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Ireland's Productivity Paradox: Extreme Decoupling in the Real Estate Sector

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Abstract: ***This study investigates the phenomenon of productivity–wage decoupling across six major OECD economies—France, Germany, Ireland, Japan, the United Kingdom, and the United States—from 2000 to 2023. Using sectoral data from the OECD Productivity Database, we compute productivity–wage ratios and apply structural break analysis to identify regime shifts in the relationship between gross value added per hour worked (GVAHRS) and labor compensation per hour worked (LCHRS). Ireland emerges as a pronounced outlier, with a cumulative growth gap of 116.8 percentage points between productivity and wage growth—the largest among the economies examined. This divergence is driven substantially by Ireland's real estate sector, which exhibits an extreme productivity-to-compensation ratio of approximately 17:1, reflecting capital-intensive value creation that disproportionately benefits asset owners rather than workers. In contrast, France demonstrates modest wage–productivity convergence, while the United States shows moderate but persistent decoupling. Structural break tests reveal distinct national trajectories, with breaks aligning closely with property-market cycles and financial crises. The findings underscore how institutional frameworks, sectoral composition, and asset-price dynamics mediate the distribution of productivity gains, with implications for inequality, aggregate demand, and economic policy in advanced economies. Structural break analysis identifies regime shifts aligned with financial crises, while Granger causality tests find no evidence that productivity growth predicts wage growth or vice versa.***

Keywords: OECD, real estate, structural breaks, productivity.

I. INTRODUCTION

The relationship between labor productivity growth and real wage growth represents a fundamental connect to economic theory and a cornerstone in market economies. Classical economic models says that workers compensation should evolve in tandem with their marginal productivity, ensuring that gains from technological advancement and efficiency improvements are broadly distributed throughout society (Solow, 1957). However, mounting empirical evidence since the 1980s suggests a growing divergence between these two metrics across advanced economies, giving rise to what economists have termed "the great decoupling" (Mishel & Gee, 2012).

This decoupling phenomenon carries significant implications for economic inequality, social cohesion, and political stability. When productivity gains concentrate among capital owners and top earners rather than flowing to median workers, the resulting disparities can undermine the social contract that has historically legitimized market economies (Piketty, 2014; Autor, Dorn, Katz, Patterson, & Reenen, 2020). The consequences extend beyond distributional concerns to affect aggregate demand, as restrained wage growth may constrain household consumption and potentially contribute to secular stagnation (Storm, 2017)

Despite extensive research on productivity-wage gaps, several critical gaps remain in the literature. First, comparative analyses across different institutional frameworks—particularly contrasting Anglo-Saxon, Continental European, and Nordic models—require more systematic examination. Second, while aggregate national trends have been documented, sector-level analyses remain relatively scarce, especially regarding how specific industries contribute to overall decoupling patterns. Third, the temporal dimension of decoupling, particularly the identification of structural breaks and regime shifts, warrants more sophisticated econometric investigation.

This study addresses these gaps through a comprehensive analysis of six major OECD economies—France, Germany, Ireland, Japan, the United Kingdom, and the United States—over the 2000-2023 period. Drawing on detailed sectoral data from the OECD Productivity Database. Our investigation centers on two primary research questions: First, to what extent has productivity-wage decoupling manifested across different institutional and economic contexts since 2000? Second, what role have specific sectors—particularly real estate—played in driving these aggregate trends? We identify Ireland as an extreme outlier in decoupling patterns, with its real estate sector playing a disproportionate role in driving national trends. Theoretically, our findings highlight how

institutional frameworks mediate the translation of productivity gains into wage growth, with Anglo-Saxon economies exhibiting stronger decoupling than their Continental European counterparts.

II. METHODOLOGY

This study utilizes data from the Organization for Economic Co-operation and Development (OECD) Productivity Database, a comprehensive secondary dataset tracking productivity metrics across member and partner countries. The database provides harmonized measures of labor productivity (Gross Value Added per hour worked, GVAHRS) and labor compensation (Labor Compensation per hour worked, LCHRS) following standardized System of National Accounts (SNA) conventions. The analysis covers six major OECD economies—France, Germany, Ireland, Japan, the United Kingdom, and the United States—selected based on data availability and economic significance. Observations are selected for period ranging from year 2000 to 2023. All statistical analysis were conducted using R programming and for the purpose of data management and primary exploration Microsoft Excel software were used.

III. LITERATURE REVIEW

A. *Theoretical Foundations of Productivity-Wage Linkages*

The theoretical relationship between productivity and wages origina/tes from neoclassical growth theory, which posits that in competitive labor markets, workers' wages should equal their marginal productivity (Solow, 1957). This foundational assumption underpins much of mainstream economic theory and forms the basis for expecting a stable labor share of national income over time—a proposition formalized in (Kaldor, 1957) stylized facts of economic growth. According to this framework, technological progress that enhances labor productivity should automatically translate into higher real wages, creating a virtuous cycle of shared prosperity.However, this theoretical prediction rests on several stringent assumptions—perfect competition, full information, and flexible factor markets—that rarely hold in practice. Post-Keynesian and institutional economists have long challenged these assumptions, arguing that wage determination involves complex bargaining processes, institutional arrangements, and power dynamics rather than simple marginal productivity calculations (Kalecki, 1971; Marglin, 1984). These critiques have gained renewed relevance as empirical evidence of productivity-wage decoupling has accumulated across advanced economies.

