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dynamics in India**

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Abstract

The paper analyzes causes of movements in Indian wages for rural unskilled male laborers, and assesses their impact on inflation. Theoretical priors derived from an analytical framework based on the concepts of fair wages, salience and over-reaction are tested using a State level rural wage data panel. The model predicts that a rise in food price inflation, non-traded wages and productivity, reduction in net labor supply, rise in labor demand and employment in the traded goods sector would raise wages in the traded goods sector, while changes in the exchange rate could have ambiguous effects. In dynamic panel regressions, food price inflation and the fiscal deficit share were two variables that were consistently high and significant, with the effect of the first three times larger. The spread of MGNREGS did not raise wages, but the sharp jump associated with wage indexation, itself a response to high food prices, did. The set of government programs impacted wages, more than a single one. Cyclical or policy variables had a minor impact. The results are in line with the predictions of the model and support psychological and social as compared to cyclical factors. The impact of wages on rural food prices was not as large, indicating some rise in productivity. Since multiple supply shocks impacted food prices, and special circumstances drove the unusual rise in real wages, large nominal wage growth may not persist if food inflation and the fiscal deficit moderate.

Keywords: Indian wage growth, food inflation, fair wages, dynamic panel, deficits, MGNREGS

JEL Code: E24, E31, J31

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1. Introduction

The paper analyzes causes of movements in wages for Indian rural unskilled male laborers, and assesses their impact on inflation. The recent behavior of price and wage inflation is puzzling. Inflation remained high over 2007–2013, with some fluctuations. Although growth rates fell, real wages rose sharply¹.

The period started with peaks in international food and oil prices, but inflation persisted in India even as it fell in most countries with the global slowdown. Periodic sharp nominal depreciation raised domestic commodity prices. The 2007 rise in domestic food prices, due to gradual pass through of international shocks, was aggravated by the steep depreciation following the global financial crisis in 2008. The rains failed in 2009, leading to another spike in food inflation. INR depreciated again in fall 2011 and in summer 2013 as rising global risk aversion led to capital outflows. Even as inflation in food and in primary articles peaked, that in manufactured products fell with inflation in fuel before recovering with it. While oil prices fluctuated, persistent food price inflation kept consumer price inflation high.

Growth in real wages for rural unskilled male laborers was often negative before September 2007, but became positive after that. Nominal wage growth far exceeded that in the relevant consumer price index. Real wage growth peaked at 12.5% in 2012m1², although this was a period of low growth. Despite a quick recovery from the global financial crisis, growth had slumped again in mid-2011.

Did wages respond to the rise in food prices? Did high output growth over 2004–2008 and 2010–11 raise labor demand and wage expectations? Did a large share of government expenditure and social programs directed to rural areas bolster this effect? Did a fall in employment and an inflationary wage-price spiral reduce the welfare impact of the rise in

¹ There was a divergence between inflation based on the wholesale price index (WPI) and that based on the consumer price index (CPI). WPI inflation (WPII) dipped in 2009, but consumer price inflation rose to double digits in this period and by 2010 WPII was back at 10%. It stayed at that level until early 2012 when it fell to about 7% and was sticky even as consumer price inflation rose to 10% after a brief dip. CPI gives an almost 50% weight to food articles while WPI gives 15% weight to fuel. CPI also includes services. High food inflation explained much of the divergence. The 2009 dip in WPII largely followed that in fuel.

² After negative and positive growth rates of -0.0124 % and 0.099 % respectively around zero over 2004 m1 to 2006 m3 and 2006 m4 to 2008 m10, real rural unskilled labour wages (deflated by CPI rural labour indices) grew at 7% over 2010 m11 to 2012 m10.

wages? If there is persistent wage-price inflation, but a slowdown in growth, can the economy be overheating? Have inflationary expectations become sticky? What is the effect of fiscal and monetary policy on wage-price inflation? Information on the sensitivity of wage and price inflation to policy variables, and on the role of expectation formation, is required to formulate appropriate policy. The paper addresses these questions. A key issue is sustainable welfare of the rural poor cannot be seen in isolation from macro stability. The social objective of inclusive growth aimed to improve the conditions of the poor. But to the extent inflation erodes a wage rise improvement does not sustain, and may come at the cost of jobs.

Since more than half of India's work force still lived in villages in 2013, rural India was regarded as absorbing unskilled labor at a subsistence wage kept low by large numbers willing to work at low wages. One special scheme designed to impact minimum rural wages was MGNREGS, an employment insurance guaranteeing 100 days of employment to each able bodied rural worker. Its first phase commenced on January 2, 2006, for 200 districts. It was extended to another 130 districts in 2007-2008, and to the whole country from April 1, 2008. Daily wages were raised to INR 100 in 2009 and indexed to a real value of INR 100 in 2011. Although the primary goal was insurance, labor employed was to be used to create productive assets, such as for water harvesting, which could raise agricultural productivity. But this aspect was relatively neglected. Did MGNREGS succeed in raising real rural wages?

Social norms as well as economic factors influence subsistence wages. Food constitutes a large share of the rural consumption basket, so high food inflation may raise the socially accepted minimum nominal wage. The impact can be greater with food inflation above some threshold level. Rising national wealth and standard of living and can also have a demonstration effect. Government social programs, such as MGNREGS, aimed at transferring spending power to rural areas may have reflected, as well as raised, social norms of 'fair' wages. High growth and revenues initially fuelled the programs and subsequently the post-crisis fiscal stimulus sustained them. Rural non-farm activities offer alternative opportunities raising labor demand and bargaining power. Migration in response to inter-State wage differences and to the urban business cycle³, can also impact rural wages, as can rising agriculture productivity.

³ More economic activity and job creation in the poorer states of central and eastern India reduced migrant labor in this period.

These factors are classified into demand, psychological and social categories and theoretical priors on their effects are derived in an analytical framework based on the concepts of fair wages, salience and over-reaction. These are then tested for the recent Indian inflationary episode, which offers a rich natural experiment. Data on State level monthly wages for rural unskilled labor has recently been made available. This is just the category targeted for schemes such as MGNREGS and the category that has a high share of food in its consumption basket.

Dynamic panel regressions took care of serial correlation and other time series problems, while expanding the short time series available. They used a variety of controls and distinguished between high and low wage inflation States. WPI food inflation and the fiscal deficit had the most consistently significant effect on rural unskilled wage inflation. Variables capturing expectations of the future were not normally significant, but expected food inflation affected wage inflation. Policy variables were rarely significant, had minor impact, and the cyclical variable reduced wage growth instead of increasing it, when it was significant. A dummy variable for the years MGNREGS spread through the country came in with the wrong sign. But announcement of a steep rise as part of indexation of MGNREGS wages in 2011 significantly raised rural wages. This was also partly a response to high food inflation. The results support the psychological and social as compared to the cyclical factors as explanations of Indian rural wage inflation.

Time-series techniques found structural breaks in rural wage inflation and rural CPI inflation in both in 2008 and in 2010. These were the years CPI food inflation accelerated into double digits and then dropped to around ten per cent by end 2010, although it remained sticky at that level. There was a brief spike in early 2011. Nominal wage growth peaked at 20 per cent by mid-2011. Thus a salient rise in food inflation may have strongly raised the level of subsistence wages, regarded as 'fair'. Government expenditure led labour demand and a reduction in net labor supply as unskilled women and youth withdrew from the labor force also supported wage growth. The evidence indicates special circumstances of repeated food price peaks and large government spending drove an unusually sharp rise in real wages. There may have been overcorrection to food price peaks, even in the setting of MGNREGS wages.

In reverse panel regressions, however, the effect of wages on rural CPI inflation was positive but low. Cyclical and monetary policy variables had an even lower impact. The fiscal deficit share was not significant. Lagged rural CPI had the largest coefficient showing persistence.

