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Distributive conflict and wage formation in Germany: A Kaleckian perspective on nominal wages and demand (1990-2024)

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Houssam Boughabi

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Formation in Germany:
A Kaleckian Perspective on Nominal
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Abstract

This paper investigates the interplay between distributive conflict, wage dynamics, and persistent unemployment within a Kaleckian framework, emphasizing the long-memory properties of wages. We develop a stochastic model in which wages adjust adaptively to cumulative historical discrepancies between prices and wages, reflecting backward-looking expectations, institutional rigidities, and distributive conflict. Applying this framework to Germany over the period 1990–2024, we provide empirical evidence that persistent price–wage divergences generate long-lasting effects on real wages and aggregate demand. Within a Kaleckian perspective in which investment and employment are demand-driven, these wage dynamics contribute to the persistence of unemployment by weakening consumption and effective demand over time. Our findings highlight that long-memory wage adjustment amplifies the macroeconomic consequences of distributive conflict and inflation, underscoring the importance of historical wage inertia in shaping employment outcomes. The results offer new insights into the structural origins of persistent unemployment in advanced economies.

JEL codes: E12, E24, E32, C22, J30

Key words: Kaleckian economics, wage–price dynamics, long-memory, distributive conflict, persistent unemployment.

1. Introduction

The dynamics of wages, prices, and unemployment have long occupied a central place in Kaleckian and post-Keynesian macroeconomic analysis. Kalecki (1937, pp. 83–90; 1939, pp. 45–54; 1954, pp. 11–25) emphasized that capitalist economies are characterized by inherent instability arising from distributive conflict between wages and profits. In this framework, prices are administered through mark-up pricing, while wages are formed within institutional bargaining structures. As a result, nominal wages and prices do not adjust instantaneously or symmetrically. Persistent deviations between wages and prices therefore affect real income distribution, consumption, and effective demand, generating prolonged unemployment and underutilized capacity. This view stands in contrast to neoclassical models based on instantaneous market clearing and provides a natural setting for analyzing wage dynamics in historical time.

Later contributions extended Kalecki's insights by linking income distribution to growth and demand. Dutt (1984, pp. 25–31) and Bhaduri and Marglin (1990, pp. 380–387) formalized the idea that changes in the wage share influence consumption and investment in opposite directions, making the overall demand effect theoretically ambiguous and empirically contingent.

While this literature focuses on the contemporaneous impact of distributional shifts, it leaves open the question of whether distributive effects persist over time through historically conditioned wage–price dynamics. The present study does not aim to resolve the wage-led versus profit-led debate, but instead examines the temporal dimension of distributive conflict and its macroeconomic consequences.

In a Kaleckian framework, distributive dynamics also operate through investment decisions, since capital accumulation is driven by expected demand and profitability rather than by intertemporal optimization.

Empirical research has repeatedly documented persistence and long-memory behavior in macroeconomic time series. Granger and Joyeux (1980, pp. 15–29) and Diebold and Rudebusch (1989, pp. 5–14) show that wages, prices, and output often exhibit slow mean reversion, implying that shocks influence economic dynamics far beyond the short run. Although Kalecki did not formalize long-memory processes statistically, post-Keynesian interpretations emphasize that persistence arises from institutional wage setting, contractual arrangements, and distributive conflict unfolding in historical time (Kalecki, 1971, pp. 121–128; Robinson, 1962, pp. 45–52; Setterfield, 2009, pp. 107–115). From a Kaleckian perspective, this persistence reflects evolving institutions and power relations rather than nominal rigidities or equilibrium adjustment frictions.

Expectations formation under fundamental uncertainty plays a key role in this process. As stressed by Davidson (1991, pp. 131–138) and Dequech (1999, pp. 415–420), economic agents rely on conventions and historically formed norms rather than probabilistic forecasts. Wage expectations, understood as collectively formed wage claims, are therefore shaped by past wage–price discrepancies, bargaining power, and institutional constraints. Because these factors evolve slowly, wage adjustment exhibits persistence rather than rapid convergence.

Within this framework, model-implied wages serve as a counterfactual benchmark derived from pricing relations under given productivity and mark-up conditions. Deviations between observed wages and this benchmark reflect unresolved distributive tensions rather than specification errors. Incorporating persistence and path dependence into wage dynamics thus provides a theoretically consistent way to model distributive conflict in historical time.

