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Female Labor Supply in Latin America and the Business Cycle: Instability and Asymmetry

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ABSTRACT

This study measures the responsiveness of female labor supply at the extensive margin to business cycle changes in Latin America. The results provide new evidence on the stability and cyclical asymmetry of the traditional added and discouraged worker effects (i.e., AWE and DWE, respectively). It is shown that these effects are not stable and react differently to business cycle variations and even strengthen from a certain threshold. The estimated cross-country and through-time differences in the AWE and DWE, and in their counterparts in the expansionary cyclical phases, that is, the subtracted and encouraged worker effects (i.e., SWE and EWE, respectively) have direct implications for the design of economic policies, particularly those aiming at reducing gender differences in labor force participation in a region in which female workers are still underrepresented.

JEL Classification: E24, C10, J64, J68

1 | Introduction

The cyclical behavior of labor force participation (LFP) is a widely researched topic in the field of labor economics, which has recently gained relevance due to the increasing integration of women into the global labor market. In Latin America, in the 1990s, approximately 40% of working-age women were in the labor force. In the last 20 years, this proportion has increased by just over 10 percentage points (p.p.) to 52%. This trend has been observed in most Latin American countries, although with variations in intensity. However, while more than half of working-age women are participating in the labor market, this trend has shown less dynamism since the 2010s, which could anticipate possible distortions in the face of changes in the region's economic cycle.

Some studies have focused on how unemployment affects LFP across economic cycles, identifying the Discouraged Worker Effect (DWE) and its counterpart Encouraged Worker Effect (EWE) hypotheses for procyclical LFP and the Added Worker Effect (AWE) together with the Subtracted Worker Effect (SWE) for countercyclical LFP[1]. The literature indicates that if DWE/EWE prevails over AWE/SWE, LFP exhibits a procyclical pattern, pointing out the necessity for accurate assessments to inform policy decisions. Although research in developed countries presents varied outcomes for women, evidence from Latin America, albeit scarce, suggests a tendency toward the countercyclical influence of AWE and SWE, underlining the complex interplay of labor market behavior and the importance of developing context-specific economic policies.

This research aims to measure the responsiveness of female labor supply at the extensive margin (i.e., labor participation) to changes in male unemployment rates (which are the cyclical indicators of the labor market used in this research) in Latin

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America. It is worth pointing out, though, that the most significant contribution of this study lies in exploring the stability and symmetry of these effects throughout the analysis, which have not been studied for Latin America to the best of our knowledge.

This study is based on a time series analysis for six selected Latin American countries from 2006 to 2019, with quarterly frequency. As mentioned, the AWE and DWE (along with their counterparts SWE and EWE) are investigated. The findings show that the reaction of the female LFP in several countries is not stable over time and is not symmetric either. We observe both procyclical and countercyclical reactions in the study period (depending on the country), which even intensify above a certain threshold.

Despite significant progress in female LFP in Latin America, a marked disparity persists compared to male participation rates, which have historically remained above 90% in the region's labor force. If the objective of those responsible for economic policy is to reduce the gender gap in the labor supply, it is essential to know how the female labor supply behaves in the different stages of the business cycle. As highlighted by Pagán (2002), the efficient allocation of labor resources serves as a key policy instrument for reducing poverty in developing countries. Thus, our estimates allow policymakers to be guided to implement the necessary measures (expansive or contractionary), at the appropriate time (expansion or recession), and with the intensity required to achieve this goal.

2 | Background

Analyzing the dynamics of labor supply throughout the business cycle is crucial for policymakers, as it provides insights into how labor markets respond to different economic conditions. Specifically, the literature has focused on two major hypotheses: the AWE and the DWE, as well as their opposing effects, the EWE and the SWE.

Seminal studies such as Woytinsky (1940) introduced the concept of AWE as a dynamic in which individuals enter the labor market to compensate for the loss of household income when the head of the household loses employment. In contrast, when there is a positive shock in the economic cycle, what has been dubbed SWE occurs. According to Evans (2018), this effect reflects the same behavioral pattern as the AWE, simply operating in the expansive phase of the business cycle.

The DWE, for its part, is primarily associated with workers who become discouraged from job searching when employment opportunities are scarce, as described by Long (1953, 1958). However, during expansionary periods, when the likelihood of finding a job improves, the opposite effect occurs, which, according to Congregado et al. (2014), is labeled in the literature as the EWE.

Understanding the interaction among these effects is crucial for analyzing labor market dynamics. For instance, Martín-Román et al. (2020) and Martín-Román (2022) suggest that if the DWE and EWE prevail over the AWE and SWE, respectively, labor force participation tends to exhibit a procyclical pattern, increasing during economic growth and decreasing during recessions. Conversely, if the AWE and SWE dominate, labor participation becomes countercyclical.

Although these alternative terminologies (i.e., EWE and SWE) are not as extensively discussed in the traditional literature compared to the AWE and DWE, they represent an extension of existing behavioral hypotheses in the opposite phases of the business cycle. The EWE captures the tendency of labor force participation to increase as economic conditions improve, while the SWE reflects a reduction in the participation rate when the economy is booming. Clarifying these distinctions provides a more nuanced understanding of how labor markets respond to both positive and negative economic shocks, highlighting the importance of considering these different effects when designing policies to enhance the labor market.

Since the early 2000s, research on the AWE/SWE and DWE/EWE has intensified. Although these phenomena have been primarily analyzed in developed countries, there is still no consensus on which effect predominates. In Latin America, efforts to delve deeper into these patterns have been concentrated in a few countries (formally, around 7 out of 23), creating a gap in regional understanding, particularly regarding the cyclical behavior of female labor force participation (LFP). Formal evidence on this topic remains limited, especially when compared to data from the Organisation for Economic Co-operation and Development (OECD) countries.

