

The Minimum Wage Puzzle in Less Developed Countries: Reconciling Theory and Evidence

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- Joint work with Ed Buffie (Indiana University) under auspices of IMF-DFID
- Building dynamic macroeconomic models for LIC policy makers



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While many low-income countries (LICs) have experienced strong economic growth over the last 15 years, they still face a number of macroeconomic challenges and vulnerabilities. Modernizing monetary frameworks, strengthening fiscal positions, managing natural resource wealth, expanding links to the global financial system, and encouraging diversification and structural transformation are important components that promote sustainable and inclusive growth in LICs.

The IMF has partnered with the UK's Department for International Development (DFID) to study these critical LIC macroeconomic policy issues. The project will focus on the following topics:

Topics

Modeling policy choices ▶

Understanding macro-financial linkages ▶

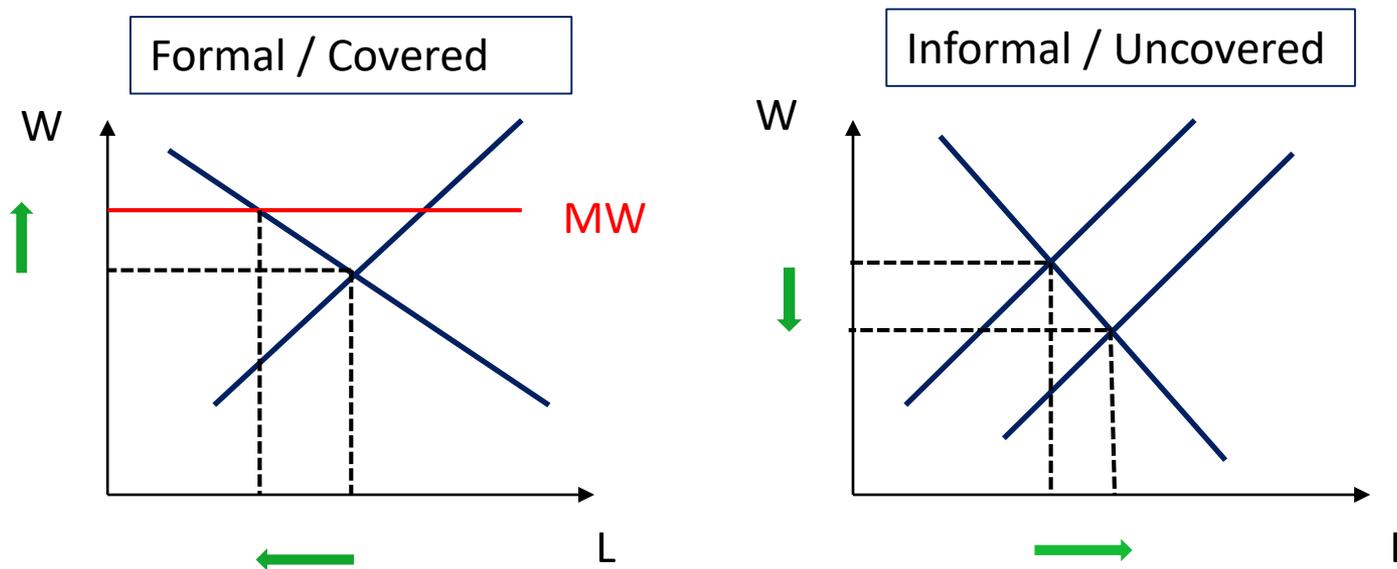
Building resilience ▶

Promoting structural change and institutional development ▶

- Fantastically rich empirical literature on labour markets (on the demand and supply side), wage setting, search and matching etc., etc..
- Nonetheless, standard LDC macro models tend to assume flex-price labour markets, possibly segmented between formal and informal.
- **Our concern:** there is a serious mismatch between the implications of these conventional models and what the empirical data tells us:
- What are we missing in terms of key macroeconomic dynamics (as well as distributional considerations)? What implications for fiscal policy and public investment under 'reasonable' labour market structures? What are impacts of key labour market reforms, including minimum wage (MW) legislation.
- Here we look at evidence on minimum wages. Interesting in their own right but allows us to think how best to model labour markets in macro models.

