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Modelling Economic Policy Issues

The exchange rate regime, a determinant of the degree of risk sharing between profits and wages

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ABSTRACT

The interaction between economic growth, profits, and wages at the macroeconomic level provides insights into firms' ability to manage risk and the degree of competition in the goods market. In both instances, policymakers have room to improve the institutions within the economy. We conduct a panel data analysis for 20 OECD countries and demonstrate that an increase in profits has a negative effect on wage changes, once labour market rigidities and the business cycle are controlled for. Notably, economic growth has significantly different effects on wages depending on the exchange rate regime and the phase of the business cycle. In other words, the exchange rate regime is an important determinant of the extent to which economic growth translates into wage changes: when a country operates with a flexible exchange rate, wages absorb a greater share of GDP (Gross Domestic Product) fluctuations over the business cycle, thereby sharing risk with capital owners. The strength of democracy and the rigidity of labour market legislation also play a crucial role in wage variations.

1. Introduction

We use an unbalanced panel dataset of twenty OECD countries over 51 years (1970-2021) to analyse the macroeconomic factors that influence changes in country-level average wages. After controlling for country fixed effects, changes in public expenditure, economic growth, and international trade, we find that increases in profits continue to have a negative effect on wages. However, as expected, the effects of GDP growth on wage evolution are positive. Interestingly, these positive effects are larger when the country operates under a floating exchange rate regime. To the best of our knowledge, the study of the relevance of the exchange rate regime in the transmission of macroeconomic variables to average wages is novel within the literature.

Many studies have analysed the determinants of wages, and the role firm profits play in their variation. At the microeconomic level, the literature is vast. On one side, it has explored the existence of some rent-sharing. Blanchflower et al. (1996) show that in the US from 1964 to 1985, changes in workers' remuneration follow earlier movements in profitability; that is, the firm's ability to pay largely explains changes in wages. They control for industry-level fixed effects and workers' characteristics. Hildreth and Oswald (1997) use establishment and worker-level panel data for the UK and find comparable results for the period 1981-1990. They show that contemporaneous changes in profits are also relevant for explaining changes in wages. On the other hand, authors like Bigsten et al. (2003) find that risk-sharing, rather than rent-sharing, explains the positive impact of firm profits on wage changes in a panel of four African countries. They argue that when firms face temporary shocks, the effect on profits is cushioned by risk-sharing with workers, especially where financial markets are underdeveloped. Risk-sharing may also manifest as an exchange of favours between employees

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and employers, with workers accepting wage variability to help cushion firm results during downturns in exchange for greater job stability, thus reducing the risk of layoffs (see Kar and Datta 2015).

Although microeconomic analyses conclude that profits have a positive effect on wages, macroeconomic data do not reflect a consistent pattern in this co-movement. Fig. 1. Per country correlations shows the correlation between the two variables and between their variations for the 20 OECD countries included in the analysis over the period 1970-2021. Indeed, several countries alternate between positive and negative correlations over time.

The macroeconomic literature focusing on the effects of GDP growth (or productivity growth), unemployment, and labour market institutions on wages is also extensive (see, for instance, Buch (2013), Dean (2015), or Paternesi-Meloni and Stirati (2023)). However, the connection between aggregate profit and wage dynamics at the country level, and the variables that may potentially influence it, are not yet well-established. For example, the macroeconomic study by Bottazzi et al. (1996) finds negative correlations between 1970 and 1992 for 12 of the 16 OECD countries it explores.[1] Opposite to them, Nichols, 1983, finds a positive connection between the profit rate and wages. Giovanni and Matsumoto (2011) construct a measure of human capital wealth for the US during the period 1952-2007 and find a negative correlation between returns to human capital and equity returns.[2] Schwellnus et al. (2017) explore the macroeconomic decoupling of wages from productivity in a group of OECD countries. They find that increasing productivity does not result in a rise in real wages for the average worker. They conclude that this is due to both a decline in labour shares and the ratio of median to average wages.

A closely related paper to ours is that of Messina et al. (2009). They conduct an econometric analysis to understand the evolution of aggregate real wages in the manufacturing sector over the business cycle. Their results highlight significant cross-country differences depending on the degree of openness to trade and the strength of unions. However, unlike the present study, they do not analyse the connection between profits and wages, nor do they consider the exchange rate regime or the expansionary or contractionary phase of the business cycle where the economy is.

Unlike microeconomic literature, which has demonstrated that many individual (worker, firm, and industry) characteristics explain wage differentials, the aforementioned macroeconomic papers do not provide in-depth insights into the macroeconomic determinants of changes in country-level average wages, nor do they exploit the potential of panel data.

Regarding theoretical models in open economy, they typically use Cobb-Douglas production technologies, which imply constant labour and capital income shares and perfect correlation between these variables. Models that deviate from Cobb-Douglas technologies generate ambiguous correlation signs between profits and wages, depending on policy and preference parameters (see Bhaduri and Marglin (1990) for a discussion). Our empirical analysis aims to provide further insights into the real determinants and linkages between these two types of income. Hopefully, it will help theorists design more realistic production technology frameworks that improve the models' ability to explain actual data.

One plausible hypothesis for understanding the profit-wages connection is that firms may use labour costs as a risk-sharing mechanism when institutional features or monetary policy decisions limit other profit-stabilisation channels. For instance, relatively high levels of labour market rigidities, which make wage cuts and layoffs difficult during tough times, may explain these findings.

The fluctuations of the exchange rate in response to market forces are also a well-known shock transmission channel in open macroeconomics literature. Consequently, a floating exchange rate is an important mechanism for risk-sharing and a source of international contagion, particularly for firms with a presence in international markets. Countries that opt for a fixed exchange rate limit one source of economic stabilisation, though they also eliminate a source of uncertainty for exporting and importing firms, depending on their pricing regime.[3] Theoretically, firms may compensate for this limitation by increasing risk-sharing with their workers.

Finally, the interaction between fiscal policy and the exchange rate regime plays a significant role in determining macroeconomic outcomes, potentially including aggregate wage dynamics (see, for example, Sachs (1980) and Carlin (2013)). This relationship is particularly relevant in contexts such as the Eurozone, where countries share a common currency but have separate fiscal authorities (Navarro-Ortiz, 2024).

Under fixed nominal exchange rates (and in common currency areas), countries facing asymmetric shocks must adjust relative prices and wages to generate real exchange rate adjustments and maintain competitiveness. Since the wage bargaining system significantly affects wage dynamics in response to macroeconomic policies, fiscal authorities become crucial for stabilisation.

To examine these possibilities, we include the quality of democracy, a measure of labour market rigidities (which controls for firms' ability to lay off workers during the business cycle), and the exchange rate regime in our analysis. These three variables have undergone significant changes in many of the considered countries over the last five decades. Therefore, the inclusion of fixed effects in the models does not obscure their potential explanatory power. Additionally, we consider two measures of the fiscal stance and their interaction with the exchange rate regime to explore the impact of their link on aggregate wages.

Our results suggest that contagion risk in a floating exchange rate regime is more significant than the limited opportunities for risk diversification in a fixed exchange rate regime in explaining the relationship between profits, the business cycle, and average wages.

To summarise, the novel feature of our analysis revolves around considering the role of the exchange rate regime in the

[1] Ireland had a negative correlation between wage growth and profit growth for the period 1970-2010. Bottazzi et al. (1996) does not include this country in the analysis.

[2] The computed value of human capital can also be thought of as the expected discounted value of a stream of future labor income.

[3] When market prices are somewhat rigid, exporters which set prices in the local currency of each destiny country suffer the uncertainty of potential movements in the exchange rate. These movements either benefit or damage profits earned abroad and, therefore, destabilize.

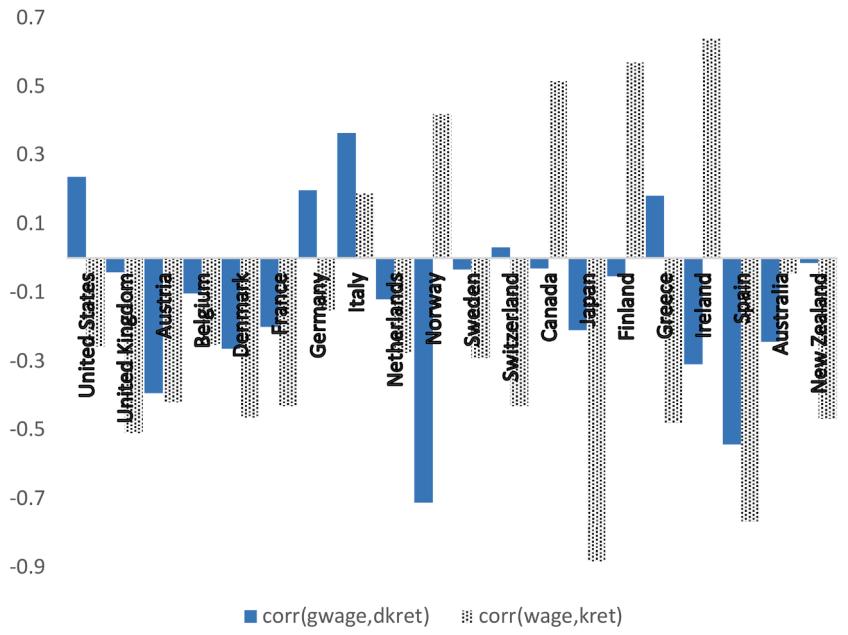

Fig. 1. Per country correlations
Notes: Correlations between percentage change of real wages and change in real capital returns, corr(gwage, dkret), and between real wages and real capital returns, corr(wage,kret), for the period 1971-2021.

interconnection between macroeconomic variables and labour income. This includes analysing the interaction between fiscal policy and the exchange rate regime to understand the effects it may have on aggregate wage dynamics.

The rest of the paper is structured as follows: Section 2 describes the data; Section 3 presents alternative empirical models and analyses the results; Section 4 reflects on the potential practical and theoretical implications of our findings; and Section 5 concludes. Finally, Appendix 1 includes two subsections: First, it provides an overview of the relevant characteristics of the countries in the analysis to help readers fully understand the results. Second, it offers a detailed list of data sources. As a robustness check, in Appendix 2, we repeat the analysis with an alternative classification of the exchange rate regime and introduce the role of the fiscal stance.

2. Data

The panel includes annual data for the following countries between 1970 and 2021: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, United Kingdom, and the United States. Appendix 1 includes a short section to put in context the environment of these twenty countries, regarding their political and economic situation along the period of study.

Series are in constant prices after using the Gross Domestic Product (GDP) deflator, or in percentages of real terms variations.

The definitions of the dependent variable, wages, and profits are taken from Bottazzi et al. (1996). Wages are defined as total labour compensation divided by the total number of employees, with both series sourced from OECD statistics. Labour compensation includes remuneration for work performed, payments in kind, employers' social security contributions, the cost of employer-provided training, and taxes classified as labour costs.

The explanatory variables, with their names for the econometric model in italics, are as follows:

Profits (kret) are measured as the gross operating surplus divided by non-residential capital stock. We use World Bank data on gross value added at factor cost and subtract total labour costs from the OECD. Non-residential capital stock is sourced from Kamps (2004), and the series is extended using the growth of non-residential capital stock from the OECD Economic Outlook. Wages are measured in terms of the rate of variation (*gwage*) from the previous year, and profit rates are in first difference (i.e. they reflect the change in the rate of return to capital).