The greater effect of food prices on wages compared to wages on food prices suggests there was some rise in productivity. Political decisions made on administered food grain prices unrelated to the cost of production, and the monopoly power of middlemen that drove large margins on perishable items, may also explain rise in food prices independent of costs. More than wages, multiple supply shocks impacted food prices—starting with the international food price shocks of 2007, monsoon failures in 2009, and episodes of sharp rupee depreciation in 2008, 2011, and 2013⁴.

So inflation expectations may reduce rapidly if food price shocks abate. Despite the indexation of MGNREGS wages, if the real wage adjustment was a specific incident, India may not be caught in a persistent wage-price spiral. Indexation maintains real wages but may prevent the earlier type of over-reaction. Moreover, a moderate rise in real wages can be accommodated without inflation if there is a rise in productivity. Dev, Mishra and Pandey (2014) show an overall improvement in agricultural performance on diverse criteria over 2004/5 to 2010/1 compared to 1993/4 to 2004/5. For example, average annual foodgrain production growth rates, computed using a double-kinked exponential curve, rose to 2.18% in the first period compared to only 1% in the second.

Conversely, real wages cannot rise in the long-term without such a rise, since inflation would continue until wages were brought in line with productivity. Both inflation and a fall in employment brought about such an alignment in the episode studied. Real wages did rise, but since employment fell welfare did not rise as much. Nominal wage growth far exceeded real, and real wage growth had also softened to 2% by October 2013 (Reserve Bank of India, RBI, 2014). Food inflation remains critical, however. Nominal wage growth, which had come down to about 15.5% in October 2013, showed signs of rising again as vegetable prices drove food inflation up into double digits in November.

⁴ Unreported regressions show the exchange rate to have a large positive effect on aggregate WPI food inflation compared to its effect on the reported rural CPI inflation State panel. See also Goyal (2012b).

The structure of the paper is as follows: Section 2 presents a literature review and analytical framework, section 3 discusses methodology and data, section 4 gives the results before section 5 concludes.

2. Analytical Framework

2.1 Literature review

Indian industry argued double digit annual increase in nominal wages drove price inflation, and kept the central bank from easing credit policy. Investment and growth slowed. But the context, each link in the chain, and adjustments in other variables matter. Using Granger causality, Hess and Schweitzer (2000) found no evidence of wage rate causing inflation for the US. Prices Granger caused unit labor cost (proxy for productivity adjusted wage) but not the other way around.

Early studies for India found limited response of wages to price rise. Martin (1990) showed rural wages not to be responsive to food price increase. Therefore an increase in food prices relative to non-food prices benefitted the rural rich, while decreasing the welfare of the rural poor. Martin (2000) also explained the relationship between food prices, rural wages and poverty taking into consideration the distributional effect. In a simple regression analysis he found high food prices had a negative impact on real wages. But on including the stickiness of rural wages, impact of agricultural productivity and inflation, the negative impact of food prices on wages vanished. The stickiness of wages matters. Dynamics of wages should be incorporated to avoid misleading conclusion from a possibly spurious negative correlation between rural real wage and food prices. Adjustments in other variables have to be taken into account. In general equilibrium analysis the welfare results differ from partial equilibrium results.

Jacoby (2013) used a general equilibrium model to empirically estimate the welfare effect of wage elasticity with respect to prices. The analysis shows that all classes of rural population benefit from a price sensitive wage. High elasticity of nominal wage to prices has greater distributional and welfare effect compared to the government promoted public distribution system. The paper also argued government restriction in food export can lead to serious welfare loss in rural India by generating difference between domestic food and non-tradable good prices. Gouel (2013) demonstrates this welfare loss more generally for government interventions in food markets. On adjusting for typical consumption baskets, welfare loss

from a rise in food prices is more for the poor, since they consume more food items (Ray and Mishra, 2011). Goyal (2012a), using ASI data upto 2003-04, with wages deflated by the CPI (IW), found non-manufacturing real wages to be much more volatile and pro-cyclical than manufacturing real wages. They rose in booms and fell in slumps, while manufacturing real wages were indexed to inflation. Non-manufacturing real wages tend to be closer to informal and rural wages. Since wages did not adjust fully or did only with a lag to food inflation, India's large informal labor was forced to bear the brunt of slowdowns as their real wages fell.

Studies for the post 2007 period, however, show a different pattern of wage-price interactions. Gulati and Saini (2013) using a variety of factors to explain food price inflation, found that apart from fiscal deficit and global food prices, wages had a higher contribution in recent food inflation. MGNREGS also set a wage floor in many informal sector activities. Their results, however, may not be robust since they use simple OLS for a short time series. Gulati, Jain, and Satija (2013), again with annual data, find the impact of MGNREGS on nominal wages is low compared to that due to rise in aggregate GDP, or agriculture, or construction. Berg et. al. (2012) estimate a positive impact of MGNREGS on real wages in districts where it was adopted compared to those where it was not and Imbert and Papp (2013) find a similar effect on nominal wages in districts where it was adopted early compared to late adopters.

Informal wages are also now being partially indexed through MGNREGS, which reduces indexation lags. In 2011 MGNREGS wages were indexed to the CPI agricultural wages, and in 2012 exceeded State minimum wages in 21 States. So even if unemployment rises, informal real wages are also likely to be sticky. But the dynamics of rural wage and price inflation is not straight forward. Many macroeconomic factors affecting the relationship need to be analyzed.

2.2 Deriving theoretical priors for tests

Goyal (2012b) analyses the effect of Balassa-Samuelson (BS) type productivity differentials across sectors, on Indian inflation. The BS result requires the productivity differential between traded and non-traded goods sectors to be higher in advanced economies (AEs) compared to emerging and developing economies (EDEs). So inflation in EDEs is often attributed to the catch-up process where productivity in traded goods starts growing faster

than that in non-traded goods. But Goyal (2012b) argues that Indian inflation is better explained by wages growing at a productivity growth relatively higher in non-traded goods compared to that in traded goods (dominated by agriculture), while nominal shocks triggered deviations from equilibrium and adjustments that sustained inflation. This framework retains the BS ranking of relatively higher productivity in traded goods in AEs, and is consistent with a lack of domestic reforms that reduced productivity in traded goods. The latter are also more dependent on physical infrastructure where bottlenecks remain.

The above wage catch-up requires real wage targets. These can also be derived from efficiency wage arguments. For example, firms may maximize profits by raising wages in line with the expenses of a basic consumption basket else worker output falls, as nutrition worsens. Akerlof and Yellen (1990) provide a variant of this argument bringing in the psychological concept of ‘fair wages’. One worker-type in a firm does not put in full effort if she feels underpaid relative to the other type. We generalize this argument to inter-sectoral wage differentials. In an economy undergoing rapid growth, as new types of job opportunities become available, concepts of ‘fairness’ or sharing the benefits of growth tend to push up wages in more traditional sectors also. This is specially so if prices of key consumption items are rising. Government schemes that seek to implement various types of transfers to further objectives of ‘inclusive growth’ reflect this process.

In order to formalize this concept in the simplest possible way, consider quadratic production functions for traded, T, and non-traded, N, sectors in an economy. The traded sector predominantly comprises traditional occupations such as agriculture, and the non-traded sector services such as construction, trade and transport to which low-skilled labor from agriculture finds it easiest to move⁵. Output, Y, is a non-linear function of labor input, L, in each sector.

$$Y_T = T_0 + T_1 L_T - T_{11} L_T^2 \quad (1)$$

$$Y_N = N_0 + N_1 L_N - N_{11} L_N^2 \quad (2)$$

The marginal product of labour is increasing, but at a decreasing rate, in each sector. For example, for traded goods:

$$Y'_T = T_1 - 2T_{11} L_T > 0 \quad (3)$$

⁵ We make this simplifying assumption since we want to consider general equilibrium reallocation of labor between the two sectors. The model results can be applied to real economies with a manufacturing sector if the latter, as in India, functions as an enclave of high-skilled labor.

$$Y_T'' = 2T_{11} < 0 \quad (4)$$

The first order condition for profit maximization equates real product wages to the marginal product of labour:

$$w_T = T_1 - 2T_{11}L_T \quad (5)$$

Where real wages in the traded goods sector, in terms of traded goods prices, are $w_T = \frac{W_T}{P_T}$.

