounts were opened and further increased to 415.8 million accounts by end 2020. Table 1 highlights trends in PMJDY accounts over the years.

Financial services offered under the PMJDY initiative include access to a free basic zero-balance savings bank account that comes with a "RuPay" debit card; access to a need-based credit; remittances; insurance; and pension facilities. Several distinct features of PMDJY initiative have been instrumental in the uptake of the program. Firstly, the free and zero-balance account has been one of the crucial pillars of PMJDY as this has been one of the obstacles for people living below the poverty line to access formal banking services (Shah, 2023). Similarly, Know Your Customer (KYC) documentation requirements are relaxed under PMJDY, enabling temporary account opening through biometric authentication without ID. Another important feature of PMJDY is the overdraft facility, which enables account holders to access credit amounting to Rs.5,000 (US$59.45), thereby providing them with a safety net and a means to savings options. The overdraft facility is only offered to account holders who maintain the bank account and transact actively. Further, life insurance facilities under the initiative, such as the Rs.100,000 (US$1,190.13) accidental coverage and the Rs.30,000 (US$357.04) life insurance for accounts opened before 2015, have also assisted the uptake of the program as it provides beneficiaries with a safety net in times of need.

In terms of implementation, the PMJDY followed a multi-faceted approach. Firstly, the districts, India's regional administrative units, were sub-divided into around 153,488

sub-service areas (SSA), each covering 1000-1600 villages. Based on the existing presence in a region, different state-owned banks were assigned different SSAs to ensure accountability. Under this arrangement, each designated bank was responsible for setting up a fixed-point banking outlet within a 5km radius of every village in their allotted SSAs. This was done either through a physical branch or a business correspondents (BCs) who act as representatives of the banks [7]. To expand access and ensure smooth implementation of the PMJDY program, the government of India established 50,000 additional BCs, 7,000 new bank branches, and 20,000 ATMs state-owned banks (Agarwal et al. (2017)). Further, the government ensured that all BCs were equipped with micro-ATMs, enabling them to function like mini-branches. As such, BCs were able to receive deposits, withdrawals, fund transfers, and balance inquiries. Another important aspect of the PMJDY program was the introduction of basic mobile banking services via SMS which enabled account holders to check balances and initiate funds transfers without visiting a physical bank branch. The provision of banking services at people's doorsteps, and the introduction of mobile banking services necessitate the removal of significant barriers such as travel costs and time, that prevent poor people's access to financial services Demirguc-Kunt et al. (2017). Additionally, banks set up account opening camps in villages to ensure large account number openings in the early stages of the program. To ensure the banks' sustainability, the government of India provided various financial subsidies to support their operations.

The PMJDY program also incorporates financial literacy programs [8], and this has improved understanding and effective use of financial services. Similarly, the adoption of technology such as micro-ATMs through business correspondents who offer doorstep services in hard-to-reach areas and mobile SMS-based banking has helped lower transaction costs and simplified access to banking services. Various studies including Chopra and Tantri (2017), and Agarwal et al. (2017) have demonstrated that PMJDY has positively improved access to financial services, mostly to those who were financially excluded.

[7] BCs are employed by the banks and operate as intermediaries between banks and customers in areas where there are no physical branches and thus play an important role in reaching out to the rural and underserved areas. BScs offer basic banking services including deposits, withdrawals, account opening, and funds transfer. BCs receive a commission for each transactions done.

[8] There is a dedicated Financial Literacy program under the PMJDY where the RBI developed operational guidelines which mandates the banks to operate Financial Literacy centres (FLCs) and provide financial literacy services in rural branches. FLCs and rural branches of banks conduct special camps for the newly included people under PMJDY where they are encouraged to make meaningful transactions and start using the associated benefits of having a bank account. The target is to have a minimum of one outdoor camp per month by each FLC and rural branch of banks. The financial literacy campaigns are mandated to adopt and provide a segmented approach to financial literacy programs specific to different categories of borrowers, rather than generalized ones. For instance, for centres in rural and semi-urban areas, banks are encouraged to concentrate on financial literacy and counselling for farming communities and those engaged in allied activities. Whereas the focus in metro/urban areas is on personal loans.