Recent post-Keynesian research has extended Kaleckian models to incorporate institutional change, policy regimes, and demand-led growth (Hein and Stockhammer, 2010, pp. 10–18; Lavoie, 2014, pp. 330–342; Stockhammer, 2011, pp. 30–37). However, wage persistence is often treated implicitly rather than modeled explicitly. Wage dynamics are recognized as institutional and political processes, yet the cumulative effects of past wage–price deviations are rarely formalized. This paper addresses this gap by introducing a stochastic representation of wage dynamics with long memory, drawing on fractional adjustment processes to capture historically accumulated distributive effects (Mandelbrot and Van Ness, 1968).

Germany provides a suitable case study due to its well-documented wage-setting institutions and the availability of long macroeconomic time series (Hein, 2014, pp. 69–74; Palley, 2013, pp. 72–78; Lavoie, 2014, pp. 330–342). Estimating the model over the period 1990–2024 allows an assessment of how persistent wage–price deviations influence expectations and macroeconomic outcomes in a mature industrial economy.

More broadly, the paper addresses methodological limitations of representative-agent and instantaneous-adjustment models, which abstract from historical time, institutional inertia, and distributive conflict (Setterfield, 2009, pp. 107–115; Storm, 2017, pp. 951–955; Lee, 2011, pp. 83–87). By modeling adaptive expectations and long-memory properties, the analysis provides a richer account of the interactions between distributive conflict, investment dynamics, and institutional wage formation. As cumulative wage–price deviations weaken effective demand over time, unemployment emerges endogenously as a persistent outcome rather than a temporary disequilibrium.

Against this background, the paper addresses two research questions:

- 1. Do nominal wages and inertial inflation exert a persistent and quantitatively significant influence on prices in Germany, consistent with Kaleckian mark-up pricing and distributive conflict?**
- 2. Do accumulated wage–price deviations enter the formation of expected wages in a persistent manner, generating long-memory dynamics with implications for demand and unemployment?**

The empirical results show that wage and inflation dynamics generate persistent wage–price gaps rather than self-correcting adjustments, and that expected wages track observed wages through a historically conditioned mechanism characterized by long memory. These findings highlight the importance of cumulative distributive conflict for understanding wage formation, demand dynamics, and persistent unemployment within a Kaleckian framework.

The remainder of the paper is structured as follows. Section 2 presents the theoretical framework and model specification. Section 3 reports the empirical results and discusses the

implications for distributive conflict, wage dynamics, and demand-led macroeconomic adjustment.

2. Discussion and Methodology

The heterodox tradition in political economy has long rejected the neoclassical assumption that prices mechanically reflect marginal productivity or real wages. Instead, prices are understood as administrated variables, shaped by institutional power, class conflict, and mark-up behavior, particularly in oligopolistic markets. This approach originates in the work of Michał Kalecki (1954, pp. 11–19) and has been further developed in the post-Keynesian literature emphasizing historical time and effective demand (Lee, 1998, pp. 45–52; Hein, 2014, pp. 69–74).

Within the Kaleckian framework, firms set prices as a mark-up over unit labour costs, defined as nominal wages relative to labour productivity, thereby explicitly anchoring price formation in both cost conditions and productive efficiency. The mark-up itself is a central distributive parameter in Kaleckian models, as it directly determines the division of income between wages and profits. Following Kalecki, the level of the mark-up is understood to reflect the degree of monopoly prevailing in the respective market, rather than being the outcome of short-run optimizing behavior. While Kalecki did not provide a fully articulated dynamic theory of mark-up adjustment, variations in productivity, market structure, and pricing strategies may nonetheless generate incomplete or asymmetric pass-through from wages to prices over time. This asymmetry between wages and prices constitutes a core element of Kalecki's theory of distribution (Kalecki, 1971, pp. 43–47) and is further developed in structuralist interpretations emphasizing the institutional and market-power foundations of income distribution (Rowthorn, 1981, pp. 3–7; Amadeo, 1986, pp. 148–152).

A central implication of this view is that profits are not residual outcomes but are actively generated through investment decisions. Kalecki famously argued that “capitalists earn what they spend,” highlighting the endogenous nature of profits and their dependence on investment dynamics (Kalecki, 1937, pp. 80–82). This insight was later extended in theories of financial instability and cumulative causation, where investment-driven demand creates inflationary pressures independent of wage growth (Minsky, 1986, pp. 173–178; Lavoie, 2014, pp. 396–401; Hein and Stockhammer, 2010, pp. 15–18).