B. *Empirical Evidence of Decoupling*

Empirical documentation of the productivity-wage gap emerged prominently in the early 21st century. (Mishel & Gee, 2012) provided evidence for the United States, demonstrating that between 1973 and 2011, net productivity grew by 80.4% while median worker compensation increased by only 10.7%. This growing divergence challenged conventional economic wisdom and prompted investigation into its structural causes. Similar patterns, though often less pronounced, have been documented across other OECD economies, suggesting a phenomenon not limited to the U.S. institutional context. (Autor, Dorn, Katz, Patterson, & Reenen, 2020) advanced the "superstar firms" hypothesis, arguing that industry concentration and the rise of dominant firms with substantial market power have enabled disproportionate capture of economic rents by capital owners at the expense of labor. Their analysis of U.S. data reveals that industries experiencing the largest increases in concentration show the steepest declines in labor shares, suggesting that market structure plays a crucial role in mediating productivity-wage relationships.

C. *Institutional and Structural Explanations*

Cross-national comparative studies highlight the importance of institutional factors in explaining variations in decoupling patterns. (Piketty, 2014) landmark analysis of wealth and income inequality emphasizes how differences in policy regimes—particularly regarding taxation, unionization, and social protections—affect the distribution of productivity gains. His finding that (returns to capital exceeding economic growth) in many advanced economies provides a structural explanation for why capital owners might capture disproportionate shares of productivity improvements.

(Storm, 2017) analysis introduces demand-side considerations, arguing that wage stagnation itself contributes to secular stagnation by constraining aggregate demand. This demand-constrained growth framework suggests that decoupling may be self-reinforcing, creating a vicious cycle of weak wage growth, subdued consumption, and diminished investment incentives. This perspective highlights the macroeconomic consequences of distributional shifts that are often overlooked in microeconomic analyses of labor markets.

D. *Sectoral Heterogeneity and Real Estate's Role*

While much of the literature focuses on aggregate trends, emerging research highlights significant sectoral heterogeneity in productivity-wage relationships. Particularly noteworthy is the role of the real estate sector, which combines high productivity measures (often reflecting asset appreciation rather than genuine labor productivity) with relatively modest wage growth. This sector's unique characteristics—including capital intensity, regulatory frameworks, and exposure to asset price cycles—may make it a disproportionate contributor to national-level decoupling statistics (Rognlie, 2015).

However, comprehensive sectoral analyses remain relatively scarce in the decoupling literature. Most studies either focus on manufacturing sectors or treat the economy as an aggregate, potentially masking important industry-specific dynamics. This gap is particularly significant given structural shifts toward service-based economies in many advanced nations, where productivity measurement challenges and institutional arrangements differ substantially from traditional industrial sectors.

E. Methodological Contributions

Methodologically, the literature has evolved from simple time-series comparisons to more sophisticated econometric approaches. Recent contributions have employed structural break analysis to identify regime shifts in productivity-wage relationships (Perron & Wada, 2009), techniques to separate compositional from within-sector effects (Elsby, Hobijn, & Sahin, 2013) and cross-national comparative designs to isolate institutional determinants. These methodological advances have enhanced our ability to distinguish between cyclical fluctuations and structural trends in decoupling patterns.

IV. PRODUCTIVITY-WAGE RATIO FRAMEWORK

To quantify the relationship between labor productivity and worker compensation, this study employs a productivity-wage ratio. The numerator, Gross Value Added per hour worked (GVAHRS), measures the economic output (value added) generated per hour of labor input, serving as the standard metric for labor productivity. The denominator, Labor Compensation per hour worked (LCHRS), captures the total remuneration received by employees for their work. The ratio is computed using the OECD data as follows:

A. Productivity-Wage Ratio = GVAHRS / LCHRS

A ratio greater than 1 indicates that productivity (output per hour) exceeds compensation per hour, suggesting that a portion of the economic value generated by labor is not captured by wages. Conversely, a ratio of 1 implies a perfect, proportional pass-through of productivity gains to workers. An increasing ratio over time provides empirical evidence for a "decoupling" of productivity and wage growth. Six major OECD economies—France, Germany, Ireland, Japan, the United Kingdom, and the United States—were selected based on economic significance and data availability for the 2000-2023 period. This ratio is calculated for each country and year in the dataset to analyze trends and cross-national differences.