Details of progress in terms of the number of accounts opened and deposits in PMJDY accounts is illustrated in Table B.1. Overall, we observe an upward trend in both the number of beneficiaries and deposits in accounts since the inception of the initiative in 2014, reflecting the program's effectiveness in providing banking services to the financially excluded. During the first year of the initiative, 179 million PMJDY accounts were opened and have continually increased to 415.8 million as of end 2020. Likewise, the increase in the number of accounts has also led to an increase in deposits under this initiative. Deposits have increased from Rs.157 million (US$1.9 million) as of end March 2015 to Rs. 1,350.8 billion (US$15.42 billion) as of end end December 2020. The data further reveals that rural and semi-urban areas have benefitted more from this initiative than urban and metropolitan areas, as 66.6 percent of total accounts under PMJDY were opened in rural and semi-urban areas.

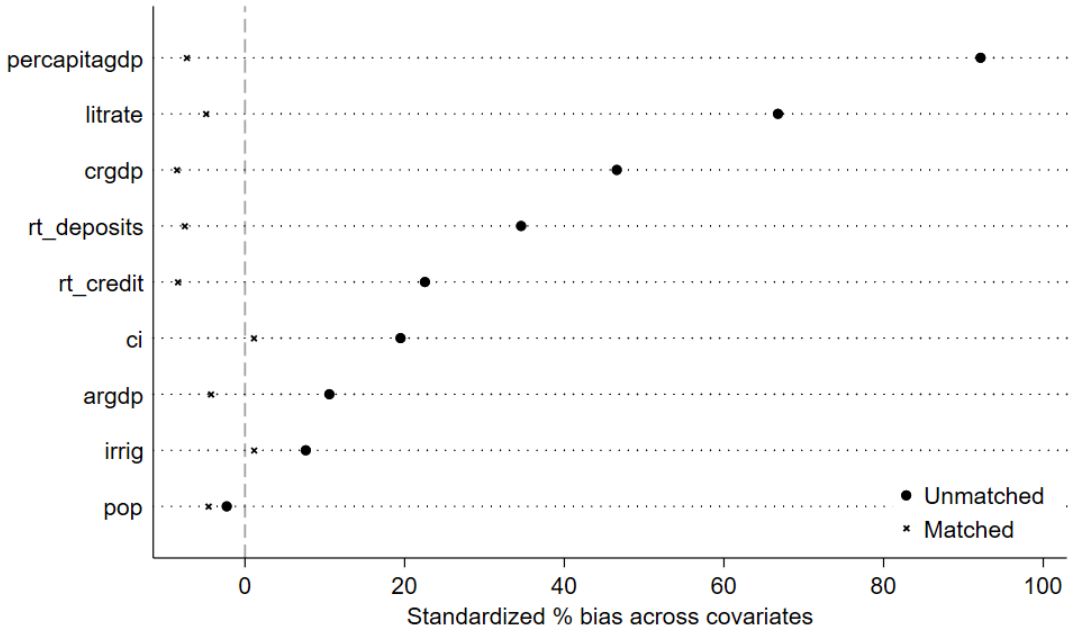
Table B.1: PMJDY Bank Category-wise Report as at end 30/12/2020 (Figures in Millions)

Bank Name / Type	**Rural/Semi-Urban Beneficiaries**	**Urban/Metro Beneficiaries**	**Total Beneficiaries**	**Deposits in Accounts (Million Rupees)**	**Rupay Debit Cards Issued (Millions)**
Public Sector Banks	201.56	127.50	329.06	1,049,217.37	260.98
Regional Rural Banks	64.85	9.19	74.04	260,092.48	33.72
Private Sector Banks	7.02	5.71	12.73	415,547.74	11.51
Grand Total	**273.43**	**142.40**	**415.83**	**1,350,848.59**	**306.21**

Further, an analysis of PMJDY accounts per bank type as presented in Table B.1 indicates that the majority of PMJDY accounts, at 79 percent, are held by Public Sector Banks (PSBs), highlighting a critical role of state-owned banks in financial inclusion efforts in India. This is followed by Rural Regional Banks (RRBs) which opened 17.8 percent of the total PMJDY accounts by end 2020 while private banks only accounted for 3 percent of total accounts opened. We also observe that PSBs and RRBs dominate in rural areas with 74 percent and 24 percent of PMJDY accounts, respectively, while private banks play a negligible role in rural areas. This distribution aligns with Table B.1's trends which highlights that rural areas registered more PMJDY accounts which reinforces the PMJDY's focus on financial inclusion in financially excluded areas. In rural and semi-urban areas, 62.7 percent, 85.7 percent, 45.4 percent, and 100.0 percent of PMJDY accounts were opened in public sector banks, regional rural banks, private banks, and rural cooperative banks, respectively. Meanwhile, in urban areas, 37.3 percent, 14.3 percent, and 54.6 percent of the accounts were opened in public sector banks, regional rural banks, and private banks, respectively.