However, Lee and Parasnis (2014) argue that the AWE predominates in developing countries, indicating, as noted by Lassassi and Tansel (2022), that the female LFP rate behaves countercyclically. In line with this perspective, Serrano et al. (2019) found evidence of a countercyclical pattern in female LFP using a panel data approach for 18 Latin American economies, particularly among married, childbearing, and vulnerable women. This analysis also revealed an effect opposite to the AWE (SWE) during expansionary phases, as female LFP decreased during the study period (1987–2014).

In countries such as Brazil, these effects have been most extensively studied. De Oliveira et al. (2014), Fernandes and De Felício (2005), and Maridueña-Larrea and Martín-Román (2024) confirmed a countercyclical behavior of female LFP, thereby identifying an AWE/SWE for that country. While Gonzaga and Reis (2011) lean toward this consensus, they clarify that an AWE/SWE exists only when explaining LFP with unemployed husbands. However, if the impact of changes in wages is considered, a DWE/EWE is confirmed, and in this case, LFP exhibits a procyclical dynamic in Brazil.

Researchers have also examined female LFP during recessions and economic expansions in Argentina. Cerrutti (2000) confirmed a countercyclical reaction and validated the AWE during recessions, as did Martinoty (2015). However, Paz (2009) demonstrated that during expansions, Argentine women are encouraged to participate in the labor market, highlighting a procyclical pattern in the LFP rate. Moreover, Groisman (2011) indicated that the factors that limit or hinder the female population's access to better-quality jobs in Argentina still seem to persist.

In Mexico, a countercyclical relationship of female LFP rate during recessions is observed; Hernández and Romano (2011) and Parker and Skoufias (2004) validate the AWE in the Mexican economy. Parker and Skoufias (2004) also conclude that in expansionary phases of the economic cycle, the LFP rate of Mexican women is procyclical, thus validating the hypothesis of the EWE.

In Colombia, Ecuador, Chile, and Uruguay, a countercyclical response in female labor force participation (LFP) has also been observed. This has been documented by Cardona-Sosa et al. (2018) for Colombia, Ontaneda Jiménez et al. (2022) for Ecuador, and Maridueña-Larrea and Martín-Román (2024) for Chile and Uruguay. Given these cases, the presence of AWE/SWE appears to be more pronounced in the region.

For developed countries, there is a mixed dynamic in the cyclical behavior of the female LFP. While Lee and Parasnis (2014) and Paternesi Meloni (2024) suggest that the DWE predominates in OECD countries, meaning that LFP reacts procyclically, authors such as Başlevent and Onaran (2003), Congregado et al. (2014) and Gałecka-Burdziak and Pater (2016) have revealed countercyclical effects in Turkey, Spain, and Poland (in that order), supporting the female AWE in those economies.

However, in the case of Poland, Congregado et al. (2021a) clarify that there is an AWE when there is a negative wage income shock (resulting in a countercyclical effect on LFP), while the DWE occurs when there is a positive job search time shock (resulting in a procyclical LFP). Specifically, they show that the AWE is stronger but transitory, whereas the DWE is weaker but longer lasting in that country.

Bredtmann et al. (2018) substantiated the AWE at both the extensive and intensive margin for all 28 EU countries. Women whose husbands became unemployed reflected a significantly higher probability of entering the labor market, indicating countercyclical behavior in the female LFP rate. These findings align with those of Cammeraat et al. (2023) and Mankart and Oikonomou (2016), who confirmed an AWE for the Netherlands and the United States, respectively. However, this result differs from that reported by Lee and Cho (2005), who showed a procyclical relationship and a DWE for women in South Korea. In turn, Martín-Román and de Blas (2002) noted that the female LFP rate in France responds countercyclically. Conversely, Darby et al. (2001) established that female LFP reacts procyclically in France, the United States, Japan, and Sweden. In the former case, the AWE is supported, while in the latter, evidence lends support to the DWE.

For the Spanish economy, Addabbo et al. (2015) indicated that female LFP reacts countercyclically, pointing to the AWE. Nevertheless, Martín-Román and de Blas (2002) suggested procyclical behavior supporting the DWE. Although the results for Spain do not align due to differences in the study periods, both scholarly works have contributed to identifying the DWE in various European contexts: Addabbo et al. (2015) for Italy, whereas Martín-Román and de Blas (2002) extended the analysis to include Germany and the United Kingdom. Furthermore, Fuchs and Weber (2017) corroborated the DWE in Germany, reinforcing the evidence of procyclical female LFP trends in these countries.

In congruence with Gałecka-Burdziak and Pater (2016) for Poland, Congregado et al. (2020) substantiated that the female LFP rate in the Polish economy is countercyclical during periods of crisis, indicating an AWE. Conversely, Evans (2018) supported the DWE in recessions for Australia, arguing that the female participation rate responds procyclically. The author also analyzed periods of economic expansion in Australia, finding procyclical dynamics in the LFP rate. Consequently, during this phase of the economic cycle, Australian women echo the EWE. Congregado et al. (2020) revealed countercyclical behavior in times of economic boom, suggesting a SWE. This implies that when the opportunities for the head of the household to find work rise, women cease working and return to the daily activities of the family unit.

As described previously, the literature on this topic primarily focuses on developed countries, despite mixed results on the cyclical reaction of female LFP. Research on developing countries in Latin America has primarily focused on Brazil and Argentina, with less attention given to Ecuador, Mexico, Chile, Uruguay, and Colombia. It is important to note that in some of these studies only certain phases of the business cycle are analyzed, not all of them together (expansionary and recessionary).