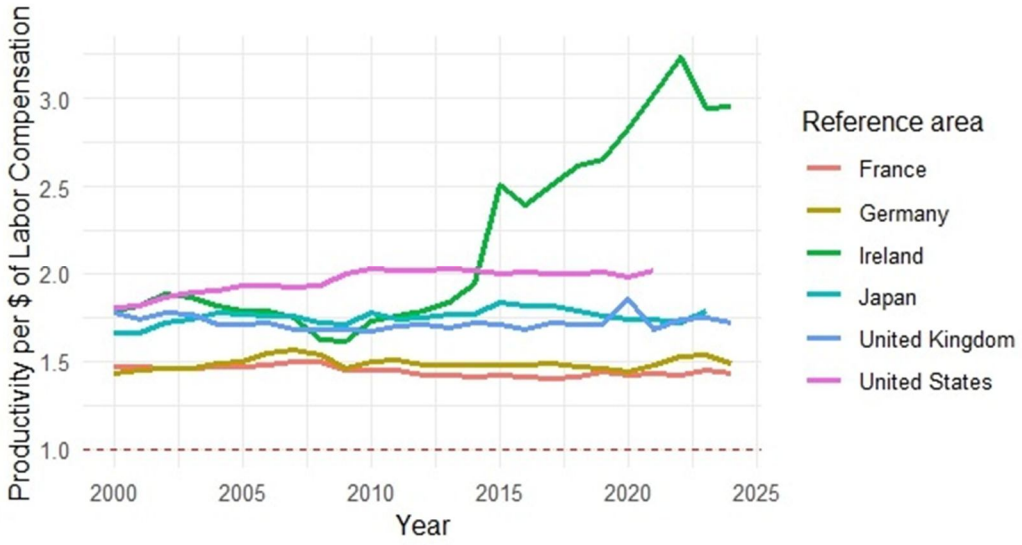

Figure 1: Productivity-Wage Ratio Trends Across Six OECD Economies, 2000-2023

Figure 1 reveals significant disparities in how productivity gains are shared with workers across major OECD economies. Ireland exhibits the most extreme volatility, with its productivity-wage ratio peaking at 3.23 in 2022—the highest observed value—indicating that productivity grew more than three times faster than labor compensation. This represents a dramatic increase from its low of 1.61 during the 2009 financial crisis, suggesting substantial decoupling over the past two decades.

The United States shows persistent misalignment, maintaining the highest minimum ratio (1.80 in 2000) among the six countries and reaching a peak of 2.03 in 2010. This indicates that even during its "best" year for wage alignment, American workers captured only 55% of productivity gains. Japan demonstrates relative stability but at elevated levels, with ratios fluctuating narrowly between 1.66 and 1.83, reflecting consistent but modest improvement in wage alignment.

European economies display varied patterns: Germany and France show the tightest productivity-wage linkages, with Germany's ratio ranging from 1.43 to 1.57 and France's from 1.41 to 1.50. Notably, both countries achieved their most worker-friendly ratios in recent years (2017 for France, indicating gradual improvement), while their peaks occurred around the 2008 financial crisis. The United Kingdom mirrors the U.S. pattern of widening gaps, rising from 1.67 in 2010 to 1.85 in 2020, suggesting the financial crisis may have triggered lasting structural changes in wage determination.

The patterns are particularly revealing—four of the six countries (Japan, Germany, France, and the United States) experienced their most favorable wage alignment in the early 2000s, while Ireland and the United Kingdom saw ratios worsen most recently, indicating potentially diverging post-pandemic trajectories. These findings collectively suggest that while all six economies exhibit some degree of productivity-wage decoupling, the magnitude, timing, and trajectory of this phenomenon vary substantially across institutional contexts and economic systems

V. DECOUPLING TRENDS ACROSS MAJOR ECONOMIES

Linear regression analysis performed to understand the productivity- wage ratio relation with time across 6 major economies, equation can be express as:

$$\boldsymbol{PWR_{i,t} = \beta_{0,i} + \beta_{1,i} * year_t + \varepsilon_{i,t}}$$

where,

- $PWR_{i,t}$ = represents the productivity-wage ratio for country i in year t
- $\beta_{0,i}$ = the country-specific intercept
- $\beta_{1,i}$ = the country-specific time trend coefficient (Slope)
- $year_t$ = time variable
- $\varepsilon_{i,t}$= error term

The result of statistical model estimated for each country is a linear time trend model:

Table 1 statistical model estimates

Nation	coefficient	r^2	p value	significance
Ireland	0.0613	0.745	0.000000028	TRUE
United States	0.00894	0.687	0.00000187	TRUE
Japan	0.00283	0.226	0.0187	TRUE
Germany	0.000739	0.0253	0.447	FALSE
United Kingdom	-0.00026	0.00229	0.82	FALSE
France	-0.00262	0.501	0.0000747	TRUE

Ireland demonstrates the most severe and statistically significant widening gap, with its productivity-wage ratio increasing by 0.0613 units annually ($p < 0.001$), explaining 74.5% of the variance over time. This represents the strongest decoupling trend, indicating a rapid divergence between productivity growth and wage growth.

The United States shows a significant but more moderate annual increase of 0.00894 units ($p < 0.001$), with the model explaining 68.7% of the temporal variation. Japan exhibits a modest but statistically significant positive trend (0.00283 units per year, $p = 0.019$), though the model explains only 22.6% of the variance, suggesting other factors substantially influence the ratio.

Germany and the United Kingdom show no statistically significant trends, with minimal coefficients and low R-squared values, indicating relative stability in their productivity-wage relationships. Notably, France is the only country exhibiting a significant negative trend (-0.00262 units annually, $p < 0.001$), with the model explaining 50.1% of variance, suggesting a gradual convergence between productivity and wage growth over the period.