Minimum Wage policies: good intentions but contested implications. ...but do we have the economics right?

- Conventional analysis from canonical segmented labour market model (Econ 101)



$L_f \downarrow$ $L_i \uparrow$ $w_i \downarrow$ $GDP \downarrow$ *Gini worsens*

Empirical evidence challenges every aspect of this narrative!

1. Formal Sector Employment

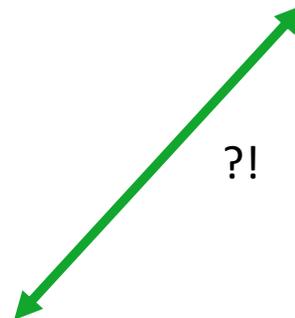
Simple flex-price labour market model:

For two-factor CES, with elasticity of substitution σ and capital share θ_K , wage elasticity of employment

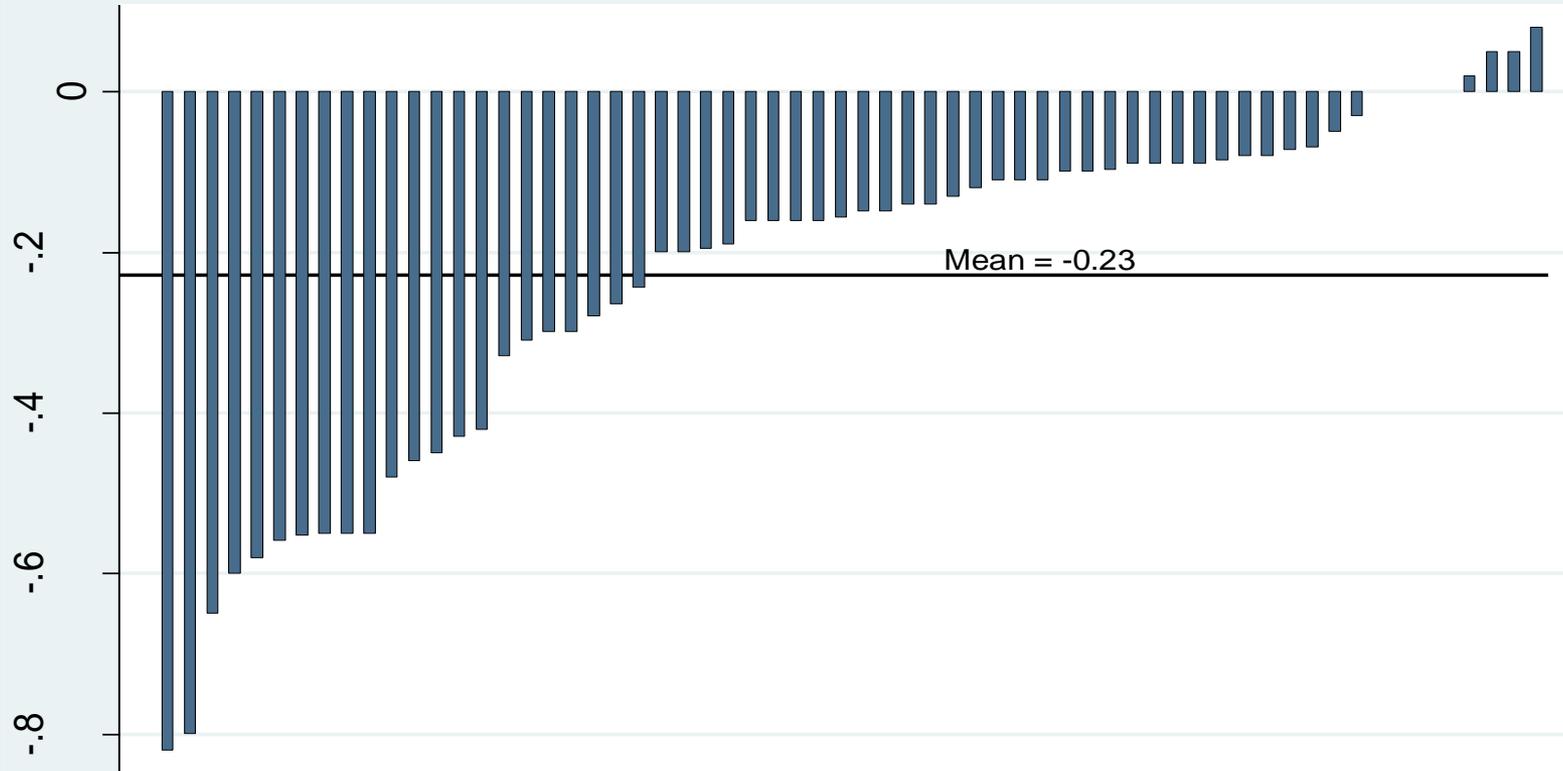
$$\varepsilon = -\frac{\sigma}{\theta_K} \approx -\frac{0.5}{0.33} \text{ to } -\frac{1}{0.33} = -1.5 \text{ to } -3$$