Regarding the labour market environment, we include a measure of labour market rigidity (legis), unionism density (unions),[4] and the rate of change in labour productivity (gprod). The OECD provides harmonised indices for annual labour market rigidity from 1985

[4] Alternatively, we used the variable "Collective bargaining coverage rate", from the OECD/AIAS ICTWSS data base, without any qualitative change in the outcomes of the estimations. The adjusted collective bargaining coverage rate is defined as the number of employees covered by a collective agreement in force as a proportion of the number of eligible employees equipped (i.e., the total number of employees minus the number of employees legally excluded from the right to bargain).

onwards and for trade union density from 1970 in the Strictness of employment protection legislation dataset. Both variables are continuous, with *legis* data ranging from 0 to 6, where higher scores indicate stricter regulation.[5]

OECD (2019) analyses the per country labour market institutions and classify them based on the collective wage bargaining regime. They offer an annual five-category classification between 1980 and 2015 for all the countries we consider. From the most rigid to the most flexible, they are the following:

- *Predominantly centralised and weakly co-ordinated collective bargaining systems (PCW):* Sectoral agreements play a strong role, extensions are relatively widely used, derogations from higher-level agreements are possible but usually limited or not often used, and wage co-ordination is largely absent.
- *Predominantly centralised and co-ordinated collective bargaining systems (PCC)*: As in the previous category, sectoral agreements play a strong role and the room for lower-level agreements to derogate from higher-level ones is quite limited. However, wage co-ordination is strong across sectors.
- *Organised decentralised and co-ordinated collective bargaining systems (OCD):* Sectoral agreements play an important role, but they also leave significant room for lower-level agreements to set the standards – either by limiting the role of extensions (rare and never automatic or quasi-automatic), leaving the design of the hierarchy of agreements to bargaining parties or allowing opt-outs. Co-ordination across sectors and bargaining units tends to be strong.
- *Largely decentralised collective bargaining systems (LD):* Firm-level bargaining is the dominant bargaining form, but sectoral bargaining (or a functional equivalent) or wage co-ordination also play a role. Extensions are very rare.
- *Fully decentralised collective bargaining systems (FD):* Bargaining is essentially confined to the firm or establishment level with no co-ordination and no (or very limited) influence by the government.

In the analysis, we take two different approaches to assess the relevance of the bargaining regime. In Table 10, we introduce the variable *barg*, which takes values from 1 to 5, corresponding to the five regimes identified by the OECD (2019). A value of 5 represents the most rigid regime, PCW, and 1 represents the most flexible, FD. Following Williams (2020), we conduct a Wald test by including *barg* in the regressions both as a continuous and as a categorical variable. The results show that the continuous variable is significant at the 5% level, whereas the categorical version is not. This suggests that the differential effects of each ordinal category vary in a (more or less) linear way, allowing us to proceed using *barg* as a continuous variable only. A post-estimation Wald test on the categorical version of *barg* further supports our decision to treat it as continuous. The null hypothesis of this joint test, that all coefficients on the indicators for *barg* are equal to 0, cannot be rejected (F: 0.84 (0.47)).[6]

Second, we estimate some of the regressions both for the full dataset and for subgroups of observations where the country-year pair falls under the same bargaining regime. To do this, we create a variable that takes values from 1 to 3, where 3 represents the most rigid bargaining regime, merging PCW and PCC, and 1 combines the two most flexible regimes, FD and LD. A value of 2 corresponds to the OCD regime. When these subgroups are used, or when *barg* appears in the regression, it replaces *legis* in the estimations.[7]

Finally, regarding institutions, it is important to consider the functioning of the product market. The level of competition or freedom in product markets interacts with labour market institutions and may affect wage dynamics (see the theoretical analysis in Amable and Gatti, 2004). Unfortunately, we do not have annual data on product markets competition. The OECD provides a Product market regulation" index (code OECD.PMR18.PMR) for 2018, with similar indices available for 1998 and 2013. However, the OECD advises that these indices are not homogeneous, preventing us from treating them as a consistent time series. Therefore, we use the Economic Freedom measure from the Fraser Institute.[8] This measure, which covers the period 1970-2021, is divided into five categories: Size of Government; Legal System and Security of Property Rights; Sound Money; Freedom to Trade Internationally; and Regulation. The Regulation category summarises the freedom of the private sector to operate according to market forces. It includes regulations in the credit and labour markets as well as business regulations and is expressed as a continuous variable ranging from 0 to 10, with 10 representing the highest level of freedom. In some of our estimation models, we include this fifth category as a continuous variable (*mktsflex)*.

A g at the beginning of the variable name indicates it is expressed in growth terms, while a D refers to first differences.

To analyse whether the exchange rate regime affects the coefficients of the main explanatory variables, we introduce a dummy variable *flex*, which takes the value 1 for floating exchange rates and 0 for fixed rates.

With globalisation, cross-border transmission of shocks becomes both an opportunity for risk-sharing and a source of contagion. Changes in GDP growth and, consequently, in profits, are transmitted to capital income (via capital returns) and to labour income (via total labour compensation). Necessarily, an increase in the share of income going to capital owners reduces the share of labour income, and vice versa. In both the risk-sharing and contagion cases, the exchange rate regime may affect the coefficients of key explanatory variables: changes in firm profits (*dkret*), and economic growth (*gy*). Therefore, interaction terms between *flex* and GDP growth (*gy*)

[5] *Legis* belongs to Version 1 of EPL in OECD Employment Protection Legislation database 2020 edition.

[6] See the discussion in Williams (2020) for the decision on the use of independent categorical variables.

[7] Ideally, one would estimate separate models for groups of countries based on their collective bargaining regimes. We attempted to follow this approach; however, very few countries remained within each group for a sufficiently long period. As a result, the estimated models were overall invalid due to the reduced number of available observations. In fact, most of our countries changed regimes once or twice over the 35 years considered.

[8] https://www.fraserinstitute.org/economic-freedom/approach

and between *flex* and changes in profits (*dkret*) are included in the regressions. To explore the influence of fiscal policy on the transmission mechanism, we also include interaction terms with the fiscal policy stance and the wage bargaining regime.

We follow the definition in Shambaugh (2004) to construct the series.[9, 10] He argues that a currency can be considered pegged to another for a given year when its end-of-month exchange rate does not fluctuate by more than 2 per cent in any month of that year. To prevent breaks in the peg status due to one-time realignments, any exchange rate that shows no percentage change in eleven out of twelve months is considered fixed. Monthly exchange rate data for the 20 countries and their reference currency are extracted from fxtop.com. The reference currency is the US dollar until 1973, when the Bretton Woods system collapsed, after which it may vary. The US dollar, sterling, German mark, Australian dollar, and euro serve as reference currencies for different countries and periods. We follow Shambaugh (2004) in selecting the appropriate reference currency. The author considers the German currency as floating from 1973. We assume the German currency is considered pegged within the eurozone from 1999 onwards.[11]

Regarding fiscal policy, we take two alternative approaches. On the one hand, we examine different public spending components. Data on per capita public spending (*g_cap*), social public expenditure (*welfare_cap*), and GDP growth (*growth*) are sourced from OECD statistics. The variable *welfare_cap* aggregates public expenditure on old age (*oldage*), incapacity benefits, health, family, labour market, and other social policy areas, which are explored in the regression models. Workers receive higher total compensation for their labour effort when public insurances are more generous, as wages include the compulsory payments firms make for these purposes.

On the other hand, based on Carlin's (2013) insights, we explore the role of the fiscal stance. The term "fiscal stance" refers to the government's discretionary budgetary decisions regarding economic stabilisation. The fiscal stance is measured as the difference between the primary structural balance of the current year and that of the previous year. The primary structural balance is an estimate that excludes from the headline budget balance any changes in expenditure (e.g., unemployment benefits) or revenue (e.g., income tax) that depend purely on the economic cycle (i.e., the "automatic stabilisers") and the payment of interest on sovereign debt. For example, if a negative primary structural balance (deficit) in one year is larger than that of the previous year, the fiscal stance is negative, and the government is applying an expansionary (or supportive) policy. Conversely, if the difference is positive, the government is applying a restrictive (or contractionary) fiscal policy (Gotti and Zoppè, 2021). We use the annual change in the "general government structural balance as a percentage of potential GDP" and the "general government primary net lending/borrowing as a percentage of GDP". Both series, in levels, are available for the period 1980-2021 and are sourced from the IMF World Economic Outlook database.To account for different political systems, we use a continuous variable measuring democracy quality (democ) developed by Integrated Network for Societal Conflict Research organization. Since some countries have experienced significant changes in this measure over the forty years in the database, this consideration may be relevant regardless of the country fixed effects included in the model.

Finally, we take international trade over GDP from OECD (trade). We also try measures of trade of each country with its reference economic region, but it results to be no significant. Table 1 summarizes the basic statistics for the relevant variables.

3. Model and results

3.1. Short-run determinants of real wage variations

In this section, we construct and estimate a panel data model to analyse the macroeconomic determinants of variations in average real wages and, especially, the sign and size of the relationship between wages, economic growth, and profits depending on the exchange rate regime.

A preliminary look at the data suggests that wages, return to capital, and public expenditure exhibit unit root behaviour. Both Dickey-Fuller tests and correlograms confirm this. Therefore, these variables are introduced in first differences in the model:

$$gwage_{it} = \delta\, Dkret_{it} + \gamma gy_{it} + \beta\, x_{it} + (\alpha_{it} + u_{it}) \tag{1}$$

where δ and γ are the coefficients describing the impact of changes in profits and economic growth on changes in wages, which are the main targets of the estimation; x is a vector of the other explanatory variables, and β is the set of parameters associated with these control variables that must be estimated; α_i is the unobservable individual-specific effect, and u_{it} is the unobservable error term.

We performed a Hausman test to decide whether to introduce random or fixed effects in the model. The differences in the results are not significant, and given the structure of the panel, with annual country-level data, it seems appropriate to retain country fixed effects (FE).[12] The results remain unchanged in a robustness test controlling for heteroskedasticity.

[9] Rose (2011) offer a full discussion on the most adequate methodology to classify exchange rate regimes. He considers the one used here as the best available methodology.

[10] As a robustness check, we repeated the analysis using the classification provided by Ilzetzki et al. (2019, 2021). All the qualitative results hold, regardless of whether a four-category variable is used for the regimes, as in their coarse classification, or a 0-1 dummy where any category above 1 in Ilzetzki et al. (2019) is considered a flexible exchange rate. See the Appendix for these results.

[11] As it has been previously indicated, we also explore the results using the exchange rate regime classification in Ilzetzki et al. (2019, 2021). Results are in Appendix 1.

[12] The literature on panel data analysis has generalised the use of two-way fixed effects. However, as Imai and Kim (2021) demonstrated, the effectiveness of this technique in adjusting for unobserved unit-specific and time-specific effects depends on the assumption of their linear additivity. The often-claimed equivalence to the difference-in-differences estimator also does not hold when moving beyond the simplest setting of two groups and two time periods. Consequently, we choose to focus on fixed effects.