Equation (5) can be inverted to derive labor demand in traded goods:

$$L_T^d = \frac{T_1}{2T_{11}} - \frac{1}{2T_{11}}w_T \quad (6)$$

Which can be written as:

$$L_T^d = b_T - c_T w_T \quad (7)$$

Where:

$$b_T = \frac{T_1}{2T_{11}} \quad (8)$$

$$c_T = \frac{1}{2T_{11}} \quad (9)$$

Labour demand for non-traded goods can be written equivalently. Employment equals labor demand in both sectors but a higher wage demand in the lagging sector can create unemployment in it. Since there is equilibrium unemployment, output is demand determined. Higher employment would in turn raise demand. We assume the non-traded labor market clears, so:

$$L_N^S = L_N^d = b_N - c_N w_N \quad (10)$$

The remaining labor is supplied to traded goods. So, for general equilibrium across the two sectors, net labor supply to traded goods must equal total labor supply minus labor demand for non-traded goods. This formulation is consistent with the role of agriculture as an absorber of labor that cannot find more productive employment elsewhere.

Let q be the real exchange rate or inter-sectoral terms of trade, \bar{L} be the total labor supply, and real non-traded goods wages in terms of non-traded goods prices written as:

$$w_N = \frac{W}{P_N} = \frac{W}{P_T} \frac{P_T}{P_N} = w_T q. \text{ Substituting these items in net labor supply to traded goods, } L_T^S,$$

gives:

$$L_T^S = \bar{L} - L_N^d = \bar{L} - b_N + c_N q w_T \quad (11)$$

Thus L_T^S rises with real wages in the traded goods sector and with real depreciation. This is because both these variables decrease labor demand and employment in non-traded goods.

If we bring in fair wages, then the psychological factors discussed earlier suggest that wages in the traditional traded goods sector will rise with wages and productivity in the non-traded sector. Government expenditure more generally and specific schemes such as MGREGS would also raise w_N . A rise in the price of essentials, such as food items, will also raise the required or fair wages. This effect may be higher if food inflation, or wage inflation in the other sector, rises above some salient level. Then the coefficients change to: $\alpha = \alpha' > \alpha$ and $\beta = \beta' > \beta$. Finally, rising net supply of labor to the traded goods sector will tend to reduce fair wages demanded. This brings in a role for cyclical factors, as falling labor demand in non-tradables will have a negative effect on fair wages demanded in the traded goods sector. Higher α or β coefficients would reduce the impact of cyclical factors. A salient rise in w_N or in P_F , due to a sharp peak or a persistent rise, can have such a large psychological impact that cyclical variables are unable to affect outcomes.

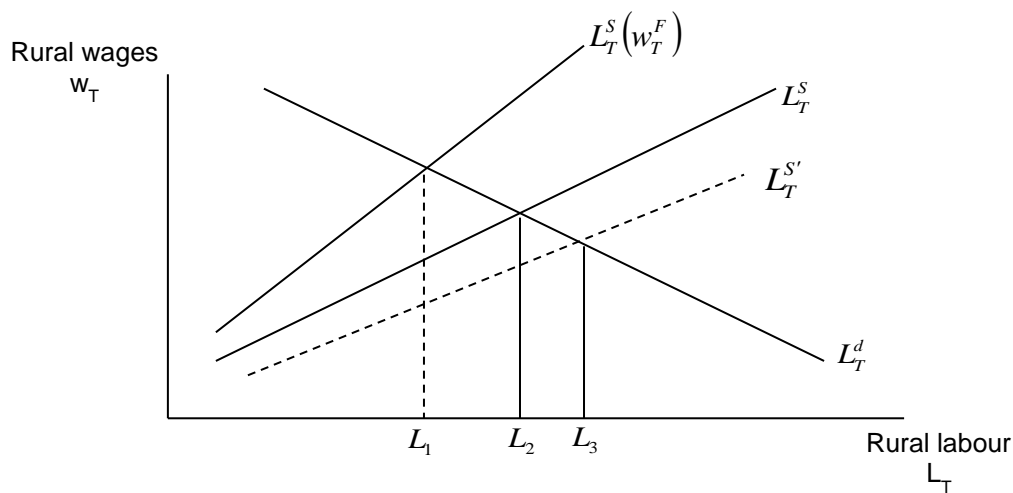
$$w_T^F = \beta w_N + \alpha P_F - (1 - \beta - \alpha)(\bar{L} - L_N^d) \quad (12)$$

Equations (7), (11) and (12) are graphed in Figure 1 in traded goods space. So this shows the demand (7) and net supply of labor (11) in the traded goods sector. It also graphs the fair wages equation (12).

We can now examine the effect of exogenous shocks in this market. The demand for fair wages reduces employment to L_1 below the market clearing level L_2 . The fair wage line

slopes upwards because of the cyclical factor $\bar{L} - L_N^d = L_T^s$. Fair wages in the traded goods sector rise as employment in non-traded goods increases with demand, or higher productivity raises w_N . A fall in labor demand in non-traded goods would have the opposite effect. If the cyclical variable has a strong effect monetary tightening could reduce wage and food price inflation. A rise in the non-traded wage level, or in food prices, would shift up the fair wage line and further reduce employment. Wages would also rise, although rising unemployment in traded goods would tend to moderate the rise.

Figure 1: Impact of wage targets and productivity differential on rural wages and employment



High fiscal deficits used to pump money into rural areas can raise labor demand and rural wages. To the extent patronage-based credit and other social programs are designed to leak, they boost consumption rather than raise productivity. In the model, such expenditure would raise w_T both directly as L_T^d rises, and indirectly by raising w_N and w_F .

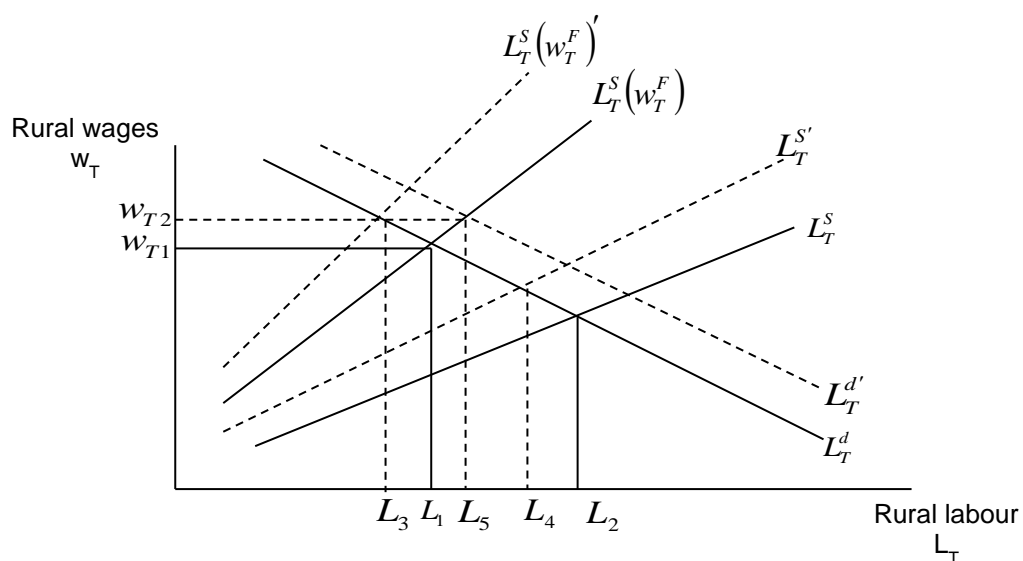
An increase (depreciation) in the exchange rate raises prices of tradable goods more than non-tradable goods. Even if government restricts the export of food articles during inflationary periods, border prices affect domestic food prices, making food articles tradable goods. Therefore fair wages should rise with an increase in the exchange rate. But as prices of traded goods rise relative to non-traded goods there is a reallocation of production to exports and import substitutes. Labor demand for non-tradables falls, so net labour supply in tradeables rises. A fall in L_N^d , with a rise in q , would shift L_T^s downwards to $L_T^{s'}$ dash. This will tend to

reduce w_T^F and w_T . So the sign of the exchange rate in the wage equation can be positive or negative, depending on which effect dominates.