To address these effects in more depth, we propose to test the following hypotheses:

Hypothesis 1. *The effects of the business cycle on female LFP rates in Latin America over the period of analysis are not stable.*

Hypothesis 2. *The effects of the business cycle on female LFP rates are not symmetric across countries in the presence of exogenous switching regimes.*

Hypothesis 3. *The thresholds delimiting the endogenous switching regimes differ across countries.*

This research offers new insights that enable a better understanding of the performance of female LFP in Latin American labor markets. The findings are unprecedented, as there is no research in the region that jointly addresses both the stability and symmetry of the female LFP rate. Moreover, it has not yet been determined at what point the effects of AWE and DWE (or, conversely, SWE and EWE) labor may intensify. This could allow policymakers to react more effectively to changes in the business cycle and minimize possible welfare distortions.

As a summary of the previously discussed literature review, Table A1, located in Appendix A, presents the studies that have examined the cyclical behavior of female LFP on a global scale since 2000. Among these studies, those focusing on Latin America include Argentina, Mexico, Brazil, Chile, Colombia, Uruguay, and Ecuador. The remainder summarizes the evidence found for developed countries, such as the United States, France, Japan, Sweden, Germany, the United Kingdom, Turkey, the Republic of Korea, Spain, Italy, Poland, the Netherlands, and Australia. Each study is classified by author, data used, the country of analysis, the econometric approach applied, and the cyclical reaction of the female LFP rate.

3 | Data

3.1 | Descriptive Analysis

Time series data for the period between 2006 and 2019, with a quarterly frequency, were obtained from the database of the CEDLAS (2022) at the National University of La Plata, Argentina[2]. These include the following.[3]

$$\text{Female labor force participation rate (FLFPR)} = \frac{\text{Female labor force}}{\text{Female working age population}}$$

$$\text{Male unemployment rate (MUR)} = \frac{\text{Male unemployed population}}{\text{Male labor force}}$$

Table 1 presents the selected countries and the periods of analysis, according to the available information provided by CEDLAS (2022). In addition, the number of recessions or expansions detected throughout the cycles under analysis for each country is included. Due to the close correlations between the labor market and economic cycles present in Okun's Law and estimated by Porras-Arena and Martín-Román (2023), a recession cycle is assumed when the male unemployment rate increases and an economic expansion cycle when it decreases[4]. The use of the MUR as a cyclical indicator is based on the fact that men have historically shown higher and more consistent labor participation rates compared to women. Therefore, given its representativeness, we believe it will accurately capture fluctuations in the business cycle.

A sample of six countries from a group of 13, which are part of the Latin American labor market data report published by CEDLAS (2022) is selected, as data series without methodological changes in household surveys during the period of analysis are consistently available for these countries. For the remaining countries, the data series are brief and contain data gaps.

To provide a general overview of the evolution of these variables, Figure 1 presents the series in levels and the first variations. The latter case is based on an inter-annual comparison of the same quarter to avoid the results losing consistency due to possible seasonality issues. Notably, although there is a certain degree of volatility between periods, Latin American women engaged in higher LFP from 2006 to 2019, with an average maximum level of approximately 68%, up from 60% (+8 p.p.).

In Peru, the FLFPR increased by 9 p.p. between 2006 and 2019 (66% versus 75%), while in Mexico, the increase is around 4 p.p. on average, reaching a participation rate of 55% in 2019. In the Ecuadorian case, certain peaks and troughs are observed over the analysis period, with the rate reaching its lowest point at the end of 2013, dropping from 67% at the beginning of 2010 to 60%; however, by 2019, it had risen to around 66%, which was 6 p.p. higher than 2013. Chile started with a FLFPR of 48% in 2006 and reached 62% in 2013 (+14 p.p.), despite the mixed trends during the review period. However, this growth rate slowed down in the following 7 years, placing Chilean women's LFP rate at around 64% until 2019 (marginal increase of +2 p.p.). In Uruguay and Colombia, the rate increased by 6 p.p. up to 2012, reaching 76% and 69%, respectively, following a similar trend. This indicator, though, remained at a 75% average for Uruguay and 69% for Colombia from 2012 onwards.

In some cases, the higher FLFPR occurred in the context of rising MUR for several economies in the region, which is the case for Ecuador, Mexico, and Peru. This dynamic could signify a possible AWE of women in these economies. Given the loss of employment for men as heads of households, female homemakers could join the economically active population to compensate for the loss of family income.

In Ecuador, the MUR among men reached peak levels ranging between 3% and 4% at the end of 2019, compared to the 2% recorded at the end of 2011. In some periods between 2009 and 2019, Mexico reflected a loss of jobs for males; for example, between 2012 and 2013 (from 3% to 4%), as well as between 2018 and 2019 (from 2% to 3%). Peru performed similarly, with relatively high unemployment rates of around 5% between 2006 and 2010, while between 2011 and 2019, the rate increased from 2% to 4% on average. In Chile, Colombia, and Uruguay, the MUR exhibited a pattern similar to that of previously mentioned countries, showing an overall increase across most periods of analysis. The context of stagnant female LFP for these countries from 2015 onward suggests that, given the difficulty faced by

TABLE 1 | Selected economies and periods of analysis.

Country	Period	Observations	Recessions	Expansions
Chile	2006T1:2019T4	56	31	25
Colombia	2009T3:2018T4	38	14	24
Ecuador	2010T1:2019T4	40	18	22
Mexico	2009T3:2019T4	42	12	30
Peru	2006T1:2019T4	56	24	32
Uruguay	2007T1:2019 T4	52	26	26

Source: CEDLAS (2022).