Inflation, in this perspective, emerges as a conflictual and distributive phenomenon rather than a purely monetary one. Firms attempt to preserve or increase their profit shares when facing cost pressures or demand constraints, leading to price increases that may occur without corresponding wage adjustments. This interpretation contrasts sharply with monetarist accounts and aligns with post-Keynesian analyses of cost-push and mark-up inflation (Arestis and Sawyer, 2005, pp. 30–34; Setterfield, 2006, pp. 653–656; Stockhammer, 2017, pp. 336–340). Over time, persistent gaps between prices and wages can weaken real demand and destabilize employment. While short-run investment expansions may temporarily support output, the resulting inflationary dynamics can generate real wage compression and declining consumption, ultimately leading to higher unemployment. Such cyclical patterns are

consistent with Kalecki's theory of the business cycle and later formalizations in growth and distribution models (Kalecki, 1939, pp. 213–219; Dutt, 1984, pp. 31–36).

Expectations play a crucial role in this adjustment process. Workers do not instantaneously revise wages in response to price movements; instead, wage claims are shaped by past discrepancies between prices and wages. This adaptive and backward-looking behavior introduces memory into wage dynamics and contributes to the persistence of distributive imbalances, as emphasized in Kaleckian and post-Keynesian growth models (Bhaduri and Marglin, 1990, pp. 377–380; Palley, 2013, pp. 74–78).

Methodologically, this approach rejects rational expectations and instantaneous market clearing. Economic agents operate under fundamental uncertainty and rely on conventions, historical experience, and institutional norms. Such behavior naturally generates path dependence and long-memory processes in macroeconomic variables, a point stressed in post-Keynesian theories of uncertainty and economic evolution (Dequech, 1999, pp. 416–420; David, 1985, pp. 332–335).

Within this framework, modeling prices as an imperfect function of wages and inflation captures the structural separation between cost formation and income distribution. The residual term reflects institutional rigidities, strategic pricing, and macroeconomic shocks that cannot be reduced to random noise, justifying a reduced-form specification consistent with empirical heterodox research on price dynamics (Lee, 2011, pp. 83–87; Storm, 2017, pp. 951–955).

$$p_t = c + aw_t + b\pi_t + \epsilon_t \quad (1)$$

In equation (1), p_t denotes the aggregate price level at time t . The variable w_t represents the nominal wage level at time t , capturing the average cost of labor in the economy. The parameter a measures the degree of wage pass-through into prices and reflects firms' pricing power and mark-up behavior.

The term π_t denotes the inflation rate inherited from the recent past and reflects inflationary momentum embedded in price-setting conventions rather than a purely contemporaneous rate of change of prices. In a Kaleckian framework with administered prices, firms do not re-optimize prices instantaneously; instead, they rely on backward-looking rules, indexation practices, and conflict-driven mark-up adjustments. The parameter b therefore captures the degree to which current pricing decisions are influenced by past inflationary experience, institutional indexation mechanisms, and distributive conflict between wages and profits, rather than implying a mechanical or tautological dependence of prices on their own level.

The constant term c captures baseline pricing effects that are not explained by wages or inflation, including autonomous costs, structural factors, or average mark-ups present in the economy.

ϵ_t is an idiosyncratic disturbance term representing institutional rigidities, demand shocks, changes in market structure, and strategic pricing decisions that are not directly explained by wages, contemporaneous inflation, or the constant term. This term is assumed to have zero mean and finite variance, reflecting the non-mechanical and path-dependent nature of price formation in a Kaleckian framework.

In Kaleckian and post-Keynesian macroeconomics, capital accumulation is not governed by intertemporal optimization but by firms' investment decisions under fundamental uncertainty. Expected profitability provides the motive for investment, but it is not sufficient on its own. Investment demand emerges only when profitability expectations are supported by firms' financial capacity, market power, and favorable macroeconomic conditions. The availability of internal funds, access to finance, and institutional constraints therefore act as enabling or limiting conditions that determine whether profit expectations are translated into effective investment expenditure. In this sense, expected profitability constitutes one necessary condition for investment, while financial resources, risk perceptions, and macroeconomic conditions form the complementary constraint—together constituting the two 'blades' that shape investment demand in the Kaleckian framework (Kalecki, 1937, pp. 80–83; Kalecki, 1954, pp. 47–52; Robinson, 1962, pp. 42–46).