With a rise in non-traded goods productivity, w_N would increase. The fair wage curve would shift out so, w_T^F and w_T would increase, decreasing employment in traded goods. Rising wages and unemployment in traded goods may also lead to a withdrawal of labor supply so \bar{L} falls to $\bar{L}' < \bar{L}$. Then $L_T^s = \bar{L} - L_N^d$ would fall to $L_T^s = \bar{L}' - L_N^d$, reducing unemployment and cyclical pressures. Transient unemployment may become structural unemployment. The fair wage curve may further shift outwards raising w_T more. A rise in productivity in traded goods, alternatively, would shift out L_T^d , raising wages and employment in traded goods. Thus if productivity in non-traded goods is rising faster than it is in traded goods, we would expect to see wages rise and employment fall in traded goods. If wages rise higher than productivity in any sector, unemployment should rise in that sector.

In Figure 2, rise in non-traded goods productivity raises wages as the fair wage curve shifts out to $L_T^s(w_T^F)'$ and reduces traded goods employment from L_1 to L_3 . But if the L_T^s also shifts upwards since \bar{L} falls, final unemployment $L_3 - L_4$ need not be much larger than its initial value $L_1 - L_2$. If productivity in T is rising at the same rate as in N, the fair wages curve would not shift out. Wages would still rise to w_{T2} but employment would also rise to L_5 .

Figure 2: A productivity rise in non-traded goods



We test these comparative static results with a monthly State-level data set on wages of rural unskilled workers. The theory suggests that an increase in food inflation should raise rural wage inflation, which may in turn aggravate the food inflation. Rising unemployment (cyclical) should moderate wage growth while a fall in net labor supply to traded goods would raise these wages. A rise in non-traded goods productivity or in labor demand, which raises non-traded goods wages, would also raise ‘fair’ wages in traded goods. If a combination of rising real wages and falling employment in traded goods is observed, it would imply productivity in traded goods is rising more slowly than that in non-traded goods. A rise in desired real wages would raise nominal wages, while real wages would evolve depending on what happens to prices.

3. Methodology and Data

If empirical testing validates the above theoretical model and the sign restrictions obtained from it, it can be used to explain the observed wage-price-growth puzzles.

State level monthly wages for manual agricultural labor, over the period April 2004 to September 2012, were sourced from Labor Bureau, Shimla, as reported in the RBI database. This includes the period of peak inflation. State-wise averages are estimated only for those occupations where the number of quotations is five or more. Data for other macroeconomic variables was also from the RBI database. All the variables were de-seasonalized, transformed into log values, and then YoY log differences were taken to get growth rates. Annualized YoY growth rates were used.

Our first set of regressions use *rural nominal wage inflation* as the dependent variable. However, we also estimate a reverse regression with *rural inflation* as a dependent variable and rural nominal wage inflation as an explanatory variable.

Rural nominal wage inflation = f{Macroeconomic variables, State specific inflation}

Average monthly wage obtained by taking the average of wages for unskilled rural activities for men was used to derive the dependent variable:

Rural wage inflation(t)= ln(average monthly wage(t))-ln(average monthly wage(t-12))

Independent Variables:

Food inflation: Derived from the aggregate WPI food articles index, base 2004-05, as well as the State level CPI rural labor, in which food has a large share. A rise in food inflation is expected to raise rural wages.

Fiscal deficit (FD) share to gross domestic product (GDP): Monthly share of fiscal deficit to GDP is derived by dividing the monthly fiscal deficit by the twelfth fraction of that year's nominal GDP, to the base 2004-05. It is expected to have a positive coefficient as it raises rural labor demand and fair wages. FD picks up the impact of more general fiscal interventions, but to test the impact of MGNREGS specifically, different types of dummy variables were used.

Expected food inflation, constructed using instrument variables with a GMM (Generalized Method of Moments) estimator, is also used as a dependent variable. This also tests psychological factors since expected inflation would raise fair wages.

Exchange rate growth rate: This is estimated on a YoY basis, using monthly INR/USD (period average). A rise is a depreciation of the INR. The theoretical prior for the sign is indefinite.

IIP growth rate: YoY growth of IIP is the cyclical variable used to capture the effect of rising labor demand and wages in the non-traded sector. It is expected to have a positive sign.

Change in the call money rates: YoY changes of the call money rate capture the impact of monetary policy cycles. This is expected to have a negative and significant coefficient if interest sensitive demand components significantly impact labor demand. IIP growth rate and the policy rate change test the impact of cyclical factors.

In the second set of regressions, rural consumer goods inflation derived from the CPI rural labour index, base July 1986- June 1987, is regressed on the other set of variables as

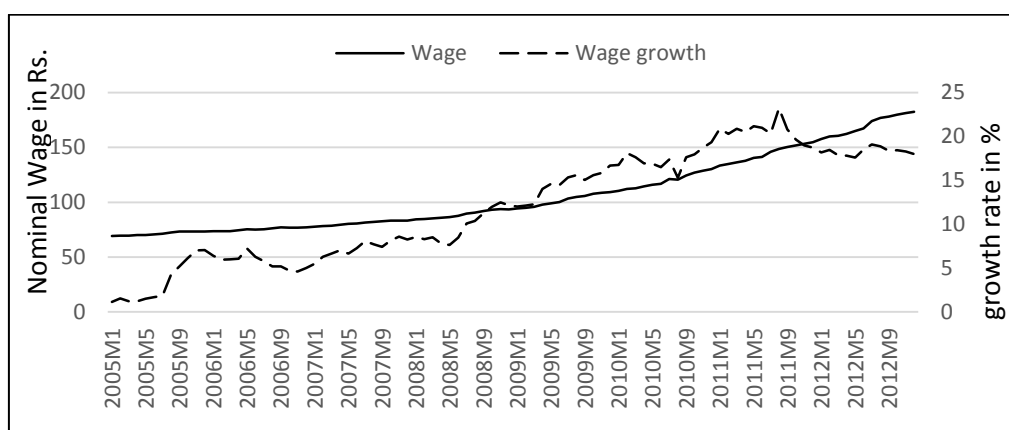
dependent variables, to test if wage inflation affects more general rural inflation⁶, subject to the other controls.

Table 1 gives the descriptive statistics for the variables in levels. Figure 3 shows the upward trend in nominal wages, the fluctuations in its growth rate, and its fall after 2011M9. The panel in Figure 4 clearly demonstrates the central puzzle we are addressing—food inflation and real wages peak, while growth falls. CPI rural and WPI food inflation peak in 2010M1. The peak in wage inflation follows that in food inflation, while coinciding with a cyclical slowdown. The fiscal deficit share peaks in 2011M1, and real wage growth in 2011M8. Figure 5 gives the real rural wage in different States compared to the all India real rural wage, identifying the high and low wage States. Only in a few States such as Assam, Maharashtra, Orissa, UP and West Bengal are real wages close to the all India real wage index, in other States there is wide divergence.

Variable	Obs	Mean	Std. Dev.	Min	Max
IIP	106	128.08	24.23	87.55	180.58
Exchange rate	108	45.98	3.75	39.37	56.03
Call market rates	108	6.10	2.06	0.73	14.07
WPI food articles (2004-05)	105	144.59	37.30	97.50	213.80
CPI rural (July 1986- June 1987)	108	467.42	109.41	334.00	689.00
Fiscal deficit shares (2004-05 base for GDP)	108	0.05	0.05	-0.10	0.16
Average rural wage	108	102.40	34.03	68.42	182.41

Note: p-values in brackets.