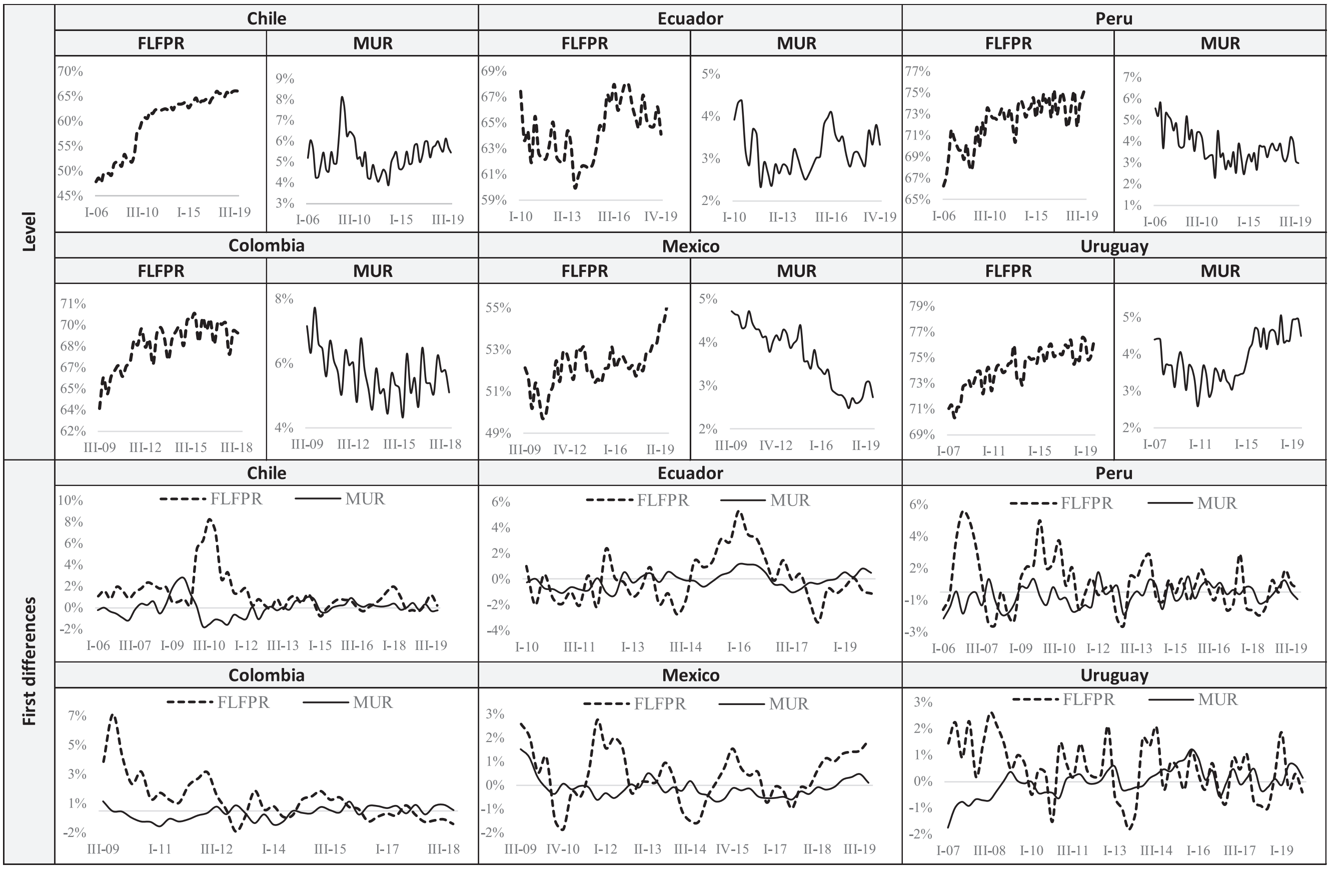

FIGURE 1 | Labor force participation and unemployment rates in selected economies.
Source: CEDLAS (2022) Own elaboration.

household heads in finding employment, women were discouraged from seeking work. This trend evolution suggests a possible DWE among women in these economies.

Figure 2 illustrates the correlation between changes in FLFPR and the MUR across the six countries studied, providing an initial approach to validating these effects. The scatter plots reveal positive relationships between these two variables for Ecuador, Mexico, and Peru, suggesting that, at the global level (considering the entire analysis period for each country) the FLFPR exhibited countercyclical behavior. For Chile, Colombia, and Uruguay, the relationship is negative, indicating a possible procyclical pattern. However, these relationships are not stable if the overall period of analysis of each country is disaggregated into expansionary and recessionary cycles. Some relationships change in some countries, as suggested by the linear trend lines that adjust the points related to the variables under study.

These results are intended to be formally examined applying a methodological strategy with greater robustness. Section 4 details the methodology we implement, formulating econometric models to more accurately specify the trends and relationships described in this section.

3.2 | Series Properties

The variables are modeled in first differences, not in levels[5]. This will allow us to capture the short-term sensitivities in the relationship between the FLFPR and MUR (i.e., the business cycle)[6]. Nevertheless, given the nature of the variables (time series) to be used, the coefficients obtained by estimating the econometric models using ordinary least squares (OLS) could be biased by spurious correlations. Therefore, it is necessary to verify the degree of stationarity of the stochastic processes using unit root tests to confirm that the variables described in Section 3.1 are stationary.