- Evidence from the literature:

- Nataraj et al (2014) -0.08
- Borat et al (2017) -0.11
- World Bank (2006) -0.20
- This paper (2018) -0.23



MW study-based estimates of employment elasticities Formal sector employment



Sources: Adam & Buffie (Appendix C)

2. Informal wages



- Informal real wages generally do not decline. On the contrary 'Lighthouse effects' seem to be present and quite strong:
 - Gindling and Terrell (2014) - Costa Rica: wage elasticity 0.15 to 0.40
 - Neumark et al (2006) – Brazil: 0.43
 - Rani and Ranjbar (2015) – India 0.45 ; 0.80 (Indonesia)
- Some weak evidence of *increase* in informal sector employment; but more typically decrease more than employment in formal sector (Bechterman, 2014).

Empirical evidence challenges every aspect of this narrative!

3. Output and Investment effects



Much less evidence on output and investment...

- Rama (2001) – Indonesia
- Azam (1997) – Morocco
- Bhorat et al (2014) – South Africa
- Mayneris et al (2014) – China



Significant increase in labour productivity (approx. 0.2 to 0.4)

Repeated calls in the literature for “new work” to make sense of the puzzles in the literature..

“While work on minimum wages is fairly mature in many OECD countries, our understanding of minimum wage policy in SSA is not”. (Bhorat et al, 2017).

Our contribution in this paper:

- Dynamic GE model with **efficiency wages (EW)** and (endogenous) capital accumulation – in formal and informal (non-agric) sector
- We argue that while there are many other competing theories of labour markets in LDCs (see Teal, IZA WP 2017) , an EW perspective gives substantial leverage against the “puzzles” in the empirical evidence on MW...
- ...and provides a basis for our extended work on labour markets in macroeconomic models.

Compelling evidence on efficiency wages in LDCs

- Rarely seen in development macro models....but extensive empirical evidence that EW operate in non-agric sectors.
- The 'wage curve' literature (Blanchflower and Oswald, 2005 and followers)
- The stylized facts
 - Firm size wage premia
 - Stable inter-industry and occupational wage differentials
 - Stable formal vs informal differentials
 - Stability across countries and time
 - Low quit rates and longer job tenure
- Really only EW models can explain these effects

- **Step 1: EW mechanisms in a simple model** (constant output and employment in informal sector).
 - Brings employment elasticity down from approx. -3 to -1 (good start, but not quite there!)
- **Step 2: EW in formal and informal sectors -- wage curves, substitutability, monitoring costs and firm-size wage premium**
 - Brings employment elasticities down to -0.2 to -0.6 (getting close!)
- **Step 3: Extending the model to allow MW in the public sector and adjustment costs in labour**
 - Good coherence with empirical literature, both long-run and short run...suggests we've got a reasonable basis for more general modelling.