This dual determination implies that investment is inherently unstable and cyclical: rising profits may stimulate accumulation, but financial fragility, uncertainty, or adverse macroeconomic conditions can interrupt or reverse investment even in the presence of favorable profitability expectations.

In this framework, investment does not respond smoothly to interest rate variations but evolves according to expectations about future demand and price dynamics. Financial conditions, uncertainty, and institutional constraints influence the pace of accumulation, making investment inherently unstable and cyclical (Minsky, 1986, pp. 194–198; Davidson, 1991, pp. 129–133).

The temporal structure of investment is particularly important. Investment today affects productive capacity tomorrow, while past investment decisions constrain current output and employment. This intertemporal linkage generates cumulative processes that amplify shocks and reinforce persistence in macroeconomic variables (Kaldor, 1957, pp. 594–597).

Furthermore, investment behavior reflects strategic interactions between firms and the broader macroeconomic environment. When inflationary pressures rise, firms may accelerate investment to protect profit margins, while adverse price dynamics may induce retrenchment. Such behavior introduces non-linearity into accumulation paths (Hein, 2014, pp. 211–215).

Wage expectations, understood not as individual forecasts but as collectively formed wage claims and reference norms in collective bargaining, constitute a key transmission channel linking price dynamics, income distribution, and employment. In a Kaleckian framework, these expectations emerge from past distributive outcomes, accumulated real wage gains or losses, and institutional bargaining practices rather than from forward-looking optimization. Wage negotiations are therefore informed by historically observed wage–price developments, which shape what workers and unions perceive as acceptable or necessary wage outcomes in subsequent bargaining rounds (Kalecki, 1971, pp. 44–48; Hicks, 1974, pp. 29–33). In the model, this historically conditioned reference wage enters through the formation of expected nominal wage claims, which adjust only gradually in response to accumulated wage–price gaps, reflecting bargaining power, conventions, and institutional inertia rather than rational expectations.

We therefore specify expected future wages as a function of current wages adjusted by

the average historical discrepancy between prices and wages over the horizon (t, T) , conditional on the available information set F_t (Lee, 1998, pp. 118–122; Stockhammer, 2017, pp. 338–342).

$$E \left[\frac{w_T}{F_t} \right] = w_t - D(t, T) \frac{1}{n+1} \sum_{i=t}^T (p_i - w_{i+1}) \quad (2)$$

This interpretation also clarifies the sign structure of the expectation rule. When prices systematically outpace wages, real wages fall and workers' purchasing power is eroded. In a Kaleckian economy with demand-determined employment, this deterioration of real wages tightens the labour market and intensifies distributive conflict, strengthening workers' wage claims. In this case, the forward-looking distributive gap $(p_i - w_{i+1})$ becomes negative, so that the adjustment term $-D(t, T) \frac{1}{n+1} \sum_{i=t}^T (p_i - w_{i+1})$ is positive whenever $D(t, T) > 0$. Empirically, the estimated responsiveness parameters are indeed strictly positive, implying that accumulated real-wage losses translate into upward adjustments of expected nominal wages. This provides a structural explanation for the increasing slope of expected wages in the model: persistent price–wage divergence does not mechanically depress wages, but, through distributive conflict and demand effects, generates compensatory wage dynamics consistent with Kaleckian conflict inflation and bargaining theory.

In this expression, $D(t, T)$ represents the degree of wage responsiveness or memory over the horizon from t to T .

The dynamics of wages in a Kaleckian framework cannot be adequately captured by short-memory or purely contemporaneous adjustment mechanisms. Wage formation reflects institutional rigidity, bargaining structures, and historical experience, implying that past deviations between prices and wages exert a persistent influence on current wage outcomes. The implication is not that wages mechanically adjust to past price movements, but that historical wage–price divergences leave lasting distributive effects that shape subsequent wage bargaining. When prices persistently outpace wages, real wages are eroded and distributive conflict intensifies, altering bargaining positions, reference norms, and institutional expectations in future negotiations. Conversely, periods of strong wage growth relative to prices can moderate subsequent wage claims by temporarily stabilizing income shares. In this sense, past wage–price deviations matter because they modify the institutional and power-related conditions under which current wage outcomes are determined. Wage formation therefore unfolds in historical time, with present outcomes reflecting the cumulative legacy of past distributive struggles rather than purely contemporaneous market conditions.