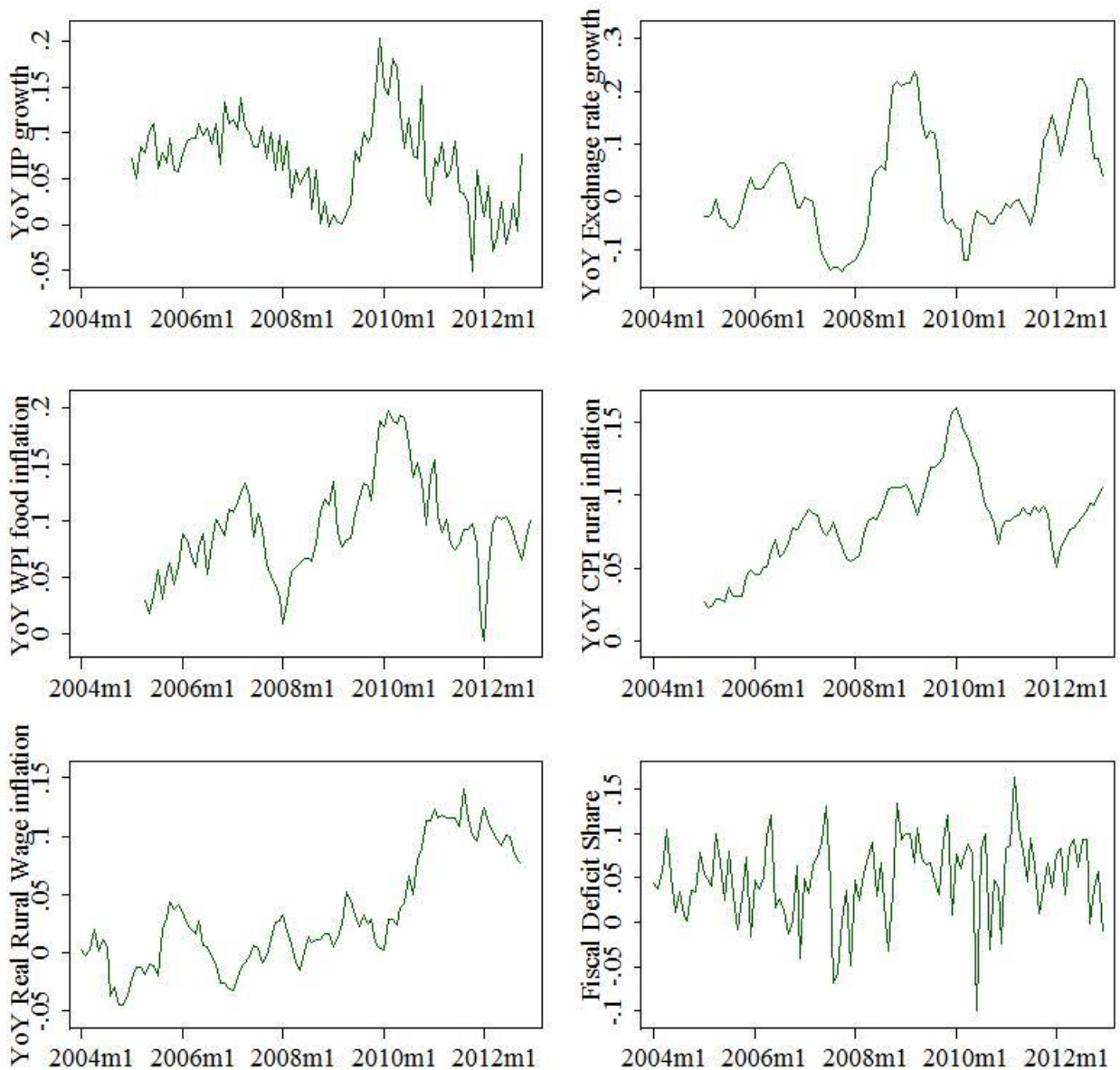
Figure 3: Nominal rural wages and their growth in India



⁶ The regression was also run with a narrower food inflation variable derived from WPI food articles. But results were not comparable because the dependent variable is not a State panel but an all India average.

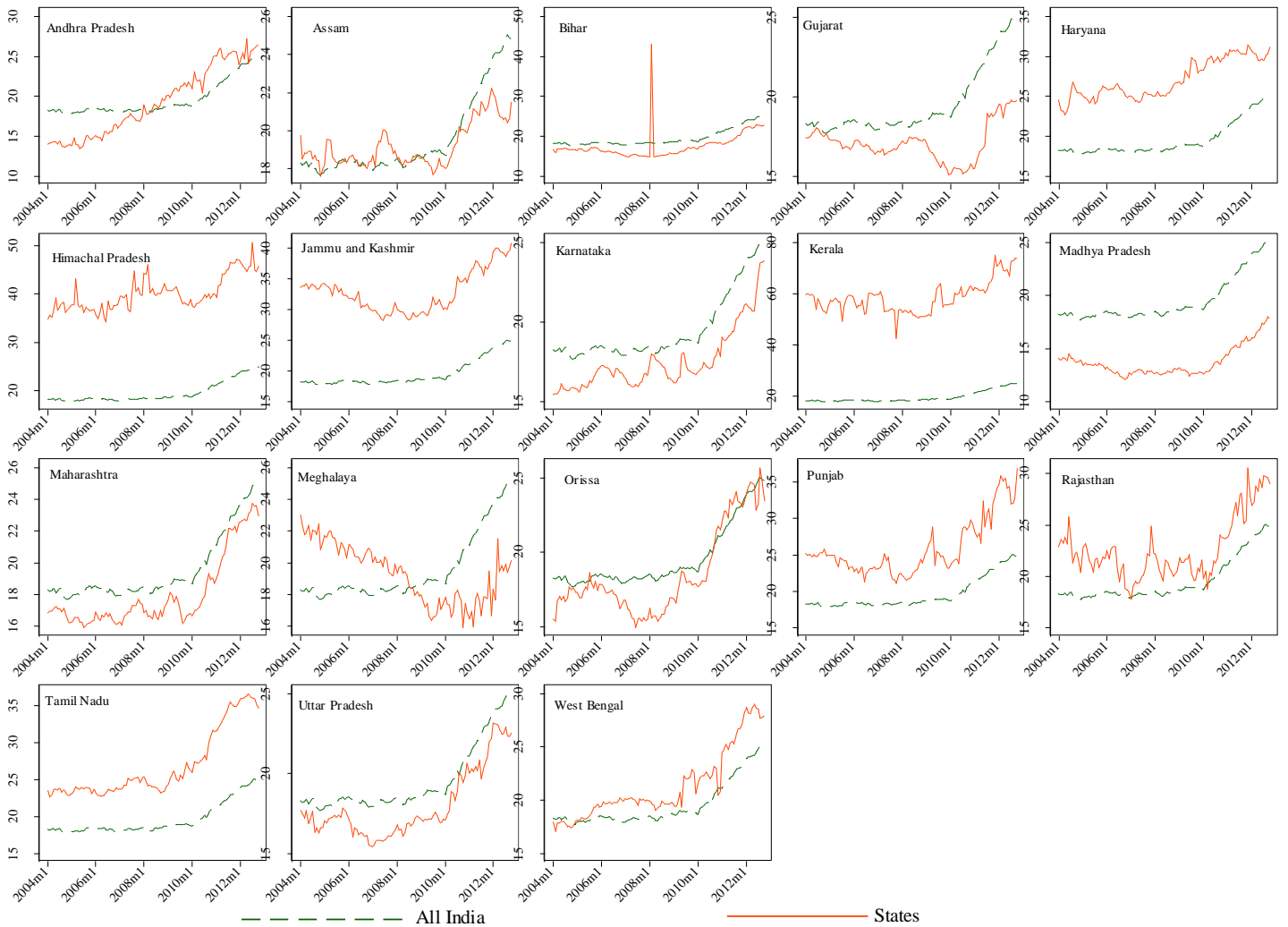
High wage growth States are Andhra Pradesh, Punjab, Kerala, Maharashtra, and Himachal Pradesh. Low growth States are Bihar, Gujarat, and Madhya Pradesh. Orissa, Assam, and West Bengal were low wage growth States in the early years of our sample but later caught up with the all India average.