Different unit root tests are conducted based on the characterization of each time series to be tested. In addition to the conventional augmented Dickey–Fuller (ADF) unit root test, the Phillips–Perron (PP) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests are included in Table 2. The tests aim to provide greater robustness in the results, since the ADF test can be biased toward indicating the presence of a unit root on certain occasions when the series does not have one. In particular, under conditions of heteroscedasticity, the ADF test tends to produce erroneous conclusions. Table 2 presents the results obtained from these tests.

As expected, the great majority of the series in the first differences are integrated of order 0. However, in the Chilean and Mexican cases, the variation in the FLFPR indicated the presence of a unit root when applying the ADF and PP tests in the first case and the ADF in the second. Therefore, the analysis continues and relies on the stationarity estimated with the KPSS test for Chile, as well as the PP and KPSS tests for Mexico.

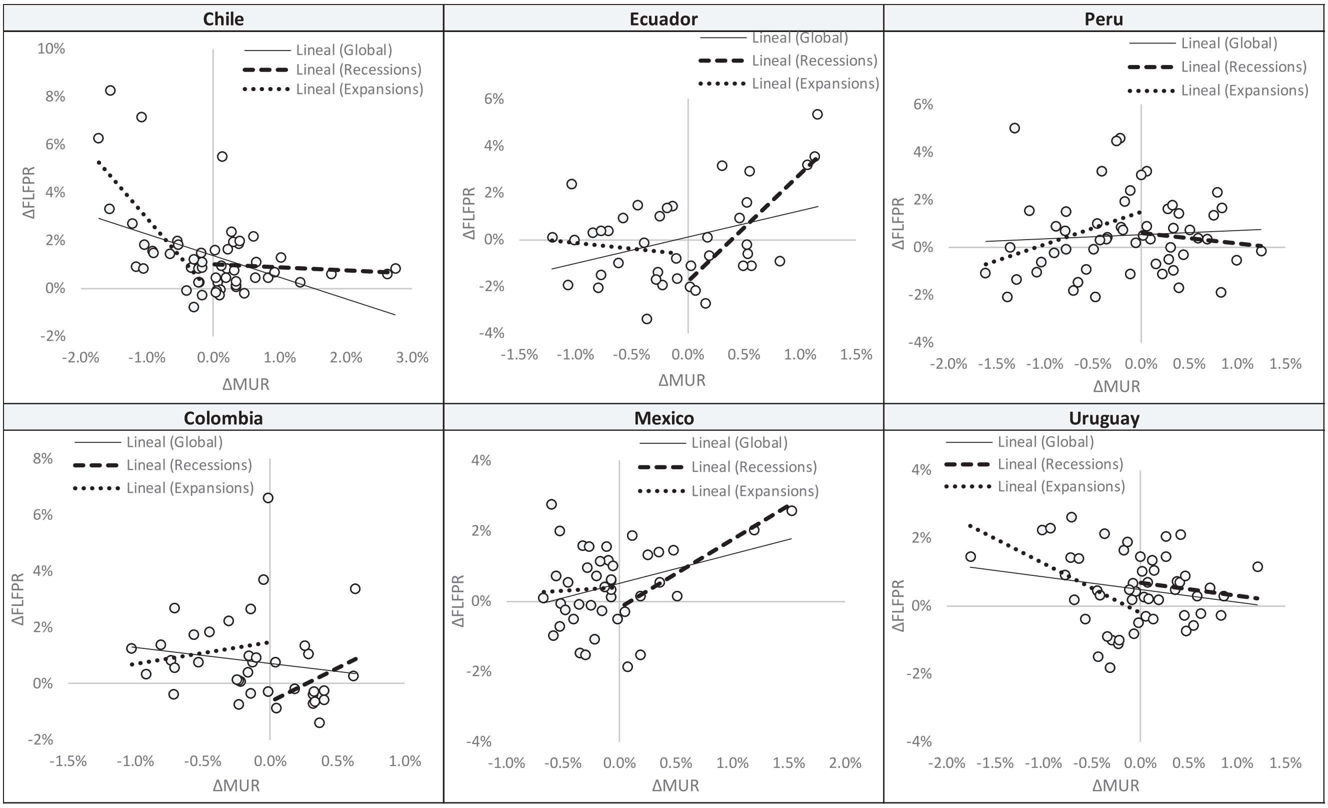

FIGURE 2 | Correlation between ΔFLFPR and ΔMUR (global period, by expansions and recessions) in selected economies.
Source: CEDLAS (2022) Own elaboration.

TABLE 2 | Unit root test.

Country	Variables	Test equation specification	ADF (H_0: unit root)	PP (H_0: unit root)	KPSS (H_0: stationarity)
Chile	ΔFLFPR	C-T	−2.87	−3.14	0.09
	ΔMUR	Without C-T/KPSS with C	−2.96***	−2.96***	0.07
Colombia	ΔFLFPR	C-T	−3.37*	−4.40***	0.10
	ΔMUR	C-T	−3.35*	−5.21***	0.07
Ecuador	ΔFLFPR	Without C-T/KPSS with C	−3.24***	−3.33***	0.14
	ΔMUR	C-T	−3.54**	−3.39*	0.08
Mexico	ΔFLFPR	Without C-T/KPSS with C	−0.98	−3.13***	0.09
	ΔMUR	Without C-T/KPSS with C	−4.10***	−4.08***	0.26
Peru	ΔFLFPR	C	−4.18***	−4.34***	0.22
	ΔMUR	C-T	−6.55***	−6.91***	0.05
Uruguay	ΔFLFPR	C-T	−5.90***	−5.87***	0.09
	ΔMUR	C-T	−4.27***	−4.30***	0.14

Note: H_0 = null hypothesis, C = constant, and T = linear trend. Δ denotes the variable at its first difference. *, **, and *** indicate that the null hypothesis is rejected at 10%, 5%, and 1% levels, respectively. Figures without * indicate that the null hypothesis is accepted at least at the 1%, 5%, or 10% levels.