VI. TOP 5 SECTORS BY GROSS VALUE ADDED PER HOUR WORKED (GVAHRS): IRELAND

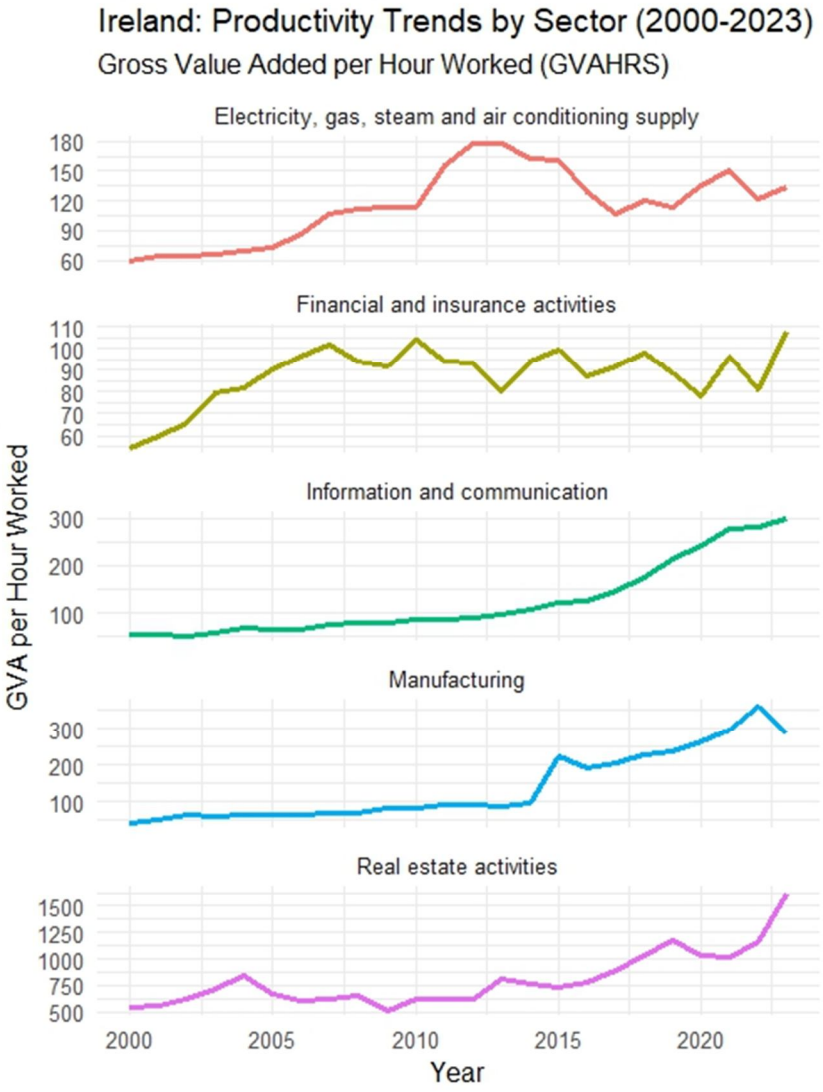

Figure 2: Gross value added per hour worked: Ireland top 5 sectors

The descriptive statistics from section B in appendix and figure 2 reveal distinct volatility patterns across Ireland's top productive sectors. Real estate activities show the highest absolute volatility (Standard Deviation: 291.87) and widest range (1,372.82), indicating substantial year-to-year fluctuations that likely correlate with property market cycles. Despite this volatility, real estate maintains a strong positive trend (Skewness: 1.05), suggesting that high-productivity years outweigh low ones. Manufacturing and information sectors exhibit moderate volatility (SD: 98.47 and 79.55 respectively) with positive skewness (1.03 and 1.33), indicating growth trajectories punctuated by periodic surges. The electricity sector demonstrates remarkable stability (SD: 44.02, Skewness: 0.07), reflecting its regulated nature and consistent demand patterns. Financial services show negative skewness (-0.88), suggesting that this sector experienced more below-average than above-average productivity years during the study period. The kurtosis measures indicate varying tail behaviors, with real estate showing leptokurtic distribution (1.96) suggesting extreme values

are more common than in a normal distribution, while other sectors show platykurtic or near-normal distributions. These volatility patterns have important implications for wage determination, as sectors with stable productivity growth (like utilities) may support more predictable wage increases, while volatile sectors (like real estate) may create uncertainty that inhibits wage growth despite high average productivity.

B. Sectoral Productivity Hierarchy: Ireland

Table 2 top 5 sectors (GVAHRS)

Economic activity	Average productivity
Real estate activities	800.2084048
Manufacturing	140.6420194
Information and communication	124.9511192
Electricity, gas, steam and air conditioning supply	115.7142636
Financial and insurance activities	87.89594166

According to table 2, Ireland's sectoral productivity landscape reveals a striking hierarchical structure dominated by real estate activities, which exhibit an average productivity level (800.21) nearly six times higher than the second-ranked manufacturing sector (140.64). This extraordinary differential suggests that Ireland's real estate sector operates under fundamentally different economic dynamics than traditional productive sectors. Manufacturing, information and communication, and utilities form a middle tier with productivity levels ranging from 115-141, reflecting more conventional patterns of value creation through goods production and service delivery. Financial services, despite their economic prominence, rank fifth with productivity (87.90) closer to national averages. The immense gap between real estate and other sectors indicates that its measured "productivity" likely reflects capital gains, asset appreciation rather than genuine labor productivity.