Table 1
Basic statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
kret	905	0.241	0.076	0.112	0.628
gwage	1013	0.0116	0.026	-0.158	0.125
dtrade	1007	0.008	0.045	-0.257	0.352
xrvol	1036	0.02	0.009	0	0.117
gprod	921	0.017	0.036	-0.151	0.214
dg_cap	1020	0.95	3.263	-4.88	31.422
legis	695	1.876	0.82	0.093	3.611
democ	962	9.706	1.784	-7	10
flex1	1040	0.468		0	1
growth	976	0.236	0.027	-0.108	0.252
mktsflex	560	7.493	0.961	3.62	9.35
dprimary	716	-0.005	0.025	-0.175	0.188
dstrbalance	666	-0.000	0.016	-0.087	0.075
bargain5	720	3.350	1.434	1	5
bargain	720	2.260	0.864	1	3

Notes: g means growth, d means first difference, dg_cap is the first difference of public spending per capita.

Table 2 presents the results for alternative short-run fixed-effect regression models. Pesaran's (2004) CD test strongly confirms the existence of cross-sectional dependence. Moreover, the estimated short-run models exhibit AR(1) disturbances, although these autocorrelations, as indicated by ρ_{ar}, are relatively low. Consequently, we have proceeded as follows: Columns [1]-[6] provide consistent within estimators for models with AR(1) residuals. Columns [7]-[11] are within estimators with Driscoll and Kraay standard errors, which are well-calibrated when cross-sectional dependence and heteroskedasticity are present. Both types of models yield similar conclusions.

Macroeconomic variables explain between 10 and 17 per cent of changes in country-average wages, and between 20 and 27 per cent of country differences in average wages, as indicated by the within and between R^2. ρ is the intraclass correlation, showing that around 4 per-cent of the variance of the dependent variable is due to differences across countries.

Three concerns may arise from this analysis:

1. Economic growth simultaneously affects wage variation and changes in the return to capital (or profits). This could cause multicollinearity issues when both variables are used as explanatory factors. However, the variance inflation factor (VIF) diagnostic for multicollinearity yields values well below 5, indicating that multicollinearity should not be a problem.
2. Since economic growth and labour market institutions may affect both wages and profits, one might consider a multivariate multiple regression (MMR) model with *gwage* and *dkret* as dependent variables. We explored this option, but the series do not meet the necessary conditions for the validity of MMR models. For example, normality of the dependent variables and homogeneity of the variance-covariance matrix were rejected in the preliminary tests.
3. In a globalised world, country-level macroeconomic variables are likely influenced by other countries' performance. This type of endogeneity could be addressed using Panel VAR estimations if the variables were not cointegrated. However, Pedroni cointegration tests clearly indicate cointegration in this case. Moreover, we have a mix of variables that are stationary either in levels or after first differencing. Consequently, VECM is neither possible. For these reasons, we conduct the short-run analysis using Driscoll and Kraay (1998) standard errors,[13] and the long-run analysis using Arellano and Bond (1991) ARDL (Autoregressive Distributed Lag) estimates.

The first conclusion from Table 2 is that changes in profits cause changes in wages, and this relationship is negative. Thus, increases in profit variations come at the expense of real wage variations, once control variables for the economic environment are included. This result aligns with Bottazi et al. (1996), who argued that a negative relationship may arise after a demand shock that enables firms to expand profit margins while wages remain quite constant in nominal terms and, consequently, decline in real terms. The Stolper-Samuelson theorem offers additional support for this finding, showing that endogenous movements of terms of trade, following technological or demand shocks, cause changes in the relative returns to input factors (e.g. capital and labour). The factor used intensively in the positively shocked sector sees its relative remuneration increase compared to other input factors.

Nevertheless, in the estimates of Table 2, the relationship between wages and profits remains negative even when we introduce economic growth or the business cycle phase (i.e. the dummy variable indicating positive or negative GDP growth). Thus, the negative sign persists even after controlling for demand shocks. Pianta and Tancioni (2008) also found this robust negative sign in their estimates, attributing it to the "conflictual nature of the functional distribution between profits and wages, where institutions, bargaining rules, and social processes affect specific outcomes."

While we attempted to control for labour market institutions with *legis* and *unions*, it is difficult, if not impossible, to fully capture their actual effects due to the complexity of their mechanisms, the multiple potential channels of effect transmission to the economy,

[13] Driscoll and Kraay (1998) propose a nonparametric covariance matrix estimator which produces heteroscedasticity consistent standard errors that are robust to very general forms of spatial and temporal dependence.

Table 2
Short run fixed effect models.

	AR(1) residuals						Driscoll-Kraay SE					
Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
dkret	-.869***	-.877***	-.886***	-.669***	-.478***	-.905***	-.879***	-.615**	-.899***	-.911***	-.577**	-.914***
	(.089)	(.092)	(.091)	(.105)	(.110)	(.091)	(.247)	(.238)	(.236)	(.230)	(.234)	(.258)
gy		.524***		.323***	.190***	.292***	.348***	.283**	.341***	.328***	.147	.280**
		(.107)		(.052)	(.054)	(.054)	(.114)	(.114)	(.125)	(.122)	(.117)	(.106)
flex	.011***											
	(.004)											
flex*gy 0	.410***		.352***									
	(.054)		(.052)									
1	.463***		.542***	.244***	.168***	.154***	.269***	.349***				.222***
	(.062)		(.058)	(.056)	(.063)	(.054)	(.096)	(.103)				(.076)
flex*gy*gy_pos 0,0									.176	.172	.179	
									(.163)	(.177)	(.158)	
0,1		-.173										
		(.125)										
1,0		-.505**							-.386*	-.408*	-.051	
		(.219)							(.218)	(.229)	(.155)	
1,1		.069							.321***	.328***	.190**	
		(.126)							(.102)	(.098)	(.076)	
flex*dkret				-.415***	-.211			-.603**				
				(.138)	(.170)			(.229)				
dtrade	-.038**	-.031*		-.036**	-.052***		-.030		-.028			
	(.017)	(.018)		(.017)	(.019)		(.029)		(.027)			
flex*XRvol	-.186											
	(.120)											
dg_cap										.001**		
										(.0005)		
democ		-.003**	-.002**			.005*					.006**	.005***
		(.001)	(.001)			(.003)					(.003)	(.002)
legis					.012**						.015**	
					(.004)						(.006)	
unions						.0003**						.0003
						(.0001)						(.0002)
F-test	20.79(.000)	19.96(.000)	30.91(.000)	26.45(.000)	11.00(.000)	21.72(.000)	6.87(.000)	6.15(.000)	6.15(.000)	4.71(.000)	9.60(.000)	
R^2 within	.135	.148	.133	.136	.100	.125	.171	.188	.187	.190	.104	
R^2 between	.270	.267	.196	.224.	.061	.322						
Corr(u_i, Xb)	-.070	-.067	-.082	-.063	-.720	-.354						
ρ_ar	.232	.217	.227	.218	.115	.195						
ρ	.040	.040	.043	.041	.246	.063						
Obs	865	830	830	865	647	804	885	885	885	885	646	

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, ** *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

and their varying levels of enforceability. Additionally, although outside the scope of the present analysis, the existence and development of jobs in the informal economy may also play a role in the labour market and labour income's response to changes in labour market institutions. Appendix 2 provides the estimates for models using the collective bargaining regime *barg*, and overall private sector market freedom *mrktsflex*, instead. The results of these versions are detailed in Appendix 2. However, the qualitative conclusions remain consistent with those presented here.

As expected, economic growth positively affects wage variations, meaning real wages co-move with the business cycle. Furthermore, the impact of economic growth is significantly greater when the exchange rate regime is flexible, even when controlling for labour market rigidities (see models [1] and models [3] to [8], where the interaction term between the *flex* dummy variable and economic growth *gy* shows positive and highly significant coefficients at the 1 per cent confidence level).

This result, indicating that firms' risk-sharing through wage adjustments is more pronounced when the exchange rate is flexible, may seem counterintuitive. Typically, a floating exchange rate is viewed as an optimal mechanism for shielding the economy from external disturbances (Friedman, 1953), which should prevent workers from bearing the consequences of their employers' risk diversification. However, recent literature provides evidence of the so-called "exchange rate insulation puzzle," whereby countries with floating exchange rates do not experience less contagion from external shocks (Corsetti et al., 2021).

Lee and Shin (2010) conducted an empirical analysis comparing consumption co-movements, output co-movements, and trade linkages for pegged currencies, currency unions, and floating exchange rate regimes. As they outline in their review of the theoretical literature on the subject, the predictions on the influence of the exchange rate regime on output and consumption co-movements are mixed and often conflicting. This is due to the existence of counteracting effects that may or may not emerge, depending on factors such as GDP composition or the degree of industry specialisation within currency unions or pegged regimes.

Their empirical findings suggest that both pegged regimes enhance consumption co-movements with the currency-partner country, with currency unions showing a stronger effect on output co-movements. The ratio of consumption to output co-movements serves as a measure of risk-sharing. Hence, they conclude that fixed exchange rates facilitate greater risk-sharing across countries, whereas floating regimes offer less risk-sharing. This explains why we observe a more negative relationship between profits and wages (i.e. the negative and significant coefficient for the interaction term *flex*dkret*):[14] firms attempt to share risk more with workers when other risk-sharing channels are less effective due to the economic environment. Additionally, this supports the finding that business cycle transmission (gy) is stronger under flexible exchange rates, as captured by the interaction term *flex*gy* in Table 2.

Finally, models [2] and [9] to [12] introduce new interaction terms to explore whether the transmission of economic growth to wage changes differs between expansions and contractions. We created a dummy variable that takes the value 1 during periods of positive economic growth and 0 during negative growth (no growth would be n/a, but there are no instances of 0.00 in the series). Caution is needed in interpreting the results associated with this interaction term, as there are few cases of negative growth in the panel data (only 131 out of 976 data points). Under floating exchange rates, positive economic growth is more strongly transmitted to wages during expansions: the coefficient for the *flex*gy*gy_pos* interaction term is positive and highly significant, and it must be added to the positive coefficient of *gy* to measure the total effect of increased economic growth on wage changes. Conversely, the coefficients of the interaction term combining flexible exchange rates with negative economic growth are negative (although they have low significance levels in models [8] and [9] and are not significant in model [10]). These negative coefficients must be added to those of *gy*, leading to a smaller final coefficient for the total transmission of negative economic growth to wage variations.

The main effects of the quality of democracy (*democ*),[15] and labour market rigidities (*legis*) are significant at the 5 per cent level of confidence as determinants of wage variations. Higher levels of firing costs or firing restrictions (i.e., higher *legis*) in the labour market imply greater variability in wages. This is intuitive: when firms cannot adjust their workforce size, they attempt to adjust labour costs through changes in wages. However, countries that provide more protection to workers against firing typically leave firms with limited scope for wage adjustment as well. This explains the small coefficient. The coefficient for *democ* is negative, indicating that countries with higher levels of democracy enjoy relatively more stable wages. This coefficient becomes positive when *democ* and *legis* are simultaneously included in the model. This may be because the countries included in the analysis are all developed nations with strong democracies, although they experienced changes in the level of democracy over the period 1970-2021. This fact hinders a deeper understanding of the consequences of improvements in democracy on wage stability. Unfortunately, data availability is drastically reduced for countries with weaker democratic situations.[16]

Per capita public expenditure (*dg_cap*) has a positive effect on wage changes.[17] Appendix 2 includes the results for estimates using the fiscal stance. The variables associated with it are significant and produce a negative effect on wage variation. This reflects how a fiscal authority may provide an alternative instrument for firms to cushion the effects of economic shocks.[18] Additionally, changes in

[14] Notice that, in Model [5], where the measure of labour market rigidities is introduced, the interaction term *flex*dkret* is no longer significant, although it keeps its negative sign.