- Two Sectors → Formal and Informal (non-agric)
- Representative agent, with CES consumption aggregate over formal and informal goods
- Efficiency wages in one or both sectors → wage curves with open unemployment

The Solow Condition (we'll use this later)

Firms face a trade-off between high-wage / high effort or low-wage/low effort. What real wage minimizes the cost of *effective* labour input?

$$e'(w) \frac{w}{e(w)} = 1$$

Firm choose K , L and w such that $MPK=r$, $MPEL=w$ and the elasticity of effort w.r.t. wage = 1.

- **CES Technology**

$$Q_f = a_f \left[a_1^{\frac{1}{\sigma_f}} (e_f L_f)^{\frac{(\sigma_f-1)}{\sigma_f}} + (1 - a_1)^{\frac{1}{\sigma_f}} K_f^{\frac{(\sigma_f-1)}{\sigma_f}} \right]^{\frac{\sigma_f}{(\sigma_f-1)}}$$

$$C = \left[(1 - \kappa)^{1/\varepsilon} C_f^{\frac{(\varepsilon-1)}{\varepsilon}} + \kappa^{1/\varepsilon} C_i^{\frac{(\varepsilon-1)}{\varepsilon}} \right]^{\frac{\varepsilon}{(\varepsilon-1)}}$$

- **Preferences**

$$\text{Max } U = \left(\frac{C^{1-1/\tau}}{1 - 1/\tau} - Z \right) e^{-\rho t} dt$$

$$P_k \dot{K} = P_f Q_f + Q_i - PC - P_k \delta K$$

$$Z = \left[e_f - g_o - g_1 \ln \left(\frac{w_f}{P} \right) - g_2 u + g_3 \ln \left(\frac{L_f}{S_f} \right) \right]^2$$

→ On the optimal path

$$e_f = g_o + g_1 \ln \left(\frac{w_f}{P} \right) + g_2 u - g_3 \ln \left(\frac{L_f}{S_f} \right)$$

Combined with Solow Condition $\Rightarrow \frac{g_1}{e_f - g_3} = 1$

→ Wage Curve in formal sector

$$\ln \left(\frac{w_f}{P} \right) = \frac{1 - g_o - g_2 u - g_3 \ln \left(\frac{L_f}{S_f} \right)}{1 - g_3}$$

The Short-run (prices and investment fixed)

Efficiency wages have significant employment effects

Assume MW initially binds and is consistent with wage curve. With new MW effort becomes

$$e_f = g_0 + g_1 \ln\left(\frac{w_m}{P}\right) + g_2 u - g_3 \ln\left(\frac{L_f}{S_f}\right)$$


Three factors now drive employment effects of MW

- The real wage effect alone (the Solow effect) $\rightarrow e_f L_f$ is constant ($e_f \uparrow L_f \downarrow$)

$$\widehat{L}_f / \widehat{w}_m = -1$$

- With plausible values of parameters (from empirical wage curve estimates) unemployment effect (g_2) and firm-size wage premium effect (g_3) combine to reduce employment elasticity much closer to empirical estimates.