Overall, we assume that $\Delta FLFPR_{jt} \sim I(0)$; $\Delta MUR_{jt} \sim I(0)$. Using this outcome, the OLS methodology is employed to test the AWE/SWE and DWE/EWE hypotheses. The regression results from the OLS application under this specification will confirm the stationarity of the disturbance or error, reflecting a non-spurious and robust short-run relationship.

4 | Methodology

To achieve the research's objectives, we employed two methodologies. The first one employs a Rolling Regression approach, which, through the use of moving windows, allows us to assess whether the relationships between the FLFPR and the MUR in each country remain stable over time.

The second methodology addresses whether the coefficients defining the relationship remain the same across different cyclical regimes. This is analyzed from a twofold perspective. First, we will construct a set of dummy variables to differentiate between booming and recessionary cyclical regimes. It must be noted that in this first stage, these cyclical regimes will be imposed exogenously. Thus, we consider that an economy is in an expansionary phase when the unemployment rate is reducing and in a contractionary or recessionary phase otherwise (i.e., when the unemployment rate is rising). In the second stage, the Threshold Regression methodology is applied, allowing regime-switching to occur endogenously. This approach enables the identification of cyclical reactions of the FLFPR that may remain undetected in conventional cyclical analysis. This is particularly important for countries where LFP only reacts to extreme circumstances in the business cycle. The implications for devising appropriate economic policies are evident. It is clear from the analysis that accurately detecting and determining regime shift thresholds is extremely significant for policy formulation.

4.1 | Baseline Model

Having verified that the time series are stationary in Section 3.2, the proposed model is theoretically supported as follows:

$$\Delta FLFPR_{jt} = \alpha_j + \beta_j \Delta MUR_{jt} + \varepsilon_{jt} \tag{1}$$

where $FLFPR_{jt}$ represents the female LFP rate in country j in period t. $\Delta FLFPR_{jt}$ is the difference between the female LFP rate in country j in quarter t compared with the same period of the previous year (i.e., $\Delta FLFPR_{jt} = FLFPT_{jt} - FLFPR_{jt-4}$). A similar approach is applied for $\Delta MUR_{jt} = MUR_{jt} - MUR_{jt-4}$, being MUR_{jt} the male unemployment rate of country j in period t. The coefficient α_j in Model 1 represents the average annual change of the FLFPR in country j when the change in MUR remains constant. Parameter β_j represents the change in the FLFPR of country j when the change in MUR increases by 1%. Finally, ε_{jt} is a random variable containing the error of the equation estimation for country j in the period t.

The rationale behind not taking into account the female unemployment to explain the participation decision of this group in the labor market is to minimize potential endogeneity problems. The use of the MUR as a cyclical indicator is a fairly conventional procedure within labor economics. The underlying logic is that men have higher and more stable LFP rates. Thus, variations in unemployment are primarily driven by changes in labor demand. Male unemployment is also considered to be a good measure of how stressed the labor market is and how easy or difficult it is to find a job.

To sum up, from Equation (1), it could be stated that if $\beta > 0$ the AWE/SWE hypothesis prevails, while if $\beta < 0$ the DWE/EWE hypothesis dominates.

4.2 | Test of Stability: Rolling Regression Methodology

To further explore the results that emerge from Model 1, the Rolling Regression methodology will be applied to test Hypothesis 1: the effects of the business cycle on female LFP rates in Latin America over the period of analysis are not stable. This technique has the advantage of dynamically adapting to the evolution of the data over time, which provides a more granular and detailed view of the underlying relationships that can vary over time according to Su et al. (2016). This can reveal important features that may be difficult to capture by traditional regression models, allowing us to identify trends and patterns that might go unnoticed in a static analysis. Therefore, the Rolling Regression model for each country will be estimated according to the following functional equation to validate Hypothesis 1 of this research:

$$\Delta FLFPR_{jtk} = \alpha_{jtk} + \beta_{jtk} \Delta MUR_{jtk} + \varepsilon_{jtk} \tag{2}$$

Following the methodological approach of Knotek (2007) the idea behind Model 2 is to estimate the parameter of interest β for each country j using model (1) at different sampling periods t. The periods have identical time dimensions (or window sizes). A window size, denoted here by k, must be chosen. This determines the number of observations used for each moving regression. If a relationship is stable over time the estimated coefficients will be quite similar. When the estimated parameters are considered to be different from each other, the coefficient of interest can be considered a time-varying parameter and the resulting time-varying estimates are used to interpret the results. As in Model 1, values of $\beta > 0$ support the AWE/SWE hypotheses, while values of $\beta < 0$ back the DWE/EWE hypotheses.

4.3 | Test of Asymmetry

4.3.1 | Exogenous Switching Regimes

Model 3 is formulated in this regard to quantify the sensitivity of parameter β to recessions and expansions in each economy, following the approach proposed by Cutanda (2023) to confirm whether the effects on the FLFPR in Latin America are symmetric (or not) over the business cycle. Two *dummy* variables associated with the cyclical phase of Model 1 are applied to test Hypothesis 2 of this study: the effects of the business cycle on female LFP rates are not symmetric across countries in the presence of exogenous switching regimes, as follows:

$$\Delta FLFPR_{jt} = \alpha_{1j} D_1 + \alpha_{2j} D_2 + \beta_{1j} D_1 \Delta MUR_{jt} + \beta_{2j} D_2 \Delta MUR_{jt} + \varepsilon_{jt} \tag{3}$$

Here, D_1 assumes the value of 1 in the phases of recession or contraction of economic activity (when the male unemployment rate increases) and 0 for expansions (when the male unemployment rate decreases), while D_2 is equal to 1 minus D_1.