[15] The expression "Main effects" refers to the direct impact of a simple variable, which is described by its coefficient estimated in the model. It is used to differentiate it from other indirect effects captured by interaction terms.

[16] Unionism level and its variation, changes in the per capita spending in welfare programs and the share of temporary contracts in the labour market are not significant to determine wage changes and models reporting these results have been discarded for space reasons.

[17] See Pappa (2009).

[18] Indeed, if one introduces an interaction term for profits*fiscal stance, *dkret*dstrbalance*, she finds a positive coefficient that would overturn the sign of the effect of profit changes on wage changes. However, this interaction term is only significant at the 10% level and it is not for models using Driscoll-Kraay SE.

international trade as a percentage of GDP have a negative, although milder, effect on wage variations.[19]

Finally, we introduced an interaction term to investigate whether the volatility of the US dollar helps explain the transmission of volatility to wages in countries with floating exchange rate regimes (*flex*XRvol*). However, the coefficient is not significant. Its inclusion was motivated by the existence of literature suggesting that exchange rate volatility may potentially affect uncertainty in other macroeconomic variables (see, for instance, Audzei and Brázdik, 2018). Therefore, potentially, large volatilities could mean that firms might have greater opportunities to smooth their yields through the exchange rate, reducing the need to adjust employment costs to achieve the same result. However, as previously discussed, this volatility is also a source of instability for firms and markets. In our estimations, the main driving currency exchange rate volatility does not significantly affect the transmission of profit variations to wages. Only when considering the 4-category classification in Ilzetzki et al. (2019, 2021) do we observe some statistical significance. The interaction term is significant for flexibility levels 2 and 4 (with 4 being the most flexible) and takes opposite signs. Indeed, when there is only some (low) flexibility in the exchange rate, higher levels of XR volatility with the US dollar imply greater transmission of profit changes to wages. When the exchange rate regime is the most flexible, higher XR volatility is sufficient to provide firms with a cushion against shocks. Consequently, they do not channel profit movements to wages, and the latter remain more stable (see Table 5).

The conclusions from these short-term regression results are as follows: rents from economic growth are shared between capital owners and workers. The more capital returns increase, the less wages grow. That said, economic growth (positive or negative) is transmitted to wages, i.e., wages are procyclical. Moreover, when a country has a floating exchange rate regime, wages experience greater variability and share the risk of income fluctuations over the business cycle with entrepreneurs. Certainly, increases in international trade slightly reduce wage variability because trade helps channel part of the risk abroad. However, the uncertainty and the risk of contagion from foreign turbulences appear to be stronger forces that explain the more pronounced coefficient of economic growth when the exchange rate is flexible.

3.2. Long-run determinants of changes in real wages

So far, we have explored the contemporaneous link between real wage changes, economic growth, and variations in capital returns. However, these macroeconomic variables tend to be persistent over time. This section analyses whether the relationships found in the short-run regressions remain relevant in the long run. This is done using Autoregressive Distributed Lag (ARDL) models. They are estimated using the one-step version of the GMM estimator developed by Arellano and Bond (1991). This estimator accounts for the fact that changes in profits (*dkret*), changes in trade as a percentage of GDP (*dtrade*), and changes in public spending per capita (*dg_cap*) are endogenous, while the variable representing the economic cycle (*gy*) and the exchange rate regime are predetermined, thereby controlling for this source of bias.

If reverse causality were at play, the models would suffer from heteroskedasticity. The Sargan test dismisses this possibility as it cannot reject the null hypothesis that the over-identifying restrictions are valid. Therefore, the direction of causality assumed in the model is correct.

To select the appropriate number of lags in Equation (2) we use the Schwarz (Bayesian) and AIC criteria. These tests suggest the inclusion of one lag for the dependent variable and none for the independent variables. Hence, the model we estimate is of the form:

$$y_{it} = \beta_0 + \beta_1 y_{i,t-1} + \beta_2 x_t + u_i + e_{it} \tag{2}$$

where the sub-indexes *i* and *t* denote *country* and *year*, respectively. The variable x_{it} is a vector composed of explanatory variables, μ_i is the idiosyncratic effect, and e_{it} is the error term.

Table 3 reports the results of the estimations of Equation (2), using the Arellano and Bond (1991) estimator.

In addition to the Sargan test, the table reports the Arellano-Bond (AB) test for zero autocorrelation in first-differenced errors. The moment conditions are valid only if there is no serial correlation in the idiosyncratic errors. However, the first difference of independently and identically distributed idiosyncratic errors is autocorrelated. Therefore, rejecting the null hypothesis of no serial correlation at order one in the first-differenced errors does not imply that the model is misspecified. Rejecting the null hypothesis at higher orders would imply that the moment conditions are not valid. In our estimations in Table 3, only specification [1] rejects it at 10% (but does not reject it at 5%).

The main conclusion drawn from Table 3 is that all results found in the short-run analysis of Section 3.1 remain true. Therefore, the relationships between changes in wages and our explanatory variables are persistent in the long term. The first lag of the dependent variable is positive and significant, confirming the persistence in the evolution of real wages. The risk-sharing effect identified by the positive coefficient of the interaction term between flex and *gy* is significant, also in the long run. Hence, the estimations confirm that countries with floating exchange rate regimes transmit economic growth (positive or negative) more to wages.[20] This is the case because firms face higher risks from abroad. Consequently, they rely more on within-country risk-sharing compared to a scenario with a fixed exchange rate regime.

Indeed, the evidence in Ahrend et al. (2011) shows how real exchange-rate flexibility, trade openness, openness to long-term

[19] Literature studying the impact of trade openness on wage levels identifies effects of different sign depending on the level of development of the country and on whether one considers the short or the long-run effect (Majid, 2004).

[20] As expected, equivalent regressions with a dummy variable taking value 1 for fixed exchange rate produce consistent negative coefficients for the interaction term with GDP growth, and positive coefficients for the interaction term with capital returns.

Table 3
Arellano-Bond Dynamic panel-data estimation

Variable	[1]	[2]	[3]	[4]	[5]
$gwage_{t-1}$	.193***	.071*	.072**	.194***	.195***
	(.030)	(.038)	(.037)	(.030)	(.030)
dkret	-.832***	-.548***	-.515***	-.833***	-.840***
	(.080)	(.095)	(.091)	(.081)	(.081)
gy	.350***	.162***	.157***	.325***	
	(.049)	(.061)	(.060)	(.055)	
flex	.005**				
	(.002)				
flex*gy	.144**				
	(.062)				
flex*gy*gy_pos					
0,0		.197*	.203*	.109	.441***
		(.119)	(.118)	(.118)	(.099)
0,1					.323***
					(.054)
1,0		-.051	-.076	-.364*	
		(.236)	(.234)	(.214)	
1,1		.172***	.183***	.262***	.581***
		(.055)	(.055)	(.049)	(.056)
dtrade	-.024	-.047**	-.055***		
	(.018)	(.020)	(.018)		
dg_cap	.001**				
	(.0004)				
democ		.005*			
		(.003)			
legis		.012***	.010**		
		(.004)	(.004)		
Sargan test	872.86	637.28	662.91	831.29	830.74
	(.320)	(.278)	(.249)	(.588)	(.564)
AB (1)	-4.43	-1.97	-2.30	- .60	-2.95
(p-value)	(.66)	(.04)	(.02)	(.55)	(.00)
AB (2)	-1.89	.23	.19	-1.71	-1.64
(p-value)	(.06)	(.81)	(.85)	(.10)	(.10)
Obs	864	626	647	864	864

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

capital flows and FDI, and international labour mobility can all contribute to spreading the impact of a negative shock internationally. Risk-spreading mechanisms would be expected to work best in the case of shocks specific to individual countries but may provide only limited help in the case of global crises.

Appendix 2 reports the results for the long-run estimations using overall private market freedom and fiscal policy stance. It also shows the results per wage bargaining system.

4. Implications

From a practical perspective, our findings highlight the intricate relationship between aggregate profit and wage variations. This is particularly relevant for policymakers and labour market stakeholders, as it underscores the potential conflict between the interests of capital owners and workers.

As we discussed, the analysis suggests that the flexibility of the exchange rate regime plays a crucial role in the transmission of economic growth to wages. In countries with floating exchange rates, wages exhibit greater variability, implying that workers bear a significant portion of the risk associated with economic fluctuations. This finding, although not unique in the literature, challenges the traditional view that floating exchange rates protect economies from external shocks and suggests that in practice, such regimes may expose workers to greater economic instability. Therefore, policymakers in countries with flexible exchange rate regimes may need to consider measures to cushion the impact of economic volatility on wages, such as enhancing social safety nets.

Moreover, the findings on the role of labour market rigidities and democratic institutions in wage stability have important implications for labour market reforms. The observation that higher firing costs are associated with greater wage variability suggests that firms may resort to wage adjustments as an alternative to workforce reductions when faced with rigid labour markets. Pereira et al. (2024), Blanchard and Summers (1986), and Bertola (1990) highlighted the connection between institutions, labour, and wages.

In the opposite direction, the stabilising effect of democratic institutions on wages indicates that strengthening democratic governance could contribute to more stable labour markets. This has practical implications for countries undergoing democratic transitions or reforms, where ensuring the protection of workers' rights and wage stability could support broader economic stability. This aligns with Rodrik (1999), although he did not focus on wages.

Our results are also relevant to theoretical literature, specifically regarding the functional distribution of income and the interaction

between macroeconomic variables. They are important for theoretical modelling using capital and labour in a production function.

On the one hand, the negative relationship between profits and wages supports the hypothesis of a conflictual distribution of income, where the gains from economic growth are not evenly shared between capital and labour. This feature has been well captured in models using, for instance, a Cobb-Douglas technology, where the technological parameters referring to capital and labour inputs sum to one.

On the other hand, we find that the distribution of income between capital and labour is not fixed, but rather fluctuates with the business cycle and is influenced by institutional factors. Therefore, some considerations are necessary to bring theory closer to reality when modelling:

a) Variable Income Shares: Traditional production functions, such as the aforementioned Cobb-Douglas, often assume constant income shares for capital and labour. Our results challenge this by showing that shares can vary significantly over the business cycle, influenced by economic conditions and institutional settings. This implies that models should incorporate mechanisms allowing for fluctuating income distribution rather than assuming fixed shares. Many papers support this result for the long-run evolution of input prices, see Acemoglu (2002) and Piketty (2014). For the short-run relationship we encounter, one can check the theoretical paper by Shao and Silos (2014) and Castañeda et al. (1998).
b) Role of Institutions: The impact of labour market institutions on the distribution of income suggests that production functions in macroeconomic models need to account for different institutional scenarios. Factors such as collective bargaining power, labour market flexibility, and legal frameworks should be integrated into models to better reflect real-world dynamics (see, for instance, Blanchard and Giavazzi (2003)).
c) Dynamic Adjustment: Although it complicates modelling considerably, our findings suggest the need to incorporate the dynamic adjustment of wage and profit shares in response to economic shocks. This would involve using production functions that allow for varying elasticity of substitution between capital and labour, as well as models that account for the cyclical nature of income distribution. A relevant paper focusing on the relevance of downward wage rigidities is that of Bartolucci (2012).