Empirically, wage series often display persistence and slow mean reversion, suggesting the presence of long-memory properties rather than simple autoregressive behavior. The factor $D(t, T)$ can be interpreted as a measure of wage memory or responsiveness, allowing estimation of the degree to which past gaps continue to influence current wage expectations. Such persistence reflects the gradual adjustment of wage norms, contracts, and expectations, particularly in economies characterized by strong distributive conflict and imperfect competition (Granger and Joyeux, 1980, pp. 15–18; Diebold and Rudebusch, 1989, pp. 993–

996). From a theoretical standpoint, modeling wages as a stochastic process with long memory allows for a richer representation of distributive dynamics. Fractional Brownian motion captures the idea that shocks to wages are not quickly dissipated but instead accumulate over time, influencing future trajectories in a non-Markovian manner. The introduction of $D(t, T)$ complements this by quantifying the partial transmission of historical deviations into expectations. This approach aligns with heterodox critiques of equilibrium labor market models (Mandelbrot and Van Ness, 1968, pp. 424–429).

The inclusion of a time-varying drift and volatility component reflects the influence of macroeconomic conditions, institutional change, and bargaining power on wage dynamics. Structural shifts in the economy, such as changes in employment regimes or inflationary environments, modify both the trend and dispersion of wages over time, while $D(t, T)$ allows the model to capture changes in wage responsiveness across different periods (Setterfield, 2009, pp. 1006–1010).

Accordingly, wages are specified as the sum of a deterministic component capturing institutional and macroeconomic trends and a stochastic component exhibiting long-memory behavior. The combination of fractional stochastic dynamics and the scaling factor $D(t, T)$ allows wage dynamics to remain sensitive to historical shocks and distributive imbalances, which is essential for understanding cumulative unemployment outcomes in a Kaleckian growth process (Stockhammer, 2011, pp. 122–126).

$$w_t = \mu_t + \sigma_t B_t^H \quad (3)$$

The long-memory structure of wages is reinforced by the formation of wage expectations understood as historically conditioned reference norms guiding wage claims. Expected future wages depend on the cumulative history of price–wage discrepancies rather than on contemporaneous inflation alone. When prices persistently outpace wages, real wage losses intensify distributive conflict and raise nominal wage claims by workers and trade unions seeking to restore purchasing power. Whether such claims translate into realized wage growth depends on institutional constraints, labor market conditions, and relative bargaining power. In cases where elevated wage claims cannot be enforced, real demand weakens due to subdued realized wage growth, while unemployment persists as accumulation proceeds. In this sense, long memory operates not through the moderation of wage claims, but through the accumulation of unresolved distributive tensions that shape both bargaining dynamics and macroeconomic outcomes.

In this setting, the expectation rule acts as a transmission mechanism through which past distributive conflicts shape future wage outcomes. The averaging of historical price–wage gaps introduces persistence into expectations, ensuring that past inflationary episodes continue to depress wage claims even after price pressures subside. This mechanism generates inertia in real wages and amplifies demand-side instability.

As capital accumulation progresses, firms' investment decisions initially sustain output, but the cumulative erosion of real wages reduces consumption demand. Given the long-memory structure of wages, this demand shortfall is not immediately corrected, leading to a gradual increase in unemployment *au fur et à mesure* of accumulation.

Thus, long memory in wages transforms short-run inflationary pressures into long-run employment effects. The interaction between persistent wage adjustment, investment-driven growth, and distributive conflict produces a cumulative process in which unemployment emerges endogenously, consistent with Kalecki's vision of capitalist instability.

2.1. Statistical Estimation of Time-Varying Wage Responsiveness

To quantify the partial adjustment of wages to historical price–wage gaps, we estimate the time-varying parameter $D(t, T)$, which captures the degree of wage memory over the horizon from t to T . The starting point is the discrepancy between realized market wages and model-implied expected wages.

From the expectation equation

$$E \left[\frac{w_{t+1}}{F_t} \right] = w_t - D(t, t+1) \frac{1}{2} \sum_{i=t}^{t+1} (p_i - w_{i+1}) \quad (4)$$

the observable forecasting error is given by

$$w_{t+1}^* - E \left[\frac{w_{t+1}}{F_t} \right] = w_{t+1}^* - w_t + D(t, t+1) \frac{1}{2} \sum_{i=t}^{t+1} (p_i - w_{i+1}) \quad (5)$$

Where w_{t+1}^* denotes the realized (real) wage observed in the market.