B.2 Robustness Checks: Matching Estimators

Figure B.1: Covariate Balance Before and After Matching: Propensity Score Matching



Note: Covariates are well balanced after matching (bias within the recommended 25 percent
This ensures a valid comparison between treated and control districts.

Note: Enough overlap is achieved after matching

Note: Gamma: Log odds of differential assignment due to unobserved factors.

sig+: Upper bound significance level, sig-: Lower bound significance level.

t-hat+: Upper bound Hodges-Lehmann point estimate, t-hat-: Lower bound Hodges-Lehmann point estimate.

CI+: Upper bound confidence interval (95%), CI-: Lower bound confidence interval (95%).

field labour and other agricultural labour wages are more robust to unobserved bias as compared to skilled labour wages

Figure B.2: Covariate Overlap Before and After Matching: Propensity Score Matching

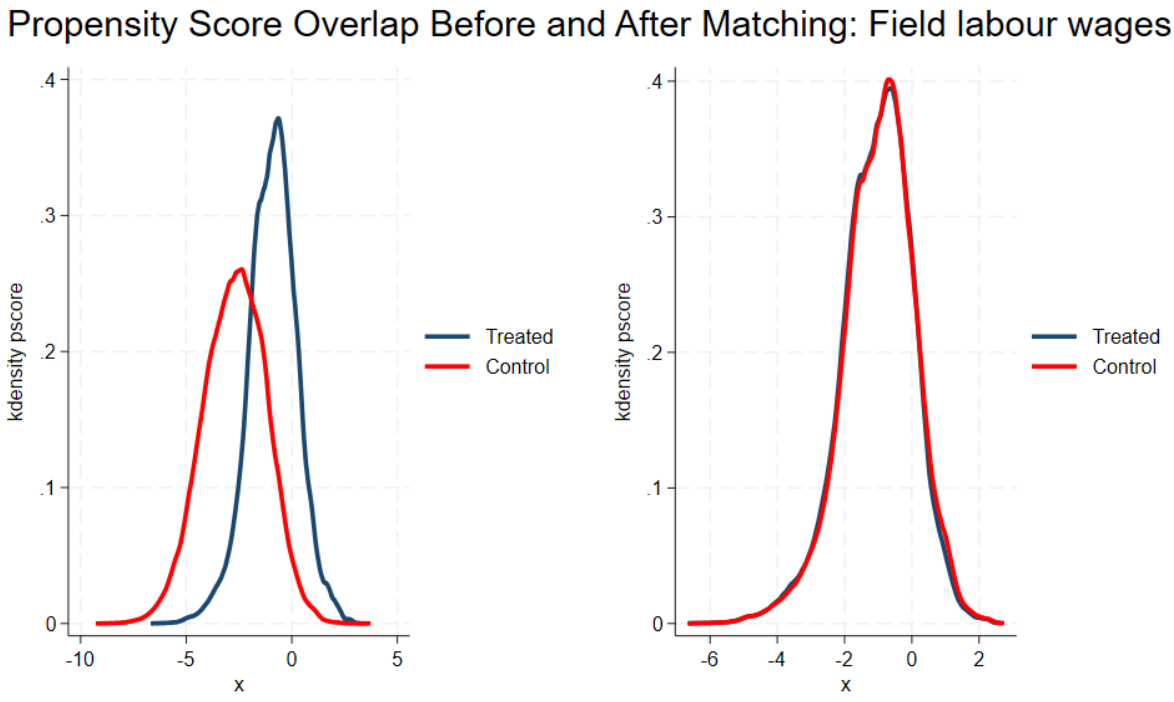


Table B.2: Rosenbaum Sensitivity Test for Agricultural Wages (Propensity Score Matching)