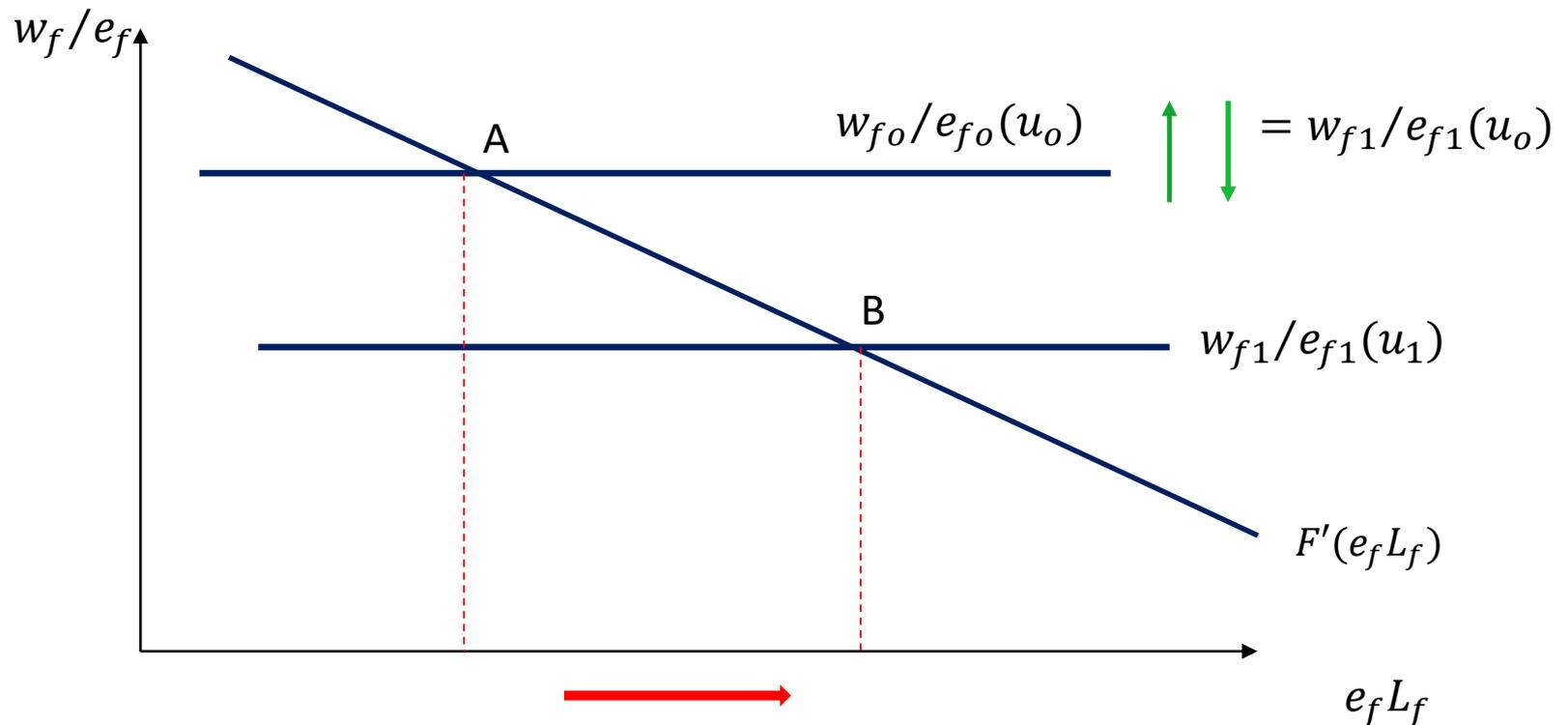
$$\widehat{L}_f / \widehat{w}_m = \approx 0.33$$

The short-run output effect

A coordination externality boosts output

Increase in MW has no effect in partial equilibrium (the Solow effect)

But as individual firms shed labour the higher unemployment induces more effort, shifting effective cost of labour down, increasing the supply of labour services and output.



Given representative agent structure, our model is not well-equipped to conduct full-blown welfare analysis (but see below)

Punchline is easy but trivial... ... subject to the caveat that we ignore distributional considerations!!

Increase in MW increases welfare in the sense that the long-run path of consumption is higher throughout

Logic is clear: employment and real wage are suboptimal at initial equilibrium. Increased MW ameliorates the coordination externality so that labour services increase and, in addition, capital increases...