VII. TOP 5 SECTORS BY LABOUR COMPENSATION RECEIVED (LCHRS): IRELAND

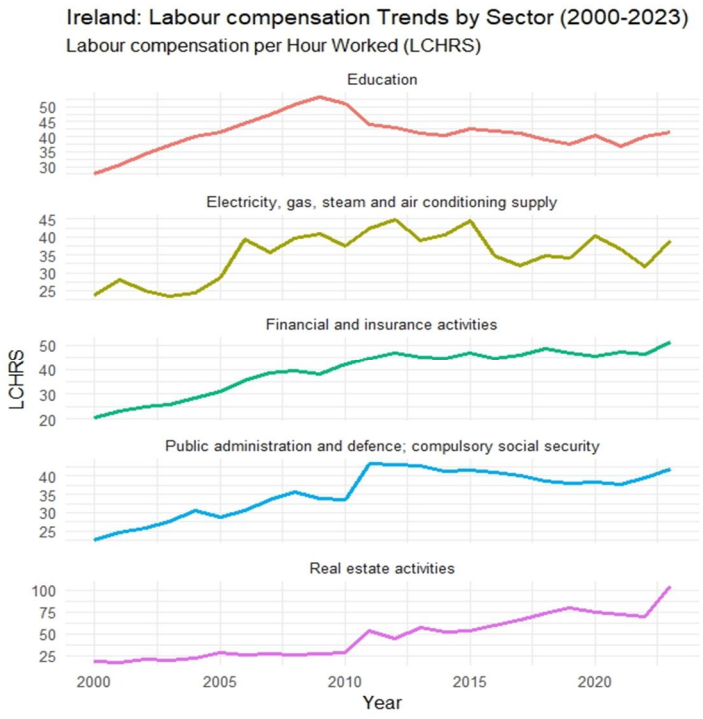

Figure 3: Top5 sectors by LCHRS Ireland

Ireland's sectoral labor compensation analysis reveals a distinctive hierarchy that contrasts sharply with the productivity rankings (Appendix: section C & figure 3). Real estate activities, despite ranking first in compensation (40.98), show extraordinary volatility (Standard Deviation: 25.80) and the widest compensation range (96.91) among all sectors. This sector's positive skewness (0.69) indicates that exceptionally high compensation years significantly influence its average. In contrast, education demonstrates stable compensation patterns with moderate mean (38.59), low volatility (SD: 7.74), and negative skewness (-0.23), suggesting more consistently distributed compensation with occasional lower-than-average years. Financial services occupy a middle position with moderate compensation (36.03) but considerable volatility (SD: 11.60), reflecting the sector's sensitivity to economic cycles. Public administration and utilities show the most stable compensation profiles, with narrow ranges (23.75 and 28.33 respectively) and negative skewness, indicating predictable wage progression. The compensation-productivity mismatch is particularly evident in real estate, where despite generating six times the productivity of manufacturing, compensation levels are only marginally higher than in education. This disparity suggests that value created in capital-intensive sectors like real estate flows disproportionately to asset owners rather than labor, creating a structural imbalance in Ireland's income distribution.

Table 3 top 5 sectors (LCHRS)

Economic activity	average compensation
Real estate activities	46.72627884
Education	41.11108089
Financial and insurance activities	39.66805775
Public administration and defence; compulsory social security	35.6214586
Electricity, gas, steam and air conditioning supply	35.02157062

The compensation distribution reveals a different hierarchy, with education and financial services emerging as the highest-paying sectors after real estate, despite their more moderate productivity rankings. Notably, electricity and utilities appear in both top-five lists, indicating better alignment between productivity and wages in this sector. The stark contrast between real estate's productivity (800.21) and compensation (46.73) compared to education's productivity (unranked in top five) and compensation (41.11) suggests fundamental differences in how economic value is distributed across sectors. This sectoral misalignment contributes significantly to Ireland's overall productivity-wage decoupling, as the most productive sectors are not necessarily the best compensated, pointing to structural factors in wage determination beyond pure productivity metrics.

The sectoral disparities in Ireland, particularly in real estate and utilities, reveal critical structural features of the productivity-wage decoupling phenomenon. The real estate sector demonstrates an extreme case where average productivity per hour worked (800.21 GVAHRS) vastly exceeds labor compensation (46.73 LCHRS), despite being the dominant productive sector. This suggests that the enormous value generated in real estate—likely driven by property appreciation, rental incomes, and capital investments rather than labor inputs—is primarily captured by capital owners rather than workers. Similarly, the electricity, gas, steam, and air conditioning supply sector shows substantial productivity (115.71 GVAHRS) relative to compensation (35.02 LCHRS), indicating that capital-intensive, regulated industries with high barriers to entry generate economic value that disproportionately benefits non-labor factors. This pattern aligns with theoretical expectations that sectors with high capital intensity, asset valuation effects, and economic rents exhibit weaker linkages between productivity and wage determination, as the marginal product of labor becomes less relevant in compensation setting compared to institutional and structural factors.

VIII. COMPARATIVE ANALYSIS: IRELAND VS. UNITED STATES REAL ESTATE SECTORS

The structural break analysis reveals both similarities and distinct patterns in the productivity-wage relationship between Ireland and the United States real estate sectors. Ireland exhibits two structural breaks in 2004 and 2010 (supF = 31.777, $p < 0.001$), while the United States shows three structural breaks in 2002, 2005, and 2009 (supF = 77.855, $p < 0.001$). Both countries demonstrate statistically significant regime shifts, though the U.S. exhibits a more complex pattern with additional breaks and a substantially higher supF statistic, indicating stronger evidence of structural change.

The structural break analysis employs the Bai-Perron (2003) methodology to test for multiple structural breaks in the productivity-wage relationship. The model can be expressed as:

$$y_t = \beta_j x_t + \epsilon_t \quad for \quad t = T_{j-1} + 1, \dots, T_j, \quad j = 1, \dots, m + 1$$

Where,

- y_t represents the productivity-wage ratio at time t
- x_t is the time trend variable
- β_j are regime-specific parameters that may change at breakpoints
- m is the number of structural breaks
- $T_1, T_2, \ldots, T_m$ are the break dates (unknown)
- $T_0 = 0$ and $T_{m+1} = T$ (sample size)
- ϵ_t is the error term, assumed to be independently and identically distributed

Table 4 Comparative Structural Break Analysis

Country	Number of Breaks	Break Years	supF Statistic	p-value
Ireland	2	2004, 2010	31.777	0.000005
USA	3	2002, 2005, 2009	77.855	<0.001

The structural break analysis reveals distinct patterns of instability in both countries' real estate sectors. While Ireland's model identifies two significant breaks (supF = 31.777, $p < 0.001$), the United States exhibits three breaks with a substantially higher test statistic (supF = 77.855, $p < 0.001$). This suggests that while both sectors experienced significant regime shifts, the U.S. real estate market demonstrated more pronounced parameter instability over the study period. The timing of breaks aligns with major economic events: Ireland's breaks correspond to its property bubble peak (2004) and post-crisis recovery (2010), while U.S. breaks occur around the early-2000s recession (2002), property bubble peak (2005), and financial crisis (2009).