Rearranging terms yields the estimation equation:

$$w_{t+1}^* - w_t = -D(t, t+1) \frac{1}{2} \sum_{i=t}^{t+1} (p_i - w_{i+1}) + \epsilon_t \quad (6)$$

where ϵ_t captures unanticipated wage shocks and measurement errors. This formulation makes explicit that the regression exploits deviations between realized wages and the model's expected wage dynamics.

If $D(t, T)$ were assumed constant, this regression would yield a single average measure of wage responsiveness. However, institutional arrangements, inflation regimes, and bargaining power evolve over time, motivating the estimation of $D(t, T)$ as a smoothly varying parameter.

Following a nonparametric or local estimation approach, $D(t, T)$ is estimated using a moving-window regression or kernel-weighted least squares:

$$\hat{D}(t) = \underset{D}{\operatorname{argmin}} \sum_{s \in [t-h, t+h]} ((w_{s+1}^* - w_s) + D \frac{1}{2} \sum_{i=s}^{s+1} (p_i - w_{i+1}))^2 \quad (7)$$

Here, the window size h governs the smoothness of the estimated $\hat{D}(t)$ series. Larger values of h generate smoother trajectories, while smaller windows allow for greater sensitivity to short-run institutional or macroeconomic changes.

The estimated $\hat{D}(t)$ series is then used to simulate the stochastic wage process with long memory:

$$w_t = \mu_t + \sigma_t B_t^H$$

where B_t^H is a fractional Brownian motion capturing long-range dependence in wages. The inclusion of $\hat{D}(t)$ ensures that simulated wages respond to historical distributive

imbalances in a manner consistent with observed labor market behavior.

Finally, the statistical procedure is validated by comparing the variance, persistence, and autocorrelation structure of simulated wages with their empirical counterparts. This calibration strategy preserves the stochastic and long-memory nature of wage dynamics, without imposing exact equality between realized wages and model expectations.

3. The Result and Conclusions

3.1. Price Equation Regression

We first estimate the aggregate price equation, including a constant term, nominal wages, and contemporaneous inflation:

$$p_t = c + aw_t + b\pi_t + \epsilon_t$$

where p_t is the logarithm of the aggregate price level at time t , w_t denotes nominal wages, π_t is the inflation rate, and ϵ_t is the idiosyncratic error term. The constant c captures baseline pricing effects not explained by wages or inflation.

The regression was performed on annual data for Germany from 1990 to 2024, yielding the results summarized in Table 1.

Variable	Coefficient	Std. Error	t-Statistic	p-Value
c	-5.370	0.809	-6.636	0.000
w_t (a)	0.795	0.072	11.027	0.000
π_t (b)	0.801	0.043	18.494	0.000
R^2		0.987		
Adjusted R^2		0.986		

Table 1: OLS estimates of the price equation for Germany (1990–2024) (WDI data)

The results indicate that both wages and inflation have a significant influence on prices at the 1% level, with coefficients $a=0.795$ and $b=0.801$. The coefficient on wages confirms the pass-through effect of nominal wages into prices, consistent with Kaleckian mark-up pricing theory. The coefficient on contemporaneous inflation should not be interpreted as a forward-looking expectation term, but rather as capturing backward-looking indexation practices, inertial price adjustment, and institutional reference norms in German price-setting. In an environment of ongoing inflation, firms adjust prices partly in response to observed past inflation, reflecting contractual arrangements, coordination effects, and conventions regarding acceptable price changes. The inflation term thus proxies the persistence and inertia of the price formation process, rather than rational inflation expectations in the New Keynesian sense.

The model explains a very high proportion of price variation, with $R^2 = 0.987$, indicating that wages and inflation together account for most of the fluctuations in the aggregate price level. The constant term is negative and significant, suggesting the presence of baseline pricing factors or structural costs not captured by wages or inflation.