- Informal sector (with EW), including a fixed factor in entrepreneurial talent (but no firm-size premium).
- MW legislation does not bind in informal sector but ‘lighthouse’ effects
- Wage Curve in informal sector

$$\ln\left(\frac{w_i}{P}\right) = 1 - b_o + b_2 \ln\left(\frac{\bar{w}}{P}\right) - b_3 u$$

- Prices and capital stocks in both sectors are now endogenous

We turn now from analytical to numerical solutions and consider a 10% increase in the MW in the formal sector.

- We calibrate to two archetypes:
 - **MIC** (e.g. Colombia or South Africa)
 - **LIC** (e.g. Kenya, Tanzania)

Key Parameters

- Structural
 - Elasticity of substitution in consumption between formal and informal goods (ε)
 - Share of formal sector good in total output
 - Labour share in value-added in informal sector
 - MW coverage (public vs private sector employees)
- Wage Curves
 - Elasticity of wages wrt unemployment (both sectors)
 - Firm-size wage premium (formal sector)
 - Lighthouse effect (informal sector)

Table 1: Long-run outcomes when (real) MW increases by 10% in the private sector (percentage changes)

Wage curve (u-slope) Elasticity of substitution	Formal sector share in expenditure = 65%					
	'Flat'		'Medium'		'Steep'	
	3	5	3	5	3	5
Real wage – informal	5.8	6.0	5.0	5.1	4.6	4.8
Employment – formal	-3.0	-1.3	-1.5	0.2	-0.9	0.8
Employment –informal	-5.8	-7.5	-3.9	-5.7	-3.1	-4.9
Employment - total	-4.3	-4.1	-2.6	-2.5	-1.8	-1.8
Capital – formal	4.9	6.7	6.5	8.3	7.2	9.0
Capital – informal	-1.8	-3.4	-0.4	-2.1	0.2	-1.5
Output – formal	5.8	7.4	7.5	9.1	8.2	9.8
Output – informal	-3.4	-4.7	-2.1	-3.4	-1.5	-2.9
GDP	2.6	3.2	4.1	4.7	4.8	5.3

Table 2: Long-run outcomes when (real) MW increases by 10% in the private sector – LIC calibration

Wage curve (u-slope) Elasticity of substitution	MIC		LIC	
			'Medium'	
		3	3	1
Real wage – informal		5.0	3.6	3.4
Employment – formal		-1.5	-2.8	-6.5
Employment –informal		-3.9	-3.6	-1.8
Employment - total		-2.6	-3.3	-3.5
Capital – formal		6.5	5.2	1.2
Capital – informal		-0.4	-1.5	0.6
Output – formal		7.5	6.6	3.0
Output – informal		-2.1	-2.1	-0.8
GDP		4.1	1.8	0.9

- CES Technology

$$Q_f = a_f (e_p L_p)^\beta \left[a_1^{\frac{1}{\sigma_f}} (e_f L_f)^{\frac{(\sigma_f-1)}{\sigma_f}} + (1 - a_1)^{\frac{1}{\sigma_f}} K_f^{\frac{(\sigma_f-1)}{\sigma_f}} \right]^{\frac{\sigma_f}{(\sigma_f-1)}}$$



$$e_p = d_o + d_1 \ln\left(\frac{W_m}{P}\right) + d_2 u - d_4 \ln\left(\frac{L_p}{S_p}\right)$$

- Public sector may be more or less productive than private sector and may put out more or less effort. We assume