Incorporating these findings into macroeconomic models would require a shift from traditional, static production functions to more dynamic, institution-sensitive frameworks. This would better capture the real-world complexity regarding income distribution and provide a more accurate tool for policy analysis and economic forecasting. A few papers have already considered this, however, most of the literature abstracts from these considerations. See, for instance, Antràs (2004) and Bentolila and Saint-Paul (2003).

The findings also contribute to the ongoing debate about the role of exchange rate regimes in economic stability. The finding that floating exchange rates lead to greater wage variability and risk-sharing between firms and workers challenges the conventional wisdom that flexible exchange rates act as a buffer against external shocks. Instead, it suggests that such regimes may exacerbate the transmission of economic volatility to wages. This finding aligns with Dabrowski et al. (2024). A theoretical paper that shows how the exchange rate regime may determine different levels of real variable volatilities is that of Wu and Ran (2011).

4.1. Implications from the long-run results

The identified explanatory variables and the signs of their coefficients in our long-run analysis build upon and reinforce the findings from the short-run analysis.

The persistence of the short-run relationships into the long term suggests that the dynamics observed are not merely transient but have lasting effects. This has important implications for policymakers. The finding that wages remain sensitive to economic growth under floating exchange rate regimes indicates that workers in such economies may experience prolonged periods of income instability due to external economic shocks. This underscores the need to assess the suitability of long-term policy interventions.

Given that firms in countries with flexible exchange rate regimes rely more on domestic risk-sharing mechanisms, it becomes crucial for these countries to develop robust social safety nets and labour protections that can mitigate the adverse effects of economic volatility on workers without preventing firms from accessing this channel to cushion their own risk. Furthermore, the persistence of the risk-sharing effect over the long term suggests that firms will continue to pass on economic risks to workers, especially in environments where labour market institutions make extensive margin adjustment difficult. Additionally, the findings highlight the importance of considering the long-term effects of macroeconomic policies and exchange rate regimes when designing strategies for economic development and wage stabilisation.

Theoretically, the long-run results reinforce the conclusions drawn from the short-run analysis, particularly in the context of the persistent nature of the relationship between wages and the identified variables. The positive and significant coefficient of the lagged dependent variable confirms that wage adjustments are not instantaneous and that there is a degree of inertia in wage changes. This persistence supports theories that emphasise the stickiness of wages and the gradual adjustment of labour markets to economic conditions. The literature has largely explored the importance of wage rigidities. See, for example, Blanchard and Galí (2007) and Faia and Pezone (2024).

In conclusion, our analysis offers practical and theoretical insights into the determinants of wage dynamics and the broader implications of macroeconomic policies for income distribution.

5. Conclusion

This article enhances our understanding of the macroeconomic determinants of changes in country-level average wages. This panel

data analysis of 20 developed countries suggests that the relationship between wages and economic variables is negative, even when controlling for factors describing the economic environment and the business cycle.

The regression models identify the exchange rate regime as a relevant determinant of the extent to which economic growth impacts wages. Specifically, when a country operates under a flexible exchange rate regime, wages absorb a larger portion of changes in GDP over the business cycle, sharing the risk with capital owners. This result may stem from the absence of "automatic" alternative insurance mechanisms, which are typically present in countries that share a common or fully pegged currency. The strength of democracy and the strictness of labour market legislation also play a significant role in wage variations.

The interaction between fiscal stance and exchange rate regimes is crucial in shaping aggregate wage dynamics. In flexible exchange rate regimes, fiscal and monetary policies must be carefully coordinated to manage inflation and wage pressures. In common currency areas like the Eurozone, the inability to adjust nominal exchange rates places greater emphasis on flexible wage-setting institutions and coordinated fiscal policies to manage economic shocks. As highlighted by Carlin (2013) and Sachs (1980), policy coordination and institutional flexibility are necessary to achieve macroeconomic stability and favourable wage outcomes.

National authorities should, therefore, assess both the effective access of economic agents (firms and households) to well-developed credit and insurance markets, which may aid in the intra-temporal transmission of risks, and the establishment of channels to mitigate aggregate macroeconomic risk. This often involves trade-offs. For example, while labour market institutions designed to increase market flexibility may reduce aggregate risk, they could also increase individual risk or job security uncertainty for certain groups of workers.

Finally, as the exchange rate regime plays a crucial role in the transmission of business cycle effects to wages, and given that economies suffer from price rigidities that prevent firms from quickly sharing risks via price adjustments (see Kehoe and Midrigan, 2015), central banks should formulate their monetary policies with consideration of their impact on firms' capacity to absorb shocks and on income distribution.

Databases

Integrated Network for Societal Conflict Research Organization, INSCR (2022) https://www.systemicpeace.org/inscrdata.html

OECD (2023), OECD Economic Outlook No 113 (Edition 2023/1), *OECD Economic Outlook: Statistics and Projections* (database), https://doi.org/10.1787/b27cc3a6-en

OECD (2022), Strictness of employment protection legislation, OECD Employment Database.

World Bank Open Data: https://data.worldbank.org/

CRediT authorship contribution statement

Marta Arespa: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The author has no relevant financial or non-financial interests to disclose.

The author confirms that all data analysed during this study are publicly available on the sources cited in detail on it.

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Appendix 1

This appendix provides a brief description of the key economic and political features of the 20 OECD countries used in the analysis and offers a list of the specific databases for the series used throughout the paper.[21]

Countries

Over the past five decades, the political environment, labour market institutions, and product market freedom of OECD countries have undergone significant transformations. Globalisation, technological advancements, and policy shifts have collectively influenced the economic landscape of these nations. This section provides a brief summary of these changes in the 20 OECD countries used in the empirical analysis: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Interested readers may

[21] It also includes some series that are not included in the final version of the paper but that were explored at different stages.

refer to the third section in Ahn and Hemmings (2000) for a detailed view of OECD country evolution in the framework conditions: macroeconomic policy; finance; trade and competition policy; 'social capital'; and population and health issues.

All countries used in the present analysis belong to the OECD. This implies that they are all developed countries that have worked to establish solid democracies and promote market freedom over recent decades. However, the pace and methods they chose were diverse, leading to global changes impacting their economies in different ways.

A large body of research supports the view that lower product and labour market regulation improves long-run economic performance (see, for instance, Fiori et al. (2012), Bernal-Verdugo et al. (2012), and Botero et al. (2004)). Numerous reports from international organisations analyse the evolution of deregulatory processes at a multicountry level (IMF (2010); OECD's annual reports highlighting developments in structural policies in OECD countries (see, especially, the reports for OECD, 2005; OECD 2012).

For instance, we can observe that Canada, the United States, and the United Kingdom have relatively liberal employment protection legislation, which allows for an easy hiring and firing process. In contrast, France, Germany, Italy, and Spain have traditionally had stricter regulations that provide higher job security at the cost of reduced labour market flexibility.

Countries also differ in the application of active labour market policies to enhance employment and reduce long-term unemployment. Nordic countries are noted for their extensive and successful use of these policy programmes.

Still focusing on labour markets, many OECD countries have experienced a shift from centralised to more decentralised wage-setting mechanisms. Australia, Canada, New Zealand, the United Kingdom, and the United States have moved towards individual wage bargaining, which has led to a decline in union density and collective bargaining coverage. Conversely, Austria, Belgium, Finland, and Sweden have maintained strong collective bargaining systems that cover a large share of the workforce with collective agreements.

Regarding the general level of market freedom, including financial, goods, and labour markets, the aforementioned Fraser Institute index shows large disparities during the 1970s and 1980s that gradually diminished over time (See Fig. 2 Markets freedom by country.

Data source: Fraser Institute. The index takes continuous values from 0 to 10, being 10 the maximum level of Markets flexibility (or freedom). Countries are indicated with the International ISO code.). The second half of the 1990s shows a clear push towards market freedom in all countries, coinciding with the detachment of central banks and, therefore, monetary policies and the control of the banking sector from governments.

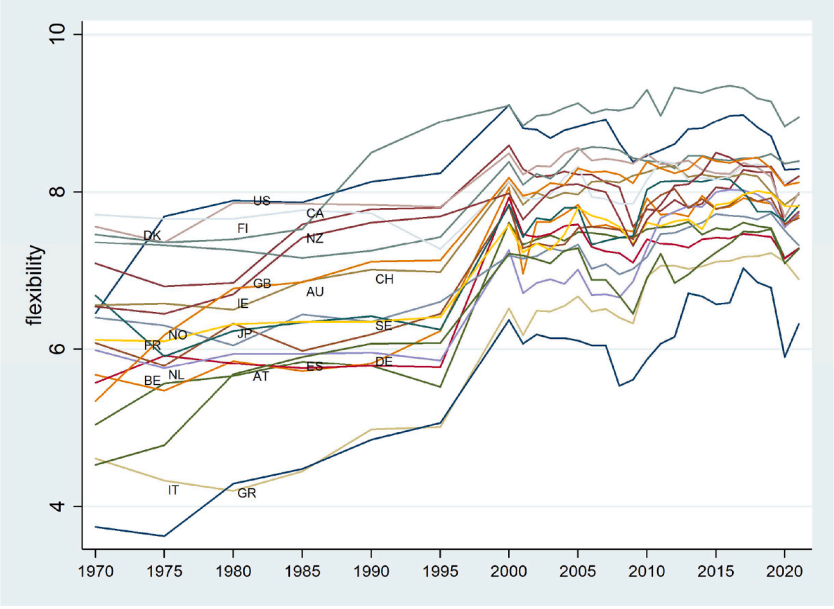

Fig. 2. Markets freedom by country.
Data source: Fraser Institute. The index takes continuous values from 0 to 10, being 10 the maximum level of Markets flexibility (or freedom). Countries are indicated with the International ISO code.

Some countries began accelerating deregulation as early as the 1980s, particularly in telecommunications and energy markets, which had previously been under public sector control. The United Kingdom and the United States were pioneers in this movement, leading to significant increases in competition and efficiency. European countries followed suit, with the European Union playing a crucial role in promoting market liberalisation and reducing barriers to entry across member states. Indeed, the European Union has developed strong antitrust laws and has been instrumental in enforcing them in every member state.

In 1957, six countries—Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany—founded the European Economic Community (EEC) with the aim of building strong economic linkages and, hopefully, removing the chances of a third world war originating in the area. Initially, it encompassed the European Coal and Steel Community and the European Atomic Energy Community. In 1993, with the Maastricht Treaty, the Community, already including 15 countries, was transformed into the European Union (EU). The single market for goods, capital, services, and people within the Union started in 1994.