Conclusion 1

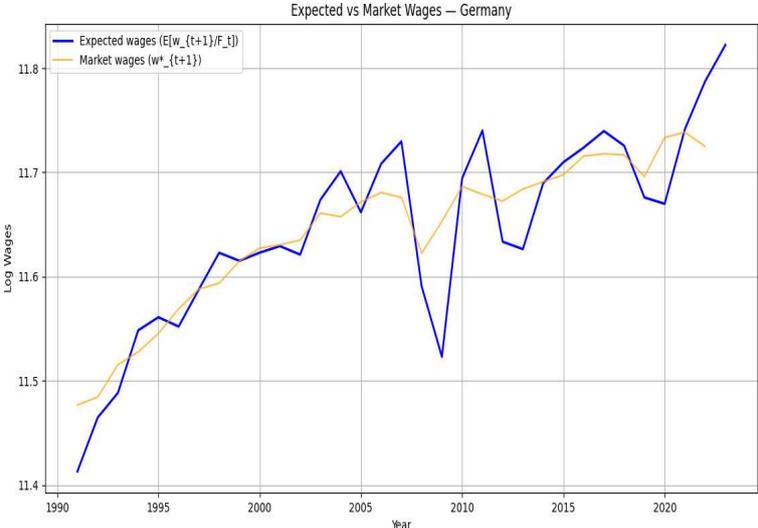


Figure 1: Expected wages vs Market wages of Germany during the period 1990-2024 (WDI data)

In the context of Germany between 1990 and 2024, these results do not merely confirm the well-established Kaleckian proposition that nominal wages enter the price equation. Rather, they provide empirical evidence on the magnitude, persistence, and stability of wage pass-through in an institutional environment characterized by inertial price adjustment. The estimated coefficients indicate that wage dynamics exert a quantitatively strong and persistent influence on prices, while contemporaneous inflation captures the inertial and conventional elements of price-setting. Taken together, these effects imply that deviations between wages and prices are not neutral or self-correcting, but accumulate over time and generate systematic distributive pressures. It is this cumulative interaction between wage dynamics and price inertia—rather than the existence of wage pass-through per se—that is central to the model’s implications for profitability, demand conditions, and, indirectly, long-term labor market outcomes.

The presence of a strong pass-through from wages to prices provides the foundation for the long-memory wage model, where past gaps between prices and wages influence expectations and future wage setting. This aligns with the observed persistence in real wages and supports our subsequent estimation of the time-varying responsiveness parameter $D(t, T)$, which captures the cumulative adjustment of wages to historical price–wage gaps.

Conclusion 2

The estimated expected wages $E[w_{t+1}/F_t]$ closely follow the trend of observed market wages w^*_{t+1} , which should not be interpreted as a mechanical consequence of using level data or of introducing wage persistence through w_t on the right-hand side. It is well

understood that specifications in levels with strong autoregressive components can generate a high degree of co-movement. The relevance of this result therefore does not lie in the goodness of fit as such, nor in any claim of superior predictive performance. Rather, its significance rests on the economic content of the adjustment term capturing historically accumulated price–wage gaps. The alignment between expected and actual wages indicates that the estimated responsiveness parameter $D(t,T)$ assigns economically meaningful weight to past distributive deviations, rather than collapsing into a purely mechanical persistence effect. In this sense, the model does not simply reproduce wage inertia, but provides a structured representation of how historically conditioned wage–price discrepancies enter the formation of expected nominal wage claims, consistent with the Kaleckian emphasis on historical time and distributive conflict.

$$E \left[\frac{w_T}{F_t} \right] = w_t - D(t,T) \frac{1}{n+1} \sum_{i=t}^T (p_i - w_{i+1})$$

The Hurst exponent $H = 0.688$ for the modeled expected wages is indicative of long-memory behavior, suggesting persistent influence of past wage–price deviations on future wages. This finding is consistent with the literature on long-range dependence in macroeconomic time series (Granger and Joyeux, 1980, pp. 15–18; Diebold and Rudebusch, 1989, pp. 993–996) and supports the fractional Brownian motion framework employed in our model (Mandelbrot and Van Ness, 1968, pp. 424–429).

The persistence confirms that wage expectations do not adjust instantaneously but rather accumulate the effects of historical conflicts between wages and prices. This is in line with Kaleckian theory emphasizing the role of distributive conflict in generating endogenous persistence in wages and prices (Kalecki, 1971, pp. 43–47; Stockhammer, 2011, pp. 121–125). The time-varying responsiveness parameter $D(t, T)$ captures this gradual adjustment, allowing the model to represent institutional rigidities, bargaining structures, and macroeconomic shocks in a realistic manner.