Figure 4: Rural India and key macro variables



- Real wage is CPI (RL) adjusted

Figure 5: Real rural wage (CPI RL adjusted)



Methodology

The stationarity required for dynamic panel data analysis was established by testing the null that all the panels contain a unit root using the Levin–Lin–Chu test for unit root and also the Fisher type implemented in Stata 11.

The next step is to choose an appropriate methodology. A fixed effect regression analyzes the effect of independent variables on the dependent variable by holding the average impact of each panel as constant. When independent variables are not strictly exogenous, and are correlated to past variables, the Durbin-Watson statistic in the fixed effect regression will be low indicating autocorrelation. Then fixed effect regression is not appropriate. Arellano–Bond dynamic panel using GMM in the first difference of the regressors corrects for

endogeneity, time series problems, autocorrelation and deficiencies of the fixed effect panel regression. Arellano–Bover/Blundell–Bond, an augmented version of Arellano–Bond, allows for more instrumental variables, which increases the efficiency of the estimation (Roodman 2009).

Arellano and Bond transform the regression:

$$Y_{it} = \beta_1 Y_{i,t-1} + \beta_2 X_{it}^1 + \beta_3 X_{it}^2 + u_{it}$$

To a difference form and applies GMM:

$$\Delta Y_{it} = \beta_1 \Delta Y_{i,t-1} + \beta_2 \Delta X_{it}^1 + \beta_3 \Delta X_{it}^2 + v_{it}$$

The basic dummy variable method or Chow test of structural break only allows for a break in the intercept or a break in slope, and does not assess the nature of the change. Clemente, Montanes and Reyes (1998) suggest a unit root testing method (CMR test) that can detect more than one structural breaks and their type. It allows for two structural breaks at the same time. The time of break is determined endogenously, not by the user as in the dummy variable method. In the additive outlier mode (AO), the CMR test can detect a sudden change in the series. And the innovative outlier (IO) mode allows detection of a gradual shift in the mean of the series. The original null hypothesis of the test is given by:

$$H_0 : Y_t = Y_{t-1} + \delta_1 (DTB_1) + \delta_2 (DTB_2) + u_t$$

Where, DTB represents the dummy for structural breaks. The break points are determined endogenously by allowing dummies for all possible time periods. Two break points are selected based on the t-statistics, which is a standard procedure in structural break methods. The innovative outlier method considers a window of time, to detect whether the change has happened gradually or not. We allowed for IO type breaks and AO type breaks separately to get the significant break points in the variables, using the Stata 11 based package of the test.

4. Results

Tables 2, 3 and 4 present the results of the wage regressions. The static panel regressions show unsatisfactory DW statistics in the simple fixed effects estimation (Table 2). The problem persists even when Newey West standard errors are used. Even so, food inflation

and the FD share are strongly significant. IIP growth, though significant, switches coefficient signs across the two regressions.

Table 2 Wage inflation: Static Panel

Wage inflation	Newey West standard error	Simple fixed effects
IIP growth	-0.57*** (0.00)	0.41*** (0.00)
Exchange rate growth	-0.09 (0.12)	-0.02 (0.45)
WPI food inflation	0.08 (0.74)	-0.58*** (0.00)
Rural CPI inflation	1.26*** (0.00)	0.57*** (0.00)
Change in call rate (YoY)	0.004* (0.05)	0.002*** (0.00)
Share of FD	0.17* (0.06)	0.17*** (0.00)
Constant	0.03** (0.002)	0.05*** (0.00)
DW Stats	0.44	1.3

Note: p-values in brackets; ***, ** and * indicate level of significance at 1%, 5% and 10% respectively.

Some of the estimated dynamic panel regressions are reported in Table 3. The lag of wage inflation has a high and significant coefficient, as is to be expected in a monthly time series. Again, food inflation and the FD share are consistently significant across all the regressions, with the food inflation coefficient thrice as large. IIP growth and its lag are sometimes significant but have a negative sign. So a cyclical upturn tends to reduce rural wage inflation. The change in the exchange rate and its lag are sometimes significant but signs switch across regressions consistent with the two opposite theoretical tendencies highlighted in Section 2. Policy tightening does not affect wage inflation except in low wage States where it raises wage inflation mildly.

Table 3: Wage inflation: Dynamic panel

Wage inflation	Lag of wage inflation	Forward looking variables	High real wage States	Low real wage States
	1	2	3	4
Lag 1	0.87*** (0.00)	0.86*** (0.00)	0.85*** (0.00)	0.91*** (0.00)
Rural CPI inflation	0.06 (0.41)		-0.06 (0.44)	0.17* (0.06)
Lead 1		0.02 (0.79)		
Level		0.04 (0.76)		
Lag 1	-0.0003 (1.00)	-0.01 (0.94)	0.10 (0.19)	-0.17* (0.06)
IIP growth	-0.09* (0.07)	-0.09* (0.10)	-0.08 (0.27)	-0.06 (0.10)
Lag 1	-0.05* (0.08)	-0.07** (0.01)	-0.03 (0.31)	-0.09* (0.09)
Exchange rate growth	0.02* (0.6)	0.03 (0.55)	0.07 (0.25)	-0.07*** (0.01)
Lag 1	-0.04* (0.15)	-0.05 (0.12)	-0.07* (0.07)	0.03* (0.08)
WPI food inflation	0.10** (0.00)		0.11*** (0.002)	0.11*** (0.00)
Lead 1		0.08* (0.09)		
Level		0.02 (0.72)		
Lag 1	-0.02 (0.58)	0.005 (0.90)	0.002 (0.96)	-0.03 (0.46)
Change in call rate (YoY)	0.001 (0.10)	0.001 (0.12)	0.001 (0.39)	0.001*** (0.002)
Lag 1	-0.001 (0.15)	-0.001 (0.23)	-0.001 (0.20)	-0.001*** (0.003)
Share of FD	0.03** (0.01)	0.03* (0.07)	0.04** (0.03)	0.03** (0.18)
DV 2006-08				

Note: p-values in brackets; ***, ** and * indicate level of significance at 1%, 5% and 10% respectively.

Testing for the effect of expected variables on food inflation shows one lead of WPI food inflation (lead 1, Column 2) does positively affect wages, but when it does so, current inflation becomes insignificant. Columns 3 and 4 in Table 3 show that more macro variables affect the low wage compared to the high wage States⁷.

Table 4: Wage inflation: Effect of MGNREGS

Wage inflation	spread dummy	2011 wage spike	2011 wage shift	DV 2006-12	DV 2012
	1	2	3	4	5
Lag 1	0.841*** (0.000)	0.865*** (0.000)	0.848*** (0.000)	0.860*** (0.000)	0.863*** (0.000)
Rural CPI inflation	0.093 (0.185)	0.055 (0.460)	0.053 (0.500)	0.063 (0.404)	0.065 (0.398)
Lag 1	-0.042 (0.455)	0.012 (0.855)	0.005* (0.943)	-0.020 (0.750)	-0.001 (0.993)
IIP growth	-0.060 (0.164)	-0.091* (0.069)	-0.076 (0.123)	-0.071 (0.169)	-0.085* (0.091)
Lag 1	-0.028 (0.260)	-0.032 (0.217)	-0.025 (0.344)	-0.030 (0.256)	-0.044* (0.110)
Exchange rate growth	0.041 (0.286)	0.023 (0.590)	0.033 (0.440)	0.030 (0.494)	0.028 (0.529)
Lag 1	-0.060** (0.016)	-0.038 (0.202)	-0.046* (0.092)	-0.039 (0.178)	-0.049* (0.103)
WPI food inflation	0.075** (0.010)	0.088*** (0.001)	0.109*** (0.000)	0.095*** (0.000)	0.095*** (0.000)
Lag 1	-0.054 (0.119)	-0.022 (0.542)	-0.024 (0.501)	-0.031 (0.397)	-0.014 (0.691)
Change in call rate (YoY)	0.001* (0.154)	0.001* (0.104)	0.001* (0.241)	0.001* (0.102)	0.001* (0.135)
Lag 1	-0.0003 (0.438)	-0.001* (0.124)	-0.001* (0.118)	-0.001* (0.190)	-0.001* (0.167)
Share of FD DV 2006-08	0.021** (0.026)	0.030*** (0.007)	0.023** (0.040)	0.029** (0.016)	0.033 (0.005)
DV Jan 2011	-0.011*** (0.000)	0.016*** (0.004)	0.007** (0.014)	0.005*** (0.001)	
D 2012					0.003* (0.208)

Note: p-values in brackets; ***, ** and * indicate level of significance at 1%, 5% and 10% respectively.