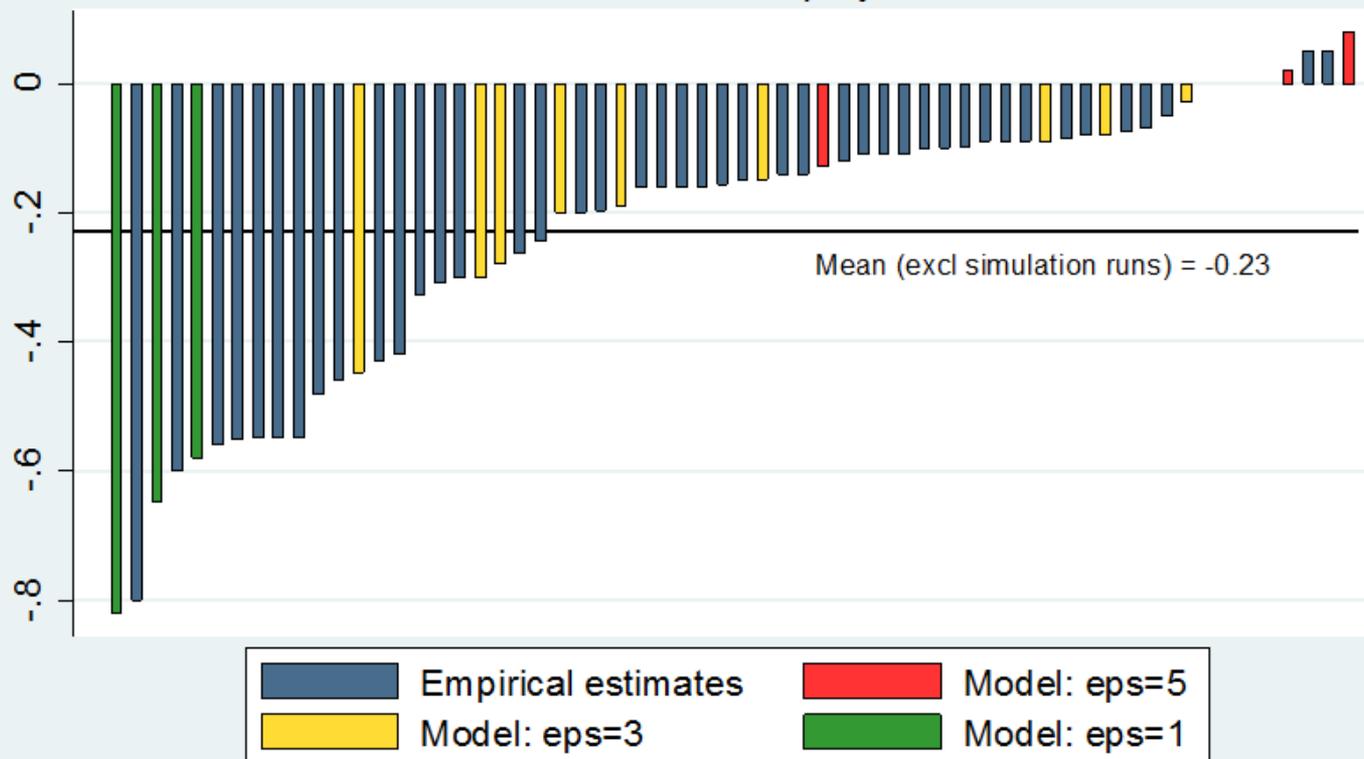
$$e_p/e_f < 1$$

$$MPL_p = \frac{\beta Q_f}{L_f} = \theta MPL_f$$

Table 3: Long-run outcomes when (real) MW increases by 10% in the private sector *and* the public sector (medium-slope wage curve)

Elasticity of substitution	Formal sector share in expenditure = 65%					
	Private		Public – low prod		Public – high prod	
	3	5	3	5	3	5
Real wage – informal	5.0	5.1	6.2	6.4	7.0	7.2
Employment – formal	-1.5	0.2	-0.8	1.0	0.3	2.2
Employment – informal	-3.9	-5.7	-4.5	-6.4	-4.6	-6.6
Employment - total	-2.6	-2.5	-2.5	-2.4	-1.9	-1.8
Capital – formal	6.5	8.3	7.2	9.1	8.3	10.3
Capital – informal	-0.4	-2.1	-0.2	-2.0	0.4	-1.6
Output – formal	7.5	9.1	8.4	10.1	9.7	11.5
Output – informal	-2.1	-3.4	-1.9	-3.3	-1.3	-2.8
GDP	4.1	4.7	4.8	5.4	5.8	6.5