TABLE 3 | Results of Model 1.

ΔFLFPR$_t$							
Parameter		**Chile**	**Colombia**	**Ecuador**	**Mexico**	**Peru**	**Uruguay**
ΔMUR$_t$	β	−0.90***	−0.56	1.12**	0.83**	0.17	−0.37
	t-statistic	−3.66	−0.97	2.44	2.19	0.53	−1.37
Observations		56	38	40	42	56	52
R^2		0.20	0.03	0.14	0.11	0.01	0.04

Note: Δ denotes the variable at its first difference. Significance is expressed as follows: *$p<0.10$, **$p<0.05$, ***$p<0.01$.

Therefore, β_1 in Model 3 captures the responses of FLFPR to business cycle when country j's economy is in recession, while β_2 will reflect such sensitivity in the expansionary phases of the cycle. Thus, for the values of $\beta_1 > 0$ and $\beta_1 < 0$, the AWE and DWE hypotheses are supported, respectively. On the other hand, $\beta_2 > 0$ backs the SWE, while $\beta_2 < 0$ accounts for the EWE.

4.3.2 | Threshold Regression

Finally, to go deeper into the results derived from the estimation of Equation (3), a fourth model is estimated using the threshold regression methodology applied in seminal studies developed by Tong and Lim (1980), Tong (1983) and Hansen (1999). This econometric approach defines a direct form of non-linear regression with linear specifications and the regime shift that occurs when an observed variable crosses unknown thresholds, as noted by Congregado et al. (2021b).

Therefore, this econometric approach enables the determination of whether the asymmetries that occur in the cyclical sensitivity of the FLFPR occur for values different from those set exogenously in the specification of Equation (3). Subsequently, the thresholds will be endogenously determined and do not necessarily have to be associated with the value $\Delta MUR_{jt} = 0$. An accurate understanding of these values is extremely important from the perspective of economic policy since it allows policymakers to determine when to start implementing corrective public policy measures.

Taking this approach into consideration, Model 4 is defined with two regions by threshold γ to validate Hypothesis 3: the thresholds delimiting the endogenous switching regimes differ across countries. The formulation is described as follows:

$$\Delta \text{FLFPR}_t^j = \alpha_1^j + \beta_1^j\, \Delta \text{MUR}_t^j + \varepsilon_t^j \qquad \text{if } -\infty \le \Delta \text{MUR}_t^j < \gamma$$

$$\Delta \text{FLFPR}_t^j = \alpha_2^j + \beta_2^j\, \Delta \text{MUR}_t^j + \varepsilon_t^j \qquad \text{if } \gamma \le \Delta \text{MUR}_t^j < \infty$$

where γ is a threshold producing two regimes, and β_1^j and β_2^j are the two different cyclical sensitivities associated with those two regimes; j, t are index of the country and time periods, respectively. ε_t^j is an IID error with mean 0 and variance σ^2.

According to Martín-Román (2022) and Kim et al. (2011) using an indicator function 1 (.) which takes the value 1 if the expression is true and 0 otherwise, and defining $1_1(\Delta \text{MUR}_t^j, \gamma) = 1$ $(-\infty \le \Delta \text{MUR}_t^j < \gamma)$ and $1_2(\Delta \text{MUR}_t^j, \gamma) = 1$ $(\gamma \le \Delta \text{MUR}_t^j < \infty)$, we may combine the two individual regime specifications into a single equation ($\forall\, m = 1, 2$):

$$\Delta \text{FLFPR}_t^j = \alpha_m^j + \sum_{m=1}^{2} \beta_m^j \cdot 1_m\left(\Delta \text{MUR}_t^j, \gamma\right) \cdot \Delta \text{MUR}_t^j + \varepsilon_t^j \quad (4)$$

Here, the FLFPR variation of country j in period t is finally explained by the MUR variations of country j in period t when the economy is exposed to different regimes (1_1 and 1_2) during the periods of analysis. Thus, β_1^j will illustrate the effect produced by the variation of MUR in country j on the FLFPR when in regime 1_1, while β_2^j will reflect the magnitude of this effect when in regime 1_2. Empirical evidence expected in support of Hypothesis 3 will be assessed by quantifying these coefficients, detailed as follows:

$$\frac{\partial \Delta \text{FLFPR}_t^j}{\partial 1_1\left(\Delta \text{MUR}_t^j, \gamma\right) \cdot \Delta \text{MUR}_t^j} = \beta_1^j$$

$$\frac{\partial \Delta \text{FLFPR}_t^j}{\partial 1_2\left(\Delta \text{MUR}_t^j, \gamma\right) \cdot \Delta \text{MUR}_t^j} = \beta_2^j$$

In summary, the threshold regression methodology will allow us to detect how the obtained coefficients (β_1^j and β_2^j) change over the expansion or recession cycles proposed in Model 3, through the endogenously determined thresholds in Model 4.

5 | Results

5.1 | Results of the Baseline Model

The results of Model 1 are presented in Table 3. As preliminarily indicated by the scatter plots in Figure 2, the FLFPRs react countercyclically throughout the analysis periods in Ecuador and Mexico. Therefore, the AWE/SWE hypothesis is validated in these economies. This effect is particularly stronger in the case of Ecuador since for each p.p. increase in the variation of the MUR, the variation of the FLFPR increases 1.12 p.p. In Mexico, the effect is less than 1 p.p., reaching an 0.83 p.p. increase for each 1 p.p. increase in the MUR. In the Peruvian case, a positive coefficient is obtained, indicating countercyclical behavior; however, it was not statistically significant.