Table 4 reports regressions seeking to isolate the effect of MGNREGS in the dynamic GMM panel. The dummy variable for the initial spread of MGNREGS which takes the value 1 over 2006-08 comes in with a negative sign (Column 1). But a dummy for January 2011 to capture the announcement effect of a sharp rise in MGNREGS wages (25%) in January 2011, after they were indexed to a uniform real value of 100, has a significant positive coefficient (Column 2). Wages rose more in some States where they were below 100. A shift dummy that takes the value 1 for all months after January 2011 is also significantly positive but has half the value of the spike dummy (Column 3), implying the announcement effect has a greater impact than the actual rise. The value '100' can itself act as a powerful focal point raising other related wages. A similar dummy that takes a value 1 for all months in 2012, when the wage growth rate was lower at 8%, was not significant (Column 5), although a dummy for the entire MGNREGS period of 2006-2012 had a low positive and significant coefficient (Column 4).

⁷ In the regression Andhra Pradesh, Assam, Haryana, Himachal Pradesh, Jammu & Kashmir, Kerala, Maharashtra, Meghalaya, Punjab, Rajasthan, Tamil Nadu, Tripura and Uttar Pradesh are classified as high wage States, while Bihar, Gujarat, Karnataka, Madhya Pradesh, Orissa and West Bengal are low wage States.

The conclusion follows that MGNREGS effects on nominal wages came largely through the 2011 jump that may itself have been driven by the preceding jump in food prices. And the effect had died out by 2012, although indexation was in place.

In the reverse regression of rural CPI inflation on rural nominal wage inflation and the other dependent variables (Table 5), the coefficient of lagged wages is high. Persistence exceeds that in the wage equation. Expected wages are insignificant, as are the share of FD and changes in the exchange rate. IIP growth mildly raises rural CPI inflation but its lag reduces it. Policy tightening mildly reduces inflation. While these regressions estimate the price-setting decision, the last column gives the regression of rural CPI inflation on rural real wage inflation (wages deflated by rural CPI inflation) to capture the effect of demand on rural inflation. There is a problem since the same price index enters both the sides of the equation⁸. Neither real wage nor IIP growth affects prices since the lag coefficient cancels out the level, although both are significant. Depreciation and the FD both raise inflation while the policy variable reduces it marginally.

Table 5: Effect of wages on rural CPI inflation			
Rural CPI Inflation	Nominal wages	Expected nominal wages	Real wages
Lag 1	0.92*** (0.00)	0.92*** (0.00)	0.93*** (0.00)
Wage inflation	0.02* (0.07)		-0.11*** (0.00)
Lead 1		0.01 (0.29)	
Level		0.01 (0.20)	
Lag 1	-0.02 (0.16)	-0.02 (0.15)	0.10*** (0.00)
IIP growth	0.03** (0.002)	0.03** (0.001)	0.02 (0.12)
Lag 1	-0.02** (0.01)	-0.02** (0.02)	-0.02*** (0.01)
Exchange rate growth	0.01 (0.17)	0.01 (0.17)	0.02* (0.09)
Lag 1	-0.001 (0.89)	-0.001 (0.92)	-0.01 (0.50)
Change in call rate (YoY)	-0.0005** (0.01)	-0.0005** (0.01)	-0.0003* (0.08)
Lag 1	-0.0002 (0.30)	-0.0002 (0.29)	-0.0003 (0.21)
Share of FD	0.003 (0.37)	0.003 (0.39)	0.006* (0.08)

Note: p-values in brackets; ***, ** and * indicate level of significance at 1%, 5% and 10% respectively.

That price inflation shows more persistence than nominal wages and is not affected by forward looking variables implies real wages will change faster than nominal during turning points. The data confirms this (Figures 3 and 4). In 2013 real wage growth had fallen to 2%, although nominal wage growth remained at 15%.

⁸ Joshi et. al. (2013), using quarterly data starting from 1999 find the long-run elasticity of WPI food inflation to real wages, from a cointegrating vector, to be 0.82. It is the largest coefficient. The result is subject to the same criticism of possible high correlation due to the price variable in the dependent and independent variable. Moreover, our more general regression with aggregate WPI food inflation, done for comparative purposes, does not support their result.

Table 6: Structural breaks					
	break 1	Break2	Type	Break 3	Type
rural wage inflation (YoY)	2008 m11	2010 m6	AO	2008 m5	IO
rural CPI inflation (YoY)	2008 m8	2010 m12	AO	2010 m5	IO

Table 6 summarizes structural break tests on the rural wage and CPI inflation series. Both the series have dual structural breaks in 2008 and in 2010. The breaks in CPI inflation are visible from Figure 3 (graph 2). But breaks in nominal wage inflation are corrected very quickly and hence they are not visible. These breaks are additive outliers. That is, a sudden shift in the series. The first break in wage inflation after November 2008 coincides with the sharp rise in food inflation and the second shift in 2010 is a decline in the rural wage inflation coinciding with the fall in food inflation. However, we also detect a breakpoint in the form of an innovative outlier during 2008 m5. Innovative outliers indicate a slow process of change in wages with gradual shifts capturing persistence. We also found an innovative or gradual break in rural CPI inflation during May 2010, as food inflation fell sharply and then rose again gradually in 2011.

The analysis of structural breaks gives insights for the behavior of the real rural wage. From 2008 to 2010 there was a declining trend in the rural real wage due to the rise in food inflation. Real wages inverted and started increasing in the early months of 2010 as nominal wages rose faster and food inflation moderated. But by the end of 2011 they again declined, due to rise in rural CPI inflation, and fall in nominal wage inflation.

In addition to the analysis of structural breaks, correlations of peaks across series, provides evidence in favor of the concepts of salience and overreaction. Peak nominal wage inflation in 2011M9 (22%) followed the peak food inflation in 2010M1 (20%) and the 2011M1 peak followed the rise in MGNREGS wages. Real wage growth peaked with nominal wage growth in mid-2011 as food inflation fell but nominal wage growth remained strong. In 2012 both nominal and real wage growth fell as food inflation softened to 10%. The data shows over-reaction to food price peaks which then comes down slowly with greater persistence in nominal compared to real series.

The largest rate of increase of the average MGNREGS minimum wage of 28.5% was in 2009, the year our MGNREGS dummy was negative. The second largest of 25.1% was in 2011, the year MGNREGS wages were indexed to give a real wage of INR 100. This pushed up wages in many States where it was below that level. The MGNREGS wage set may itself have been influenced by a food price inflation generated 'fair wage' effect. After indexation stabilized, the rates of increase were more moderate at 8 and 10%. So indexation may actually prevent the over-reaction that happened without it. The lag of response of nominal wages to food inflation had already shortened from 2008; indexation need not reduce it further.

In addition to the regression, structural breaks and analysis of peaks, changes in employment across sectors also support the theoretical priors. If non-traded goods productivity growth exceeds that in traded goods, we expect to see a fall in rural employment and rise in rural wages. This is what the data shows. We can conclude that agricultural productivity growth lagged that in the other sector, while agricultural wage growth exceeds that in productivity. Inflation was not driven by Balassa-Samuelson type rise in traded sector productivity.