German reunification in 1990 resulted in the enlargement of the European Community to the East, but it did not involve the accession of a new Member State through negotiations and treaties. It was simply the extension of the Federal Republic of Germany. Within the European Economic Community, trade between East and West Germany was already considered inter-German trade and was not subject to the EEC's common external tariff. The Dublin European Council (28 April 1990) decided that the integration of GDR territory into the Community would be effective as soon as unification had been legally established.[22]

The countries in our analysis include five of the six founders of the EEC, who subsequently became part of the EU. Denmark, Ireland, and the United Kingdom entered the EEC in 1973 and joined the EU from the beginning. However, the United Kingdom retained its own currency when the euro was introduced in the banking system in 1999 (and as legal tender from January 2002) and decided to leave the Union in 2020 after a referendum, thus initiating the Brexit process. Greece joined the EEC in 1981, and Spain and Portugal in 1986, with all three joining the EU when it was created. Austria, Finland, and Sweden joined the EU in 1995; however, the latter never adopted the euro as a currency.[23, 24]

Australia, Canada, Japan, New Zealand, and the United States are outside the influence of the European Union and, consequently, have never entered either of the two economic areas. Norway is also not part of the EU; however, it participates in the European Free Trade Association (EFTA), has bilateral agreements with the EU, and is part of the single market through the European Economic Area (EEA). Finally, Switzerland is also a member of the EFTA.

The period we analyse includes, for some countries, the final years of their dictatorship regimes: Greece (1967-1974), Portugal (1933-1974), and Spain (1939-1975). Each of these countries underwent a process of democratisation and modernisation of their policies at the end of their totalitarian regimes.

References for the data series

OECD

The OECD does not provide series codes in its databases, and their staff confirmed that these were not publicly available. Moreover, at the time of finishing this article, the OECD is migrating its database to its new platform.[25] Following the staff's advice, we detail the name of each sub-database for the series extracted from their website. For the series that have completed migration, where available, we provide the new link to the new platform database.

- Total labour cost (millions). Total Economy. Annual. Unit: level. Dataset: OECD, Unit Labour Costs.
- Total employment (labour force survey basis). All sectors. Annual. Unit: persons. Dataset: OECD, Employment.
- Not-residential capital stock: Kamps (2004), and OECD Table 21 and 22 Annex Economic Outlook (different years).
- Labour legislation strictness (cost and limitations on firing). Dataset: OECD Employment Protection Legislation 2020 edition.
- Unionionism density. Dataset: OECD Strictness of employment protection legislation.
- Productivity growth rate. Dataset: OECD Productivity and unit labour costs https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_PDB@DF_PDB_ULC_Q&df[ag]=OECD.SDD.TPS
- Unemployment rate. Dataset: OECD Employment, unemployment, and participation rates by place of birth and sex, https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_MIG@DF_MIG_NUP_SEX&df[ag]=OECD.ELS.IMD
- Temporality of contracts. Dataset: OECD Employment by permanency of the job – Incidence, https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_TEMP@DF_TEMP_I&df[ag]=OECD.ELS.SAE
- Public expenditure on social welfare for old people, health, family, incapacity and total welfare expenditure (all per capita). Dataset: OECD, Social Expenditure and Welfare State. https://data-explorer.oecd.org/vis?df[ds]=DisseminateFinalDMZ&df[id]=DSD_SOCX_AGG@DF_SOCX_AGG&df[ag]=OECD.ELS.SPD
- Public expenditure, Dataset: OECD Government Final Consumption Expenditure, Annual, Levels, Economic Outlook.
- International trade (International exports in goods and services over GDP (Gross Domestic Product) plus International imports of goods and services over GDP), Dataset: OECD Country statistical profiles.
- Wage bargaining regime, OECD (2019).

IMF

- Primary budget, Dataset: IMF, General government primary net lending/borrowing, https://www.imf.org/external/datamapper/GGXONLB_G01_GDP_PT@FM/ADVEC/FM_EMG/FM_LIDC?year=2024
- Structural balance, Dataset: IMF, General government structural balance.
- Flexibility or freedom of markets, Dataset: Fraser Institute's degree of freedom for private markets (Area 5).

[22] See more details in the Luxembourg Center for Contemporary and Digital History (https://www.cvce.eu/en/collections/unit-content/-/unit/df06517b-babc-451d-baf6-a2d4b19c1c88/03167992-d38d-4f75-90f7-a8b69492bda3).

[23] See the Official Webpage of the European Union for further details: https://european-union.europa.eu/principles-countries-history/history-eu_en.

[24] The first euro countries are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain. Denmark, Sweden and the United Kingdom decide to stay out for the time being.

[25] The data links we registered when dowloading the series from OECD do not work anymore due to the migration.

World Bank

- GDP deflator. Code: NY.GDP.DEFL.ZS. Dataset: World Bank.
- Gross value added at factor cost (current LCU). NY.GDP.FCST.CN. Dataset: World Bank.
- Public expenditure in military activities and equipment (defense), as a proxy for participation in conflicts. Code: MS.MIL.XPND.GD.ZS, Dataset: World Bank.

Other Sources

- Democracy index, Source: Integrated network for Societal Conflict Research Organization, Dataset: Polity5 Annual Time-Series, 1946-2018.
- Exchange rate regime: own calculations using fxtop.com following Shambaugh (2004) http://www.dartmouth.edu/~jshambau/, and Ilzetzki et al. (2019, 2021).

Appendix 2

This appendix provides, first, some robustness checks for our results and, second, the estimations for the short- and long-term models which consider different wage bargaining regimes, the measure of private sector freedom *mktsflex*, and the fiscal stance as explanatory variables.

Robustness checks

In this section, as a robustness check, we repeat the estimation of the regressions analysed in the main text using an alternative classification for the exchange rate regime developed by Ilzetzki et al. (2019), hereafter referred to as IRR.

IRR conducted a detailed analysis of the different exchange rate regimes and reference currencies for 194 countries or economic areas from 1946.[26] They offer both a detailed and a coarse classification for the regimes. The latter is based on five levels of rigidity: code 1 refers to currencies fully pegged to a reference currency or a basket combining several currencies; code 2 refers to narrow bands, where the exchange rate varies less than 2% for 80% of the time in five-year rolling windows; code 3 refers to broad bands and managed floating, with movements below 5%; code 4 implies a fully floating exchange rate; and, finally, code 5 is assigned to the so-called "free falling regime." In the latter case, the currency is experiencing a crisis, accompanied by high levels of inflation. They adjusted the definition of code 4 (fully floating regime) for the data of the 21st century, assuming a currency belongs to code 4 when its volatility is below 5% for 100% of the time included in the rolling window. They did so to capture the general reduction in exchange rate volatility for most advanced countries. Apart from the algorithm we have just summarised, based on the measured volatility of the exchange rates within the rolling windows, IRR also consider the narratives of the different central banks regarding their exchange rate policies to build their 1 to 5 classification.

In the main analysis, we limit the introduction of the exchange rate regime as a dummy variable, taking values of 0 (for rigid exchange rates) or 1 (for flexible exchange rates). Here, we take two alternative approaches: First, we pair IRR code 1 with our pegged exchange rate and all the other codes (from 2 to 5) with our floating exchange rate. This is reflected in the variable *irr*. Second, we use a categorical explanatory variable, taking discrete values from 1 to 5 that coincide with those in IRR. Among the 20 countries we use for the analysis, only Italy in 1993 takes value 5 (free falling). We have repeated the analysis, either discarding this country or substituting code 5 with code 4 for that year. The results do not change qualitatively compared to the case in which we keep code 5.

IRR offer their database at a monthly frequency. However, we conduct an annual analysis. To convert one to the other, we assigned to each calendar year the code most frequently occurring in its twelve months. The exchange rate regime classification is quite stable, and there is no year in which more than one regime change occurs.

Results

Based on the estimations in Table 4, macroeconomic variables explain between 11 and 18 per cent of the changes in country-average wages, but only between 1 and 8 per cent of country-differences in average wages,[27] as indicated by the within and between R^2. The intraclass correlation, ρ, shows that, depending on the regression model, between 5 and 12 per cent of the variance of the dependent variable is caused by differences across countries. In other words, it indicates the fraction of variance due to the individual-specific term, which does not vary over time. The ρ in Model [5] is dramatically larger compared to Models [1] to [4], indicating that 37% of the variance of the dependent variable comes from cross-sectional differences. Compared to Model [4], this model only adds *legis,* the measure of labour market rigidity, as an explanatory variable.

The only coefficient that changes its sign from Table 2 to Table 4 is that for the interaction term between the exchange rate regime and the variation of profits, *irr*dkret*. This term indicates that a marginal increase in profit variation produces more variation in

[26] The updated database for the exchange rate regime classification in IRR is available at Ethan Ilzetzki's webpage, https://www.ilzetzki.com/irr-data (We use the latest available version, from August 2021).

[27] Model [6] is an exception, with a between R-squared of 20%.

average wages when the country is under a flexible exchange rate regime. For Model [5], in which we add the level of labour market rigidity as an explanatory variable, this positive interaction term is larger, in absolute value, than the coefficient for profit variation, *dkret*. In other words, for Model [5], the total effect of profit variation on average wages is positive in countries with floating exchange rates. The total effect of profit changes on average wages in Models [4] and [7] remains negative.

Table 5 reports the estimations for Models [1] to [5] using the first four categories of the coarse classification in IRR. The value 5 for Italy in 1993 has been substituted by a 4. Keeping the 5 or dropping this country from the analysis does not cause any notable change in the results.[28] Note that in Model [1], *irr4* is treated as a continuous variable to capture whether higher values of flexibility generate more or less variability in wages. We acknowledge that this is not the most accurate approach for a categorical variable with only four categories. However, this regression is used purely as a robustness check.[29]

Table 5 provides new insights. In Table 2, we highlighted that GDP growth, *gy*, was more likely to be transferred to wages in floating regimes. Table 5 shows a non-linear pattern of the transfer of economic growth to wages. The coefficient for the interaction term *Irr4*gy* clearly increases when the exchange rate regime moves from a fully pegged currency to a narrow band regime. However, it reduces again when the band increases to 5% (the broad band coded as 3 in IRR). Nevertheless, in Model [3], all the coefficients of this interaction term for codes above 1 are larger than that of the pegged regime. For Model [1], the coefficient for the floating regime is slightly smaller than that of the pegged currency. Consequently, it seems that the initial conclusion from Table 2 is still valid, but it contains a non-linearity that theory should aim to analyse.

Finally, Table 6 reports the estimations for the long-run relationships when irr is the dependent variable. The results are almost identical to those in Table 3. The only significant difference is that the coefficient for *irr*gy* is now not significant. This suggests that, when using the IRR classification method, there is no evidence in the long run that more flexible exchange rate regimes would transmit the business cycle to wages in any stronger manner.

Table 4
Short run fixed effect models with IRR 0,1 explanatory variable.