C. Productivity-Wage Gap Context

These structural break findings provide important context for understanding the extreme productivity-wage gap identified in Ireland's real estate sector. While both countries experienced real estate bubbles, Ireland's gap between average gross value added (800.21) and average compensation (46.73) was substantially more extreme than patterns observed in the United States. The structural break analysis suggests that this divergence may be attributed not only to the magnitude of the property bubble but also to differing institutional responses during crisis periods and recovery phases.

The more frequent breaks in the U.S. data (three vs. two in Ireland) suggest that the U.S. real estate market may be more responsive to economic shocks, potentially due to more flexible labor markets, different mortgage structures, or more active monetary policy interventions. Ireland's breaks, occurring later in the crisis timeline, may reflect the country's specific vulnerability as a small, open economy with concentrated banking exposure to property markets.

The real estate sector is extremely capital-intensive, most value created goes to property owners, investors, and shareholders rather than workers. This explains why real estate shows the largest productivity-wage decoupling in Ireland's economy.

The extreme productivity-wage gap in Ireland's real estate sector can be mathematically represented through the regime-specific means:

For Ireland's real estate sector:

$$\frac{\boldsymbol{LCHRS\ (Compensation)}}{\boldsymbol{GVAHRS\ (Productivity)}} = \frac{\mathbf{800.21}}{\mathbf{46.73}} = \mathbf{17.12}$$

The value 17.12 represents the extreme productivity-to-wage multiple in Ireland's real estate sector.

D. Interpretation of Comparative Findings

The temporal alignment of breaks reveals intriguing patterns. Both countries experienced breaks around **2004-2005**, coinciding with the peak of their respective property bubbles. However, while Ireland's subsequent break occurred in **2010** (during its banking crisis and EU-IMF bailout), the United States experienced its next break earlier in **2009**, aligning with the peak of the subprime mortgage crisis and Lehman Brothers collapse. This timing difference suggests that Ireland's real estate sector exhibited a delayed response to the global financial crisis, possibly due to different regulatory environments and policy responses.

The higher supF statistic for the United States (77.855 vs. 31.777 for Ireland) indicates more pronounced structural changes in the U.S. real estate sector. This may reflect the more diverse and complex nature of the U.S. real estate market, which encompasses multiple regional markets with varying dynamics, compared to Ireland's more concentrated property sector.

Both countries show a significant breakpoint around the mid-2000s property bubble peak, but the U.S. exhibits an additional early break in 2002, which may correspond to the aftermath of the dot-com bubble and early 2000s recession, or to specific regulatory changes in U.S. real estate markets that preceded Ireland's experience.

IX. COUNTRY PERFORMANCE ANALYSIS

Following figure illustrates the relationship between cumulative wage growth (x-axis) and productivity growth (y-axis) across six major economies from 2000 to 2023. The red 45° line represents parity where productivity and wages grow at equal rates. Points above the line indicate economies where productivity grew faster than wages, while points below indicate stronger wage growth. Marker size and color intensity both represent the magnitude of the growth gap.

Figure 4: Productivity vs. Wage Growth Across Six Economies, 2000-2023

Table 5 Country Performance Metrics, 2000-2023 (Calculated using Equations from Appendix: section A)

Country	Average ratio	volatility	Productivity Growth	Wage Growth	Growth Gap
Germany	1.487843529	0.034165077	95.33714288	86.94038884	8.396754037
France	1.445802446	0.027260009	69.65591526	74.04517523	-4.389259962
United Kingdom	1.720291445	0.040386179	-3.704525708	-6.349699374	2.645173666
Ireland	2.178601434	0.52266977	202.883906	86.10422833	116.7796777
Japan	1.753289744	0.042117659	18.73230115	10.1258022	8.606498951
United States	1.960100189	0.070024646	118.3578329	94.77320597	23.58462694

The analysis reveals three distinct patterns of productivity-wage dynamics among advanced economies over the 2000-2023 period. Ireland emerges as a clear outlier, exhibiting both the highest average productivity-wage ratio (2.18) and the largest growth gap (116.8 percentage points), indicating that productivity grew more than twice as fast as wages. The United States shows a similar but less extreme pattern of decoupling, with a 23.6 percentage point growth gap. In contrast, France demonstrates convergence, with wage growth slightly outpacing productivity growth (-4.4 percentage point gap). Germany and Japan exhibit modest decoupling (8.4 and 8.6 percentage points respectively), while the United Kingdom shows nearly balanced but negative growth in both productivity and wages. Notably, Ireland's exceptional volatility (0.523) suggests an unstable productivity-wage relationship compared to France's stable pattern (0.027 volatility).

These divergent trajectories highlight how institutional frameworks and economic structures mediate the translation of productivity gains into wage growth, with Anglo-Saxon economies showing stronger decoupling than Continental European models.