Other evidence also supports this conclusion. Between 2004-and 2012 real agricultural GDP per worker in agriculture rose 51% and net fixed capital stock per worker grew by 71.5% (Gulati and Jain, 2014). These are indicators of productivity per worker. But MGNREGS wages grew 94.2% nominal unskilled wages 174.7% and real wages 35.9%. That wage growth far exceeded productivity indicates contagion from higher productivity growth elsewhere. The result was inflation that left real wage growth at rates closer to productivity while employment also shrank.

Between 1999 and 2004 the economy added 60 million jobs while between 2005 and 2010, it added barely 2.72 million jobs. While aggregate job growth was low, there was major re-allocation across sectors. Agriculture lost 15 million workers and its share in total employment fell from 57% to 53%. For the first time absolute numbers employed in agriculture fell. Manufacturing lost 5 million jobs. Construction added 18 million, and services sector only 4 million, compared to the 18 million it had added during 2000-2005. Non-manufacturing dominated by construction, trade and transport increased its labor share by 4% to 26% in 2009-10 compared to 2004-05 while agriculture lost 4%. Although the labor force grew by about 13.9 million between 1st January 2010 and 2012 (NSS 66th and 68th

round surveys on employment and unemployment)⁹, agriculture lost another 13 million workers.

The theoretical priors suggest if productivity and wages in non-traded goods are rising, these should drive up rural wages as 'fair wages' rise. Since 2009 non-farm rural wages grew at almost 17%¹⁰. Wages for blue-collar workers, skilled and unskilled, grew at an estimated 15% in 2013, faster than the 6% average inflation rate, but barely above the 13% increase in food prices¹¹. MGNREGS wages were only a lower bound, since other rural wages were generally above them. For example, in 2012 (NSS 68th Round) daily wages for rural casual laborers in works other than public works were INR 139; in public works other than MGNREGS public works were INR 121, and in MGNREGS public works were INR 107. The NSS data also suggests that MGNREGS works may not always be paid the mandated minimum wage since this was INR 138 in 2013. But the sharp 2011 jump in official MGNREGS wages, did further push up the 'fair wages' demand.

Rising unemployment, as well as prosperity, can reduce components of labor supply. The female labor force participation rate fell from 37.3% in 2004–05 to 29% in 2009–10 and 23% in 2011-12. Women and youth withdraw from the labor force, some of them to spend more time studying to improve job prospects in the non-traded goods sector. In rural India 23 million women left the labor force over 2004-10, thus reducing the pressure of unemployment that could otherwise have moderated the rise in 'fair' wages.

5. Conclusion

The model suggests sharp or persistent increase in food inflation should raise 'fair wages' and rural wage inflation. Food inflation turns out to consistently have the largest positive coefficient.

Both the monetary policy and the cyclical variable (IIP) are insignificant for wage inflation. Monetary policy tightening has a mild effect on price inflation but no direct effect on

⁹ See 12th Plan, <http://pib.nic.in/newsite/erelease.aspx?relid=96641>, and <http://economictimes.indiatimes.com/news/politics-and-nation/upa-policies-leading-to-jobless-growth-report-by-govt-body/articleshow/18391984.cms>

¹⁰ Lanjouw and Murgai (2009) find growing non-agricultural employment began to push up agricultural wages in India after 2004.

¹¹ A real estate developer remarked: "When workers come and tell you they can't afford essential food items with what they are earning, you have to raise wages." See http://www.firstpost.com/economy/rising-wages-for-blue-collar-jobs-threaten-efforts-to- quell-inflation-1309195.html?utm_source=ref_article

reducing wage inflation. Repeated peaks in food inflation dominated the period of estimation. The model suggests the alpha and beta coefficients could rise in such periods, reducing the impact of cyclical and policy variables, so that cyclical variables lose power just as inflation rises.

The fiscal deficit has a large positive coefficient suggesting the structure of government spending raised demand for rural labor and fair wages, but it was not significant for price inflation. Although the spread of MGNREGS through the country did not raise wages, the sharp 2011 jump in MGNREGS wages did have this effect. The indexation of MGNREGS wages also probably over-reacted to the prevailing food inflation. The many aspects of Government intervention did together raise rural wages. While indexation of MGNREGS wages reduces lags in wage adjustment it may also reduce the earlier over-reaction of nominal wages to sharp peaks in food prices. For example, the moderate rise in MGNREGS wages in 2012 did not raise rural wages.

As employment in construction rose with government expenditure, so did the level of fair wages. The demand for higher wages reduced employment in agriculture. The pattern of rural wages rising and employment falling in agriculture implies productivity in other sectors was rising faster than it was in agriculture, unlike the Balassa-Samuelson type of inflation in developing countries where productivity in the traded sector rises faster raising other wages. The sign of the exchange rate in the wage equation was indeterminate in theory, depending on whether the cost-push or labor reallocation effect dominates. This is also observed in the regressions.

There is a literature on how raising wages is one of the most effective ways to reduce poverty. But sustainable real wage growth is linked to a rise in productivity—the rest washes out in inflation or in a loss of jobs. MGNREGA had a transient effect on nominal wage growth. Permanent impact on the level of real wages was related to a rise in rural productivity to which it may have contributed.

These results suggest the special circumstances of repeated food price peaks and large government spending drove the unusually sharp rise in real wages, raising social norms of what was the ‘fair’ subsistence wage. But since the impact of wages on rural food prices was low there was some accompanying rise in productivity. Bottlenecks in marketing, and other

exogenous shocks, however sustained food inflation, manifesting in multiple supply shocks. Even so, there may not be a wage-price spiral. Nominal wage growth can reduce if food price inflation moderates, especially since expected food inflation affects nominal wage growth. Since persistence in prices is greater than that in wages, real wage growth would reduce before nominal wage growth.

The analysis allows us to answer the questions with which we started the paper. A sharp rise in real wages took place in a period of low growth because of the exceptional rise in food prices and the large share of government expenditure directed to rural areas. Repeated food prices shocks kept nominal wage growth high but there may not be a wage-price spiral, since wages did not affect rural prices. Expected food inflation affected nominal wage growth. There was some improvement in productivity in agriculture but it lost jobs since productivity and wage growth in construction, another major employer of unskilled rural labour, was higher. Gains in inclusion were limited to the extent job growth was low, and inflation eroded nominal wage growth. Essential complementary policies to remove marketing restriction in agriculture were missing.

For social programs to sustain a rise in real unskilled wages, productivity has to rise.

The regression results and other evidence are in line with the predictions of the model and support psychological and social as compared to cyclical factors. Therefore the analysis provides a robust explanation for the observed wage-price-growth puzzles, taking account of general equilibrium feedback across sectors.

Despite inflation, the economy was not overheating. Monetary tightening had no effect on wage inflation and only a mild impact on rural price inflation, despite a large reduction in growth rates. It therefore should be used sparingly although unproductive fiscal spending must be curbed. Even so, policy must react quickly to food inflation above a threshold and more so if persistence indicates second-round effects are occurring. But supply-side response is preferable since demand variables have little effect. There is a role for mild monetary tightening in moderating food inflation, but it needs to be complemented by fiscal and other supply side variables. Even as it reduces fiscal deficits, the government has to act on structural factors weakening food supply chains, such as restraints on the inter-State movement of goods, marketing monopolies, bottlenecks on power generation that vitiate cold

storages. Sharp nominal depreciations must be prevented since a steep rise in border food prices raises domestic prices.

Better agricultural markets are required so the functioning of the *mandis* must be improved even as alternatives to them are allowed to develop. The committees that govern them must not be allowed to restrict entry, and *mandi* fees strictly used to develop infrastructure and improve systems. Better storage and processing would smooth repeated price peaks. Nominal wage growth can be contained, even as real wages rise with productivity, if bottlenecks in agriculture are addressed. Despite some rise in agricultural productivity over-frequent food price shocks point to other structural issues that must be addressed.

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