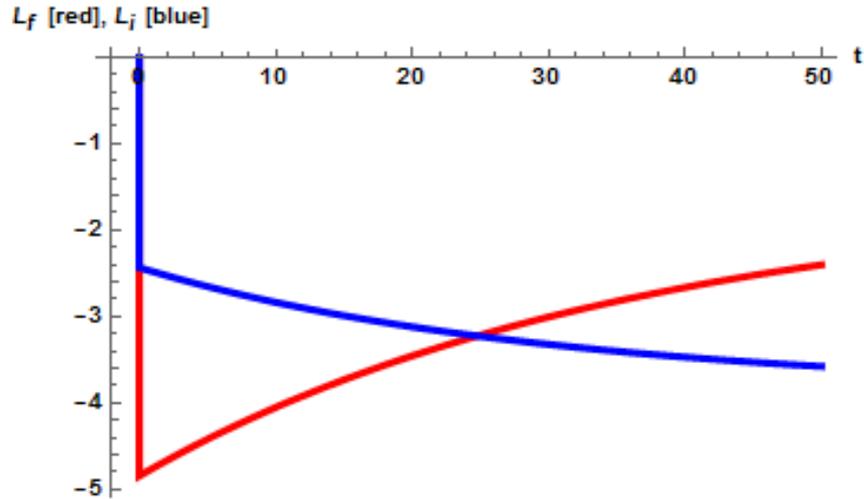
Empirical vs model-based employment elasticities Formal sector employment



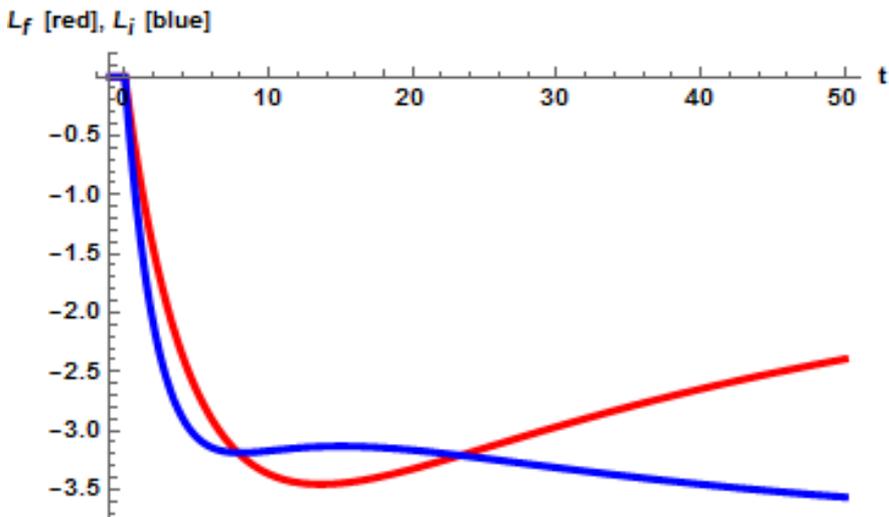
Sources: see text

Transitional Dynamics and adjustment costs

Table 1 (central panel)



Implausible 'overshoot' in formal labour market without adjustment costs in labour Reallocation.



- We have written down a simple and plausible GE model that is consistent with broad stylized facts on the impact of MW in LDCs.
- This is the basis for an extended macroeconomic model
 - Introducing an informal / subsistence agriculture sector
 - Reservation wages, and the question of open unemployment
 - Wage leadership and unions
 - Enforcement and coverage
- Coming back to MW, we can undertake a full-blown welfare analysis → heterogeneous households.

Thank you!