E. Granger Causality Analysis

To investigate the temporal relationship between productivity and wage growth, we employ Granger causality tests (Granger, 1969). The test examines whether past values of one time series (e.g., productivity growth) help predict current values of another (e.g., wage growth), beyond what can be predicted by past values of the series itself.

Table 5 Granger Causality Test Results

Country	Null Hypothesis	F-Statistic	p-value	Conclusion
Ireland	Productivity ↛ Wages	0.060	0.942	No causality
Ireland	Wages ↛ Productivity	0.775	0.476	No causality
USA	Productivity ↛ Wages	0.092	0.913	No causality
USA	Wages ↛ Productivity	2.434	0.124	No causality

The Granger causality tests reveal a significant finding (Table 5): there is no statistically significant causal relationship between productivity growth and wage growth in either direction for Ireland or the United States at conventional significance levels. For Ireland, neither productivity growth Granger-causes wage growth ($F = 0.060$, $p = 0.942$) nor do wages Granger-cause productivity ($F = 0.775$, $p = 0.476$). The United States exhibits similar patterns, with no significant causality from productivity to wages ($F = 0.092$, $p = 0.913$) and only borderline non-significant causality from wages to productivity ($F = 2.434$, $p = 0.124$).

Interpretation: These results suggest that the observed decoupling is not driven by temporal lead-lag relationships but rather by simultaneous structural factors that affect both variables independently. The absence of Granger causality challenges neoclassical models that assume automatic transmission of productivity gains to wages, instead supporting institutional theories where wage determination operates through bargaining processes, social norms, and policy interventions rather than responding mechanistically to productivity changes.

The Granger causality analysis provides important insights into the dynamics of productivity-wage relationships. Contrary to theoretical expectations of automatic transmission mechanisms, we find no evidence that productivity growth predicts future wage growth in either Ireland or the United States. This empirical result aligns with institutional perspectives (Kalecki, 1971; Marglin, 1984) that emphasize the role of bargaining power, social norms, and policy frameworks in wage determination. The absence of causal links helps explain why productivity-wage decoupling can persist over extended periods without self-correction through market mechanisms alone.

X. CONCLUSION

This study provides compelling evidence of significant and varied productivity-wage decoupling across six major OECD economies from 2000 to 2023, with Ireland emerging as a striking outlier exhibiting the most pronounced divergence. Our analysis reveals that productivity gains have not been uniformly translated into wage growth, but rather that institutional frameworks, sectoral composition, and economic structures critically mediate this relationship. The findings demonstrate that Anglo-Saxon economies, particularly Ireland and the United States, show stronger decoupling patterns than their Continental European counterparts, with Ireland's real estate sector playing a disproportionately large role in driving national-level trends. The identification of structural breaks in 2004-2005 and 2010-2011 across multiple economies suggests that major economic crises—particularly the global financial crisis—fundamentally reshaped productivity-wage dynamics in ways that have persisted through the recovery period. These results challenge simplistic narratives about technological determinism in wage stagnation, highlighting instead the importance of sector-specific dynamics, institutional arrangements, and policy choices in determining how economic gains are distributed. The evidence presented here underscores the need for policy interventions that address not only aggregate productivity growth but also the mechanisms through which these gains are shared with workers, particularly in sectors where capital intensity creates structural imbalances in value distribution.

Our analysis reveals three key findings: First, Ireland exhibits extreme productivity-wage decoupling, particularly in its real estate sector. Second, structural break analysis identifies regime shifts aligning with major economic crises. Third, Granger causality tests find no evidence of temporal causality between productivity and wage growth, suggesting that institutional factors rather than automatic market mechanisms govern wage determination.

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XI. APPENDIX

A. *Section A: Calculation Methodology for country performance matrix*

1) Average Productivity-Wage Ratio:

$$\bar{R}_i = \frac{1}{T}\sum_{t=1}^{T}\left(\frac{GVAHRS_{it}}{LCHRS_{it}}\right)$$

2) Ratio Volatility:

$$\sigma R_i = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T}(R_{i,t} - \bar{R}_i)^2}$$

3) Cumulative Productivity Growth:

$$g_i^{prod} = \left(\frac{GVAHRS_{i,T}}{GVAHRS_{i,1}} - 1\right) * 100$$

4) Cumulative Wage Growth:

$$g_i^{wage} = \left(\frac{LCHRS_{i,T}}{LCHRS_{i,1}} - 1\right) * 100$$

5) Growth Gap:

$$\Delta g = g_i^{prod} - g_i^{wage}$$

Where:

- i indicates countries
- t indicates years (2000-2023)
- T is the total number of years
- 1 is first year in data (2000)
- GVAHRS = Gross Value Added per hour worked
- LCHRS = Labor Compensation per hour worked

B. *Section B: Descriptive statistics for GVAHRS Ireland*

	Electricity, gas, steam and air conditioning supply	Financial and insurance activities	Information and communication	Manufacturing	Real estate activities
Mean	102.9821284	79.98825746	110.0864729	121.0260121	724.9933446
Standard Error	8.174869391	3.985604013	14.77246581	18.28489537	54.19861516
Median	111.2061699	88.98891239	80.52486139	82.84329054	651.4640892
Standard Deviation	44.02301895	21.46313447	79.55216301	98.46717507	291.868475
Sample Variance	1938.026197	460.6661412	6328.54664	9695.784567	85187.20667
Kurtosis	-1.147800836	-0.552035334	0.634691288	-0.211208771	1.96200668
Skewness	0.067581064	-0.876112953	1.328863043	1.030665832	1.04807762
Range	140.238889	69.82064525	269.8209108	343.2888881	1372.816364
Minimum	37.95241883	38.35265659	31.05998394	19.35196039	250.2883248
Maximum	178.1913078	108.1733018	300.8808948	362.6408485	1623.104688
Sum	2986.481724	2319.659466	3192.507713	3509.75435	21024.80699