Panel A: Field labour wages						
Gamma	**sig+**	**sig-**	**t-hat+**	**t-hat-**	**CI+**	**CI-**
1	0	0	0.109576	0.109576	0.102554	0.116592
1.25	0	0	0.054393	0.164777	0.047382	0.17182
1.5	0.003656	0	0.009704	0.209769	0.002617	0.216928
1.75	1	0	-0.027914	0.247537	-0.035064	0.254676
2	1	0	-0.060118	0.279804	-0.067316	0.287042
Panel B: Skilled labour wages						
Gamma	**sig+**	**sig-**	**t-hat+**	**t-hat-**	**CI+**	**CI-**
1	0	0	0.070914	0.070914	0.064802	0.076972
1.25	0	0	0.022844	0.119065	0.016868	0.125116
1.5	1	0	-0.013614	0.158095	-0.022044	0.164298
1.75	1	0	-0.047073	0.195626	-0.05526	0.197164
2	1	0	-0.077162	0.219266	-0.083554	0.225661
Panel C: Other agric labour wages						
Gamma	**sig+**	**sig-**	**t-hat+**	**t-hat-**	**CI+**	**CI-**
1	0	0	0.12103	0.12103	0.113698	0.128325
1.25	0	0	0.063485	0.178614	0.056155	0.185984
1.5	0	0	0.016831	0.225547	-0.04963	0.239243
1.75	1	0	-0.02227	0.264892	-0.09699	0.2724
2	1	0	-0.055791	0.298785	-0.14635	0.36637

Table B.3: Covariate Balance Before and After Weighting using Entropy balancing

	Treat			Control		
Variable	Mean	Variance	Skewness	Mean	Variance	Skewness
Panel A: Before (without weighting)						
credit	5.362	1.090	-0.359	5.115	2.149	0.002
Deposits	6.192	0.752	0.221	5.788	1.719	0.007
Cropping intensity	4.992	0.022	-0.067	4.955	0.024	0.459
Irrigation intensity	0.479	0.044	0.053	0.453	0.054	0.749
Literacy rate	0.302	0.015	-0.241	0.434	0.065	-1.165
Population	14.310	0.750	-1.215	14.290	0.500	-1.152
GDP per capita	0.243	0.355	0.292	1.370	1.483	-0.516
Agric GDP	7.048	0.953	-0.436	7.053	1.419	-0.018
Construction GDP	6.316	0.691	-0.695	5.800	1.341	-0.493
NREGS	1.000	0.000	–	0.403	0.241	0.396
Panel B: After (*using Entropy balancing as the weighting variable)						
Credit	5.362	1.090	-0.359	5.358	1.547	-0.410
Deposits	6.192	0.752	0.221	6.188	1.120	-0.189
Cropping intensity	4.992	0.022	-0.067	4.992	0.025	-0.047
Irrigation Intensity	0.479	0.044	0.053	0.479	0.050	0.343
Literacy	0.302	0.015	-0.241	0.303	0.023	-0.692
Population	14.310	0.750	-1.215	14.310	0.664	-1.720
GDP per Capita	0.243	0.355	0.292	0.243	0.568	-0.118
Agric GDP	7.048	0.953	-0.436	7.050	1.025	-0.300
Construction GDP	6.316	0.691	-0.695	6.312	0.848	-0.765
NREGS	1.000	0.000	–	0.999	0.001	-26.830

Note: Using entropy balancing as weighting variable to adjust the control group to match the treatment group on the first moment (mean),
Panel B indicates balance on means achieved at two decimal places
NREGS is National Rural Employment Guarantee Scheme

Table B.4: Average Treatment Effects on the Treated: Impact of PMJDY on Agricultural Wages using Pre-treatment Covariates

	(1) NNM (nn=1)	(2) NNM (nn=4)	(3) Bias-adj NNM (nn=1)	(4) Bias-adj NNM (nn=4)	(5) PSM (nn=1)	(6) PSM (nn=4)	(7) EB
Field labour	0.481***	0.528***	0.483***	0.532***	0.511***	0.550***	0.065*
	(0.016)	(0.014)	(0.016)	(0.014)	(0.016)	(0.015)	(0.038)
Observations	5,266	5,266	5,266	5,266	5,266	5,266	5,266
Skilled labour	0.337***	0.368***	0.341***	0.372***	0.365***	0.394***	0.099***
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.017)	(0.099)
Observations	5,405	5,405	5,405	5,405	5,405	5,405	5,405
Other agric labour	0.374***	0.365***	0.379***	0.374***	0.344***	0.355***	0.115***
	(0.063)	(0.059)	(0.063)	(0.059)	(0.045)	(0.046)	(0.036)
Observations	4,958	4,958	4,958	4,958	4,958	4,958	4,958

Note: Dependent variables are log of real agricultural wages. Standard errors in parentheses. All estimators use pre-treatment covariates (2010-2013 averages) to address post-treatment bias concerns. NNM is Nearest Neighbor Matching; Bias-adj NNM is Bias-adjusted Nearest Neighbor Matching; PSM is Propensity Score Matching; EB is Entropy Balancing methodology. Treatment defined as districts with rural population share above median (high PMJDY intensity). * p<0.10, ** p<0.05, *** p<0.01