The results suggest that in the German labor market, cumulative wage adjustments have contributed to slow adjustment of real wages, thereby affecting investment decisions and unemployment dynamics (Bhaduri and Marglin, 1990, pp. 377–381; Dutt, 1984, pp. 31–36). The long-memory property emphasizes that temporary shocks in wages or prices can have lasting effects, reinforcing the need for policies that account for path dependence and historical wage–price gaps (Hein, 2014, pp. 214–218; Setterfield, 2009, pp. 1005–1010).

The combination of statistically significant alignment between expected and market wages, together with the Hurst exponent confirming long memory, validates our modeling approach and underscores the importance of persistent wage dynamics in Kaleckian frameworks. These findings contribute to the post-Keynesian literature on wage–price interactions, distributive conflict, and cumulative unemployment (Lavoie, 2014, pp. 395–401; Robinson, 1962, pp. 42–46; Kalecki, 1954, pp. 47–52).

3.2. Data and Estimation

The analysis uses annual macroeconomic data for Germany over the period 1990–2024. All variables are obtained from the World Bank’s World Development Indicators (WDI). The aggregate price level is measured by the consumer price index (CPI, FP.CPI.TOTL), while inflation is captured by the GDP deflator growth rate (NY.GDP.DEFL.ZS). A nominal wage proxy is then constructed implicitly by combining real wage measure with the estimated price level, allowing the analysis to focus on wage–price interactions in logarithmic form.

A measure of hourly wages would indeed be preferable from a labor-market perspective, particularly in the presence of secular changes in average working hours. However, given data availability and the objective of capturing long-run distributive dynamics at the macroeconomic level, GDP per employed person provides a commonly used and internally consistent proxy for average wage developments. The interpretation of the results is therefore framed in terms of aggregate wage income per worker rather than contractual hourly wage rates, and conclusions are drawn accordingly. All data are downloaded using the `wbdata` Python package, sorted by year, and cleaned of missing observations prior to estimation.

To prepare the data for estimation, the CPI and real wages are transformed using the natural logarithm, denoted by $p_t = \ln(\text{CPI}_t)$ and $w^*_t = \ln(\text{wages}_t)$, respectively. Inflation is converted from percentage terms to a decimal fraction. These transformations allow the model to interpret changes in prices and wages in terms of proportional differences, facilitating the comparison between expected and actual wage dynamics within the Kaleckian framework.

The stage of estimation involves fitting a linear price equation that relates the aggregate price level p_t to contemporaneous wages w^* and inflation π_t :

$$p_t = \text{const} + aw^* + b\pi_t + \epsilon_t$$

The regression is implemented using ordinary least squares (OLS) via the `statsmodels` Python library. The fitted values \hat{p}_t are then used to construct the model-implied wage series $w_t = \hat{p}_t/a$, which represents the equilibrium wage predicted by the model in the absence of stochastic shocks and path-dependent adjustments.

The second stage estimates the time-varying responsiveness of wages to historical price–wage gaps, denoted as $D(t, T)$. A moving-window regression with a window size of $h = 2$ is used to capture local variations in wage adjustment. For each year t , the difference between the observed market wage at $t + 1$ and the model-implied wage at t , $w_{t+1}^* - w_t$, is regressed on the average gap between prices and model wages over the current and following period. This procedure generates a sequence of estimated $D(t)$ values, reflecting the partial adjustment of wages in response to distributive pressures and institutional rigidities.

The model then computes the expected wage for the following period, $E[w_{t+1}/F_t]$, by subtracting the product of $D(t)$ and the price–wage gap from the model-implied wage at time t . This expected wage series is plotted alongside the observed market wages to visually assess the alignment between modeled expectations and empirical outcomes. The plot uses a blue line for expected wages and an orange line for market wages, highlighting the

model's ability to track observed trends over time.

Finally, the Hurst exponent of the expected wage series is calculated using a rescaled range analysis to quantify long-memory properties. The resulting exponent $H = 0.688$ confirms the presence of persistence in the expected wage dynamics, consistent with the theoretical specification of the model using fractional Brownian motion. This measure validates the model's capacity to capture cumulative effects of past price–wage deviations on future wage expectations, emphasizing the relevance of path dependence and distributive conflict in German wage dynamics.

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