C. Section C: Descriptive statistics for LCHRS Ireland

	Education	Electricity, gas, steam and air conditioning supply	Financial and insurance activities	Public administration and defence	Real estate activities
Mean	38.58714158	32.27095634	36.02860932	33.05170537	40.98074095
Standard Error	1.438070149	1.595768958	2.154336243	1.508801445	4.790185944
Median	40.22791431	34.802386	39.47532474	33.8094786	28.05351032
Standard Deviation	7.744244755	8.593478833	11.60145572	8.12514444	25.79594077
Sample Variance	59.97332683	73.84787845	134.5937747	66.01797217	665.43056
Kurtosis	-0.584222103	-1.128923347	-1.451252596	-1.351703837	-0.482039393
Skewness	-0.22962811	-0.388019336	-0.46608125	-0.372819102	0.688331726
Range	27.06002425	28.33437272	34.09664694	23.75498611	96.90830336
Minimum	26.17375375	16.55605123	17.24112429	19.74240171	8.476683938
Maximum	53.23377799	44.89042395	51.33777123	43.49738782	105.3849873
Sum	1119.027106	935.857734	1044.82967	958.4994558	1188.441487

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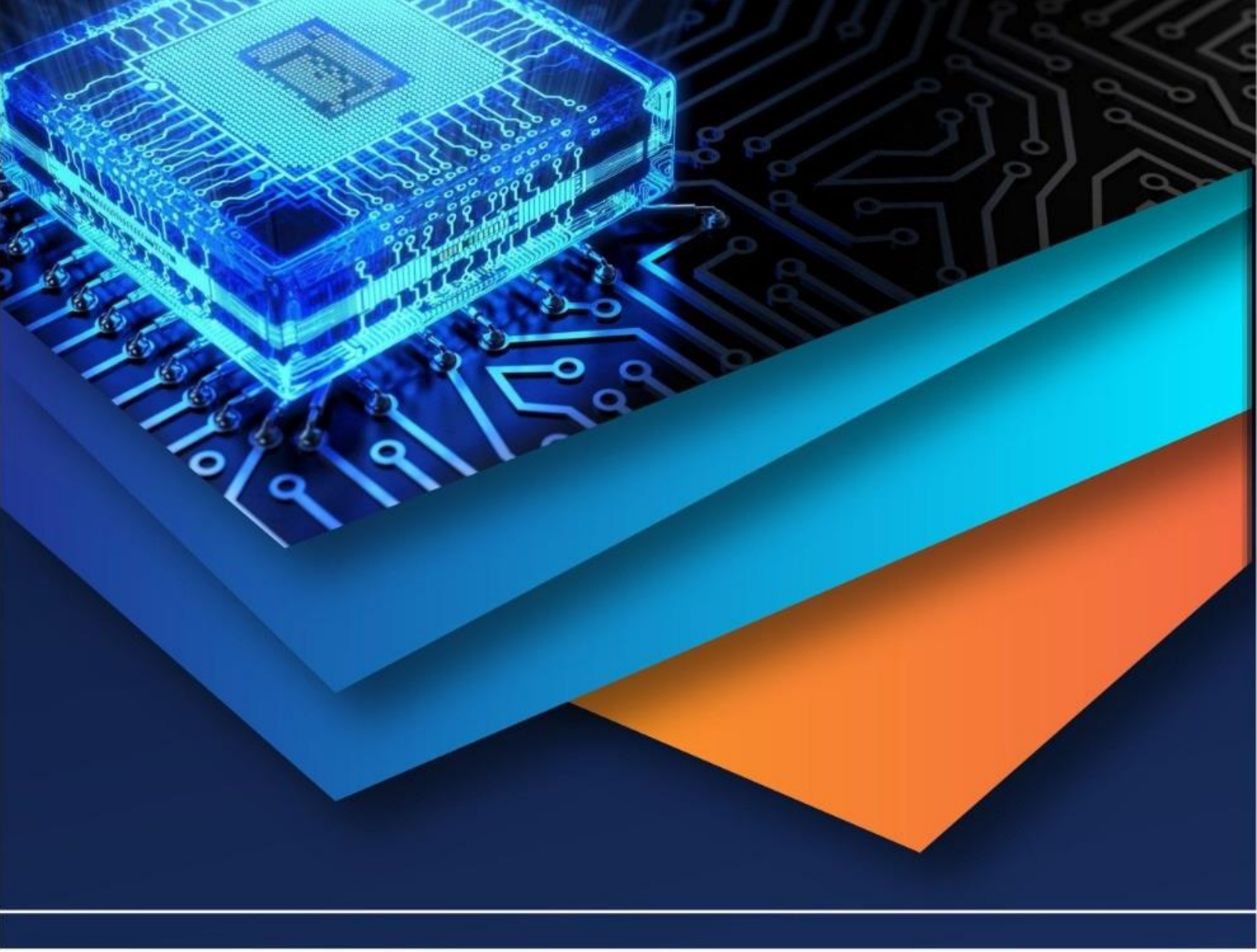

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