	AR (1) residuals						Driscoll-Kraay SE					
Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
dkret	-.814***	-.811***	-.849***	-.888***	-.659***	-.877***	-.806***	-.914***	-.795***	-.806***	-.518**	-.867***
	(.088)	(.092)	(.092)	(.092)	(.100)	(.092)	(.253)	(.233)	(.240)	(.236)	(.231)	(.255)
gy		.528***		.356***	.270***	.287***	.323***	.333***	.282**	.268**	.118	.269**
		(.121)		(.059)	(.059)	(.061)	(.117)	(.117)	(.128)	(.129)	(.113)	(.119)
irr	.021***											
	(.005)											
irr*gy 0	.388***		.324***									
	(.060)		(.059)									
1	.464***		.515***	.145**	-.039	.128**	.252***	.214**				.198***
	(.057)		(.057)	(.064)	(.075)	(.065)	(.084)	(.092)				(.067)
irr*gy*gy_pos												
0,0									.245	.236	.241	
									(.177)	(.188)	(.171)	
0,1		-.243*										
		(.142)										
1,0		-.328*							-.166	-.177	-.024	
		(.183)							(.138)	(.141)	(.131)	
1,1		.060							.355***	.361***	.223*	
		(.138)							(.082)	(.083)	(.112)	
irr*dkret				**.590****	**.825****			**.663****				
				(.138)	(.202)			(.314)				
dtrade	-.044**	-.035*		-.042**	-.058***		-.034		-.032			
	(.017)	(.018)		(.017)	(.018)		(.029)		(.026)			
irr*XRvol	-.165											
	(.108)											
dg_cap										.001**		
										(.0005)		

(*continued on next page*)

[28] The command for Driscoll-Kraay SE regressions does not handle categorical variables. Therefore, to include them, one must manually create factor variables (i.e., 0,1 categorical variables) to isolate the effect of each level of exchange rate regime flexibility against the others. The same applies to interaction terms. Since they have not provided any notable insights in the analysis conducted thus far, we have disregarded them in TABLE 5.

[29] Continuous normal theory maximum likelihood applied to regressors that are categorical variables may lead to biased parameter estimates and incorrect standard errors and model test statistics when the number of categories is small (Johnson and Creech, 1983). However, as Rhemtulla et al. (2012) showed, this bias becomes smaller as the number of categories increases, with larger sample sizes, and when category thresholds are (approximately) symmetric. They found that treating categorical explanatory variables as continuous is acceptable when these have five categories or more.

Table 4 (*continued*)

	AR (1) residuals						Driscoll-Kraay SE					
Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
democ		-.001	-.002			.006**					.006**	.006***
		(.001)	(.001)			(.003)					(.002)	(.002)
legis					.016***						.015**	
					(.005)						(.006)	
unions						.0004***						.0004*
						(.0001)						(.0002)
F-test(Prob>F)	20.32	18.97	29.51	25.89	12.90	20.74	6.68	6.75	7.18	7.06	9.09	8.43
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
R^2 within	.145	.142	.128	.134	.111	.120	.160	.169	.176	.177	.099	.153
R^2 between	.011	.007	.025	.032	.080	.199						
Corr(u_i,Xb)	-.409	-.230	-.137	-.102	-.825	-.514						
ρ_ar	.225	.228	.237	.245	.115	.198						
ρ	.123	.082	.063	.057	.373	.104						
Obs	863	830	830	863	647	784	883	883	883	883	646	804

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

Table 5
Short run fixed effect models with 4-category IRR explanatory variable AR(1) residuals.

Variable	[1]	[2]	[3]	[4]	[5]
dkret	-.826***	-.817***	-.856***	-.476***	-.335***
	(.088)	(.092)	(.091)	(.127)	(.129)
gy		.511***		.234***	.152***
		(.121)		(.064)	(.065)
Irr4	.006***				
	(.002)				
Irr4*gy					
1	**.385*** **		**.336*** **		
	(.060)		(.058)		
2	.596***		.651***	.477***	.259**
	(.077)		(.073)	(.082)	(.124)
3	.465***		.475***	.378***	.372***
	(.092)		(.092)	(.112)	(.124)
4	**.357*** **		**.345*** **	-.017	-.020
	(.088)		(.088)	(.104)	(.112)
Irr4*gy*gy_pos					
1,1		-.208			
		(.142)			
2,0		-.228			
		(.248)			
2,1		.200			
		(.150)			
3,0		-.625*			
		(.327)			
3,1		.075			
		(.157)			
4,0		-.213			
		(.256)			
4,1		-.120			
		(.159)			
Irr4*dkret					
2				-.808***	-.490
3				(.185)	(.347)
4				-.887***	-1.06***
				(.198)	(.207)
				.448**	.588**
				(.230)	(.229)
dtrade	-.041**	-.033*		-.031*	-.047***
	(.017)	(.019)		(.017)	(.018)
Irr4*XRvol					
1		.134			
		(.142)			
2		.294**			
		(.136)			
3		-.146			
		(.132)			

(*continued on next page*)

Table 5 (*continued*)

Variable	[1]	[2]	[3]	[4]	[5]
4		-.359*			
		(.185)			
dg_cap					
democ		-.001	-.002		
		(.009)	(.001)		
legis					.012**
					(.005)
F-test(Prob>F)	13.33(.000)	13.11(.000)	21.63(.000)	20.79(.000)	11.73(.000)
R^2 within	.150	.152	.139	.183	.160
R^2 between	.061	.054	.110	.063	.004
Corr(u_i,Xb)	-.216	-.123	-.059	-.183	-.717
ρ_ar	.222	.215	.224	.220	.142
ρ	.077	.059	.049	.062	.299
Obs	863	830	830	863	647

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

Table 6
Arellano-Bond Dynamic panel-data estimation for irr as independent variable.

Variable	[1]	[2]	[3]	[4]	[5]
$gwage_{t-1}$	.186***	.072*	.074**	.193***	.195***
	(.030)	(.038)	(.038)	(.030)	(.030)
dkret	-.761***	-.492***	-.453***	-.740***	-.750***
	(.079)	(.093)	(.089)	(.080)	(.080)
gy	.364***	.135**	.132**	.267***	
	(.053)	(.066)	(.066)	(.061)	
irr	.009***				
	(.003)				
irr*gy	**.077**				
	(.064)				
irr*gy*gy_pos					
0,0		.251*	.252*	.187	.451***
		(.131)	(.130)	(.131)	(.110)
0,1					.278***
					(.061)
1,0		-.001	-.012	-.180	
		(.179)	(.177)	(.163)	
1,1		.200**	.201**	.292***	.554***
		(.080)	(.079)	(.063)	(.057)
dtrade	-.028	-.048**	-.057***		
	(.018)	(.020)	(.018)		
dg_cap	.001**				
	(.0005)				
democ		.006**			
		(.003)			
legis		.013***	.010**		
		(.004)	(.004)		
Sargan test	876.47	636.64	662.69	844.86	837.65
	(.281)	(.284)	(.250)	(.437)	(.477)
AB(1)	-3.15	-2.01	-2.64	-1.09	-1.38
(p-value)	(.002)	(.04)	(.01)	(.27)	(.17)
AB(2)	1.18	-1.44	1.06	-2.22	-1.35
(p-value)	(.24)	(.15)	(.29)	(.03)	(.18)
Obs	862	626	647	862	862

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

Estimations considering the wage bargaining regime

The exchange rate regime uses the classification method in Shambaugh (2004). Tables 7–9 present estimations for sub-groups of observations classified by the bargaining regime, allowing us to compare the results with the estimates for the full database [all].[30] Table 10, includes the continuous variable *barg* to capture the effect of different levels of rigidity in wage bargaining.

As expected, when wage bargaining is more centralised and rigid, profit changes are less transmitted to wages (i.e., the size of the

[30] The bargaining regime 1 is only included in the estimations when the model happens to be overall valid, at least, at the 10% level.

negative coefficient is larger in models [barg2] and [barg3] compared to the full database estimation). The interaction term between the exchange rate regime and economic growth indicates, as in the previous tables, greater transmission of the business cycle under the floating exchange rate. This holds true both in the full database and with the most rigid bargaining system. However, this is not the case when we examine the partially rigid bargaining system, *barg2*. A post-estimation Wald test for the equality of the two coefficients of the interaction term rejects the null hypothesis, i.e., they are statistically different. However, we must be cautious about this discordant result, as this sub-group of observations is much smaller than the others. Models [2] seem to confirm that negative economic performance is less channelled to wages when the exchange rate is flexible, as we had previously found.

The results show that the discretionary policy carried out by the fiscal authority is relevant to explaining average wage dynamics. A first glance at the estimations seems to indicate that larger and positive changes in the structural balance leave economies with less dynamic wages (the coefficient is negative). That is, when governments take steps to increase their savings or reduce their deficits (with tighter fiscal policies, once these policies have been adjusted to the business cycle phase), wage variations are milder.[31] We reach the same conclusion when we use changes in the primary budget (see Model 4 in Table 7 and Model 3 in Table 8). The interaction term between the fiscal stance and the exchange rate regime is only significant when we use the structural balance over potential GDP to measure the fiscal stance, and it is not significant when we use the primary budget.[32]

To better understand the connection, Table 11 provides estimates for models that only include the main regressors of our analysis. Models [3] and [4] mimic Models [1] and [2] but substitute the dummy variable *flex* the opposite dummy, *rigid*, which takes a value of 1 for fixed exchange rates.

Notice that in the estimates that include the variable *rigid,* changes in the structural balance are not significant when considered in isolation. Nevertheless, their interaction with the dummy variable is significant and takes a negative sign. This suggests that only when the exchange rate is fixed does discretionary fiscal policy play a role in wage dynamics, reducing their variability when this measure of the public stance is tighter.

In contrast, the primary balance yields consistent results across regimes: the variable is negative and significant when considered in isolation, and its interaction term with the exchange rate regime is not significant regardless of which regime-dummy is used.

Therefore, the conclusion we can draw is that efforts to improve public balances provide stability to the economy and, consequently, to wage dynamics. To the best of my knowledge, there are no specific analyses on the role of fiscal restraint on real wage volatility. However, the existing literature highlights the effects of public spending moderation on macroeconomic stability, which includes real wage stability. Our result aligns with this evidence. For instance, Reuter et al. (2022) find that the requirement of fiscal rules reduces fiscal volatility and, consequently, contributes to macroeconomic stability. They show that their result only holds for rules designed to be unaffected by the business cycle, i.e., budget balance rules that set ceilings in cyclically adjusted terms.

Table 7
Short run fixed effect models with AR(1) residuals.

	[1]			[2]			[3]	[4]
Variable	[all]	[barg2]	[barg3]	[all]	[barg2]	[barg3]	[all]	[all]
dkret	-.776***	-1.069***	-1.100***	-.853***	-1.147***	-1.160***	-.388***	-.860***
	(.093)	(.201)	(.167)	(.095)	(.197)	(.164)	(.072)	(.112)
gy				.415***	.587**	.488***		.399***
				(.091)	(.250)	(.150)		(.061)
flex							.018***	
							(.005)	
flex*gy 0	.312***	.578***	.383***					
	(.053)	(.150)	(.095)					
1	.427***	.558***	.434***					.277**
	(.078)	(.164)	(.114)					(.113)
flex*gy*gy_pos 0,0								
0,1				-.107	.062	-.086		
				(.113)	(.292)	(.198)		
1,0				-.557**	-.686*	-.639**		
				(.220)	(.416)	(.306)		
1,1				.122	.170	.081		
				(.122)	(.303)	(.197)		
flex*dkret								-.005
								(.235)
dtrade	-.042**	-.074	-.006	-.029	-.064	-.019	-.018	-.036**
	(.018)	(.049)	(.027)	(.083)	(.048)	(.025)	(.018)	(.018)

(*continued on next page*)

[31] This result is in line with the existent literature, which sustains that pro-cyclical fiscal policy is suitable to stabilize the economy, given that buffer building is guaranteed during good times and that governments work to fiscal contention, once the policy is adjusted for the current business cycle phase. See, for instance, IMF (2015), and Furceri and Jalles (2018).

[32] Remember that the first of these measures is cleaned from the effects of the business cycle on the public balance and uses, as a reference, the potential GDP, which is defined as '*an estimate of the level of GDP that would prevail if the economy were working at full capacity*' in the OECD glossary.

Table 7 (*continued*)

	[1]			[2]			[3]	[4]
Variable	[all]	[barg2]	[barg3]	[all]	[barg2]	[barg3]	[all]	[all]
flex*XRvol	-.081	-000	-.023				-.414**	
	(.110)	(.268)	(.160)				(.167)	
dstrbalance	-.284***	-.139	-.414***	-.299***	-.124	-.404***	-.264***	
	(.074)	(.202)	(.107)	(.075)	(.198)	(.104)	(.077)	
flex*dstrbalance	.313**	-.007	.512***	.322***	-.014	.528***	.319**	
	(.121)	(.259)	(.169)	(.120)	(.253)	(.167)	(.124)	
dprimary								-.235***
								(.043)
flex*dprimary								-.326**
								(.152)
democ				.006**	——-	.007*		
				(.003)		(.003)		
mktsflex								.001
								(.002)
F-test	12.74(.000)	4.87(.000)	8.52(.000)	13.68(.000)	5.87(.000)	8.93(.000)	8.84(.000)	15.68(.000)
R^2 within	.157	.260	.238	.189	.297	.270	.102	.248
R^2 between	.065	.176	.051	.123	.133	.097	.029	.132
Corr(u_i, Xb)	-.123	-.200	-.115	-.104	-.280	-.115	-.034	-.274
ρ_ar	.157	.137	.198	.162	.200	.173	.155	.197
ρ	.100	.055	.309	.092	.081	.311	.086	.098
Obs/countries	575/20	125/6	241/15	557/20	125/6	241/15	575/20	409/20

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets. —- indicates a variable has been omitted in the estimation because there were not sufficient observations with value variation in the series.

Table 8
Short run fixed effect models with Driscoll-Kraay SE.

	[1]				[2]			[3]
Variable	[all]	[barg1]	[barg2]	[barg3]	[all]	[barg2]	[barg3]	[all]
dkret	-.754***	-.353*	-1.047***	-.702	-.768***	-1.10***	-.701	-.793***
	(.196)	(.184)	(.334)	(.458)	(.192)	(.355)	(.456)	(.188)
gy	.318***	.068	.483**	.282	.305***	.461**	.284	.402***
	(.083)	(.065)	(.209)	(.171)	(.077)	(.158)	(.165)	(.095)
flex								
flex*gy 0								.166
								(.135)
1	.025	.620***	.022	.105				
	(.114)	(.185)	(.204)	(.157)				
flex*gy*gy_pos 0,0								
0,1								
1,0					-.276*	-.437	——-	
					(.143)	(.283)		
1,1					.060	.180	.106	
					(.153)	(.271)	(.155)	
flex*dkret								-.057
								(.179)
dtrade	-.033	-.008	-.041	.003				-.034
	(.028)	(.063)	(.050)	(.024)				(.026)
flex*XRvol								
dstrbalance	-.372***	-.033	-.177	-.459***	-.398***	-.235	-.457***	
	(.076)	(.196)	(.121)	(.129)	(.065)	(.157)	(.122)	
flex*dstrbalance	.128	-.551**	-.097	.722***	.178	.079	.720***	
	(.187)	(.217)	(.385)	(.197)	(.177)	(.303)	(.195)	
dprimary								-.271***
								(.051)
flex*dprimary								-.164
								(.147)
democ								
mktsflex	-.005**	.000	-.003	-.007**	-.005*	-.003	-.007**	-.004**
	(.002)	(.007)	(.005)	(.003)	(.003)	(.005)	(.003)	(.002)
F-test	27.08(.000)	4.18(.001)	5.24(.003)	15.84(.000)	16.20(.000)	6.58(.001)	16.54(.000)	49.20(.000)
R^2 within	.193	.076	.224	.277	.188	.232	.277	.258
Obs/countries	421/20	109/8	97/6	141/15	421/20	97/6	141/15	429/20

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

Table 9
Arellano-Bond Dynamic panel-data estimation for fiscal stance among the independent variables.

Variable	[1]			[2]	[3]	[4]
	[all]	[barg2]	[barg3]	[all]	[all]	[all]
$gwage_{t-1}$	.051	-.069	.052	.106**	.056	.086*
	(.035)	(.056)	(.060)	(.048)	(.035)	(.046)
dkret	-.775***	-1.31***	-1.10***	-.770***	-.774***	-.804***
	(.086)	(.151)	(.153)	(.105)	(.086)	(.104)
gy	.308***	.532***	.420***	.302***		
	(.047)	(.111)	(.084)	(.055)		
flex	.006***	.008*	.007*	-.001		
	(.002)	(.005)	(.003)	(.006)		
flex*gy	.097	.116	.038	.049		
	(.075)	(155)	(.106)	(.161)		
flex*gy*gy_pos						
0,0					.362***	.381***
					(.085)	(.089)
0,1					.274***	.299***
					(.058)	(.069)
1,0						
1,1					.561***	.471***
					(.072)	(.179)
dstrbalance	-.361***	-.307*	-.450***		-.359***	-.374***
	(.070)	(.178)	(.102)		(.070)	(.070)
flex*dstrbalance	.316***	.321	.411***		.330***	-.307
	(.114)	(.229)	(.155)		(.113)	(.277)
mktsflex				-.011***		-.009**
				(.004)		(.004)
Sargan test	620.66	146.16	268.18	395.24	620.93	382.68
	(.062)	(.067)	(.068)	(.149)	(.061)	(.229)
AB(1)	-1.50	-.714	-.339	-3.45	-1.59	-1.91
(p-value)	(.133)	(.476)	(.734)	(.001)	(.113)	(.057)
AB(2)	-1.03	-1.36	-.770	1.88	-1.25	.499
(p-value)	(.303)	(.174)	(.441)	(.060)	(.211)	(.618)
Obs/countries	575/20	129/6	242/15	373/20	575/20	371/20

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

Table 10
Short and long run estimations with wage bargaining regime as explanatory variable.

Variable	AR(1) residuals			Driscoll-Kraay SE			Arellano-Bond
	[1]	[2]	[3]	[1]	[2]	[3]	[1]
$gwage_{t-1}$							.043
							(.037)
dkret	-.897***	-.900***	-.831***	-.828***	-.883***	-.619**	-.881***
	(.102)	(.102)	(.112)	(.250)	(.239)	(.247)	(.094)
Gy		.421***	.355***	.318***	.340***	.298***	.342***
		(.094)	(.055)	(.085)	(.083)	(.104)	(0.50)
Flex	.016**						.005**
	(.006)						(.002)
flex*gy 0	**.344****				-.355***		
1	**(.056)**		.239***	.170***	(.103)	.336***	.071
	.316**		(.066)	(.059)	.222***	(.089)	(.077)
	(.085)				(.070)		
flex*dkret			-.356**			-.502**	
			(.165)			(.248)	
dtrade	-.013	-.017		-.020		.010	
	(.021)	(.020)		(.023)		(.030)	
flex*XRvol	-.386**						
	(.168)						
dstrbalance	-.303***	-.305***		-.358***	-.376***		-.365***
	(.081)	(.078)		(.073)	(.074)		(.075)
flex*dstrbalance	.282**	.326***		.277**	.322**		.294**
	(.127)	(.124)		(.136)	(.126)		(.118)
dprimary			-.201***			-.255***	
			(.042)			(.054)	
flex*dprimary			-.043			-.030	
			(.074)			(.120)	

(*continued on next page*)

Table 10 (*continued*)

Variable	AR(1) residuals			Driscoll-Kraay SE			Arellano-Bond
	[1]	[2]	[3]	[1]	[2]	[3]	[1]
Barg	.003**	.003**	.003***	.003**	.003**	.001	
	(.001)	(.001)	(.001)	(.002)	(.002)	(.002)	
Democ		.008**					
		(.004)					
Sargan test							539.78(.071)
AB(1) (p-value)							-1.15 (.251)
AB(2) (p-value)							-1.36 (.173)
F-test	11.65	12.28	20.66	26.36	30.98	50.01	
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	
R^2 within	.198	.207	.240	.189	.198	.211	
R^2 between	.001	.003	.005				
Corr(u_i, Xb)	-.211	-.191	-.225				
ρ_ar	.155	.145	.225				
P	.131	.128	.116				
Obs/countries	501/20	501/20	551/20	521/20	521/20	571/20	501/20

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

Table 11
Short run estimations focusing on the role of the fiscal stance.

Variable	AR(1) residuals				Driscoll-Kraay SE			
	[1]	[2]	[3]	[4]	[1]	[2]	[3]	[4]
Flex	.007***	.008***			.009***	.010***		
	(.002)	(.002)			(.002)	(.002)		
Rigid			-.007***	-.008***			-.009***	-.010***
			(.002)	(.002)			(.002)	(.002)
Dkret	-.821***	-.890***	-.821***	-.890***	-.771***	-.739***	-.771***	-.738***
	(.092)	(.085)	(.092)	(.085)	(.178)	(.129)	(.178)	(.129)
Growth	.320***	.411***	.320***	.411***	.332***	.391***	.332***	.391***
	(.048)	(.047)	(.048)	(.047)	(.075)	(.066)	(.075)	(.066)
Dstrbalance	**-.314****		.044		**-.371****		-.032	
	(.072)		(.093)		(.079)		(.123)	
flex*dstrbalance	**.357****				**.339****			
	(.002)				(.126)			
rigid*dstrbalance			**-.357****				**-.338****	
			(.002)				(.126)	
Dprimary		**-.231****		**-.201****		**-.284****		**-.223****
		(.040)		(.057)		(.048)		(.078)
flex*dprimary		.030				.062		
		(.068)				(.086)		
rigid*dprimary				-.030				-.062
				(.068)				(.086)
F-test	20.34	30.58	20.34	30.58	25.42	56.05	25.42	56.05
	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)	(.000)
R^2 within	.156	.203	.156	.203	.161	.187	.161	.187
R^2 between	.076	.038	.076	.038				
Corr(u_i, Xb)	-.140	-.191	-.140	-.191				
ρ_ar	.157	.211	.158	.211				
P	.101	.110	.101	.110				
Obs/countries	575/20	625/20	575/20	625/20	595/20	645/20	595/20	645/20

Notes: The dependent variable is year-to-year percentage increase in real total labour compensation per worker (gwage). *, **, *** denote significance levels at the 10%, 5% and 1% respectively. Standard errors are within brackets.

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