In Chile, Uruguay, and Colombia, the reaction of the FLFPR is procyclical throughout the cycles analyzed for each country, although the β coefficient is only significant in the Chilean case, indicating that the DWE/EWE hypothesis is supported at the global level only for Chile. The magnitude of this effect suggests that for each p.p. increase in MUR variation, the change in the FLFPR of Chilean women decreases by 0.90 p.p.

5.2 | Results of the Stability Test: Rolling Regression

Regarding the estimation of Model 2, an important decision that we had to make was the choice of the window size, since it can affect the conclusions obtained. Along these same lines, we must take into account the limitations that exist in the construction of a database for Latin American labor markets. In particular, it is complex to find time series long enough to implement the Rolling Regression methodology.

However, Zanin and Marra (2012) mention that, in the literature, there are several proposals on the length of a typical business cycle. All of them support the idea of regular periodic cycles such as the Kitchin cycle of 3–5 years or the Juglar cycle of 7–11 years. Therefore, we believe that a window size of 30 quarterly observations adequately captures the relationships between the FLFPR and the MUR variations in Latin America. Considering the availability of information for each country, 8 to 26 windows of analysis were generated. The estimates of Model 2 are shown in Figure 3. These extend the results of Model 1 in terms of the sign of β; and reveal some volatility in the magnitude of the parameter in each subperiod of analysis[7].

In relation to the sign, a DWE/EWE was observed for Chile and an AWE/SWE for Ecuador. On the other hand, in Mexico there was a mixed dynamic between cycles, although the β was not significant during the reference period. In Colombia, the β coefficient became statistically significant only after 2010, thus making the FLFPR procyclical (i.e., a DWE/EWE was obverved). Finally, in Uruguay a statistically significant β was exhibited only in 3 out of 22 windows (2010Q4-2018Q2, 2011Q2-2018Q4 and 2011Q3-2019Q1) thus manifesting an AWE/SWE as in Peru (only between 2012Q2 and 2019Q4; 1 out of 26 subperiods).

Regarding the magnitude of the β, there are some findings to highlight. For example, in Chile the DWE/EWE between 2006Q1 and 2015Q4 averaged 0.93, while it intensifies to 1.22 between 2008Q3 to 2018Q4. The DWE/EWE is detected for Colombia from 0.91 between 2010Q1 and 2017Q4 to 0.87 between 2010Q3 and 2018Q4. In Ecuador, an AWE/SWE of up to 1.51 is estimated between 2010Q4 and 2018Q2, which loses strength to 1.05 between 2012Q2 and 2019Q4. Similar trends were observed for Uruguay.

These outcomes reveal that, in terms of order of magnitude, the estimates of Model 2 suggest an instability of the parameter β. On the one hand, this is a confirmation of Hypothesis 1. On the other hand, this instability could be anticipating the influence of cyclical asymmetries and reactions of FLFPR only in certain scenarios or thresholds, which will be verified in the next section.

5.3 | Test of Asymmetry

5.3.1 | Results of Exogenous Switching Regimes

The results of econometric Model 3 are presented in Table 4. According to the correlations observed in Section 3.1 (Figure 2), it can be concluded that the relationship between the variables under study changes if the recessive and expansionary cycles are analyzed. While in Model 1 Peru and Uruguay showed a non-significant β coefficient, Model 3 demonstrates that the FLFPRs only react in the expansionary phases of the economic cycle. In the recessionary phases, the coefficients were not statistically significant. This finding complements the results of Model 2, as it evidences that the coefficient β estimated here is not symmetric and only reacts for a certain regime.

In fact, in Peru, it was observed that FLFPR behaves countercyclically during economic expansions. This outcome could indicate that when males in the household find work, women return to the housework and leave the labor force. This SWE is quantified at 1.35 p.p. for every 1 p.p. reduction in the variation of the MUR in this country. This behavior is congruent with the findings of Serrano et al. (2019) for a set of 18 Latin American countries, including Peru, although their study only focused on expansionary phases of the economic cycle.

The FLFPR in Uruguay behaves procyclically in expansionary cycles, given that for every 1 p.p. reduction in the variation of the MUR, the variation of FLFPR increases by 1.46 p.p. Therefore, the hypothesis that female workers in Uruguay are encouraged to look for work when they perceive that men are more likely to find a job during economic booms is held. This finding is consistent with the results presented by Parker and Skoufias (2004), Paz (2009) for Mexico and Argentina, respectively[8].

The DWE/EWE found for Chile in models 1 and 2 has its counterpart in Model 3. During economic expansions, a procyclical reaction of the FLFPR is revealed, validating the EWE, which is even substantially stronger than that in Uruguay. For every 1 p.p. reduction in the variation of the MUR, the variation of the FLFPR rises by 3.21 p.p. Nevertheless, the Chilean FLFPR did not exhibit a statistically significant reaction to changes in MUR during recessions.

The countercyclical relationship registered in Model 1 for Ecuador and Mexico is strengthened in Model 3. Nonetheless, FLFPR in these countries only responds to periods of economic crisis, which confirms the traditional AWE in these cycles. In Model 3, the magnitude is four times stronger in the Ecuadorian case than in Model 1 (4.59 p.p. versus 1.12 p.p.). Similarly, in Mexico, the reaction is stronger, moving from 0.83 p.p. in Model 1 to 1.95 p.p. in Model 3.

Overall, it can be observed that in many countries the cyclical sensitivity of the female activity rate varies significantly depending on whether the economy is in an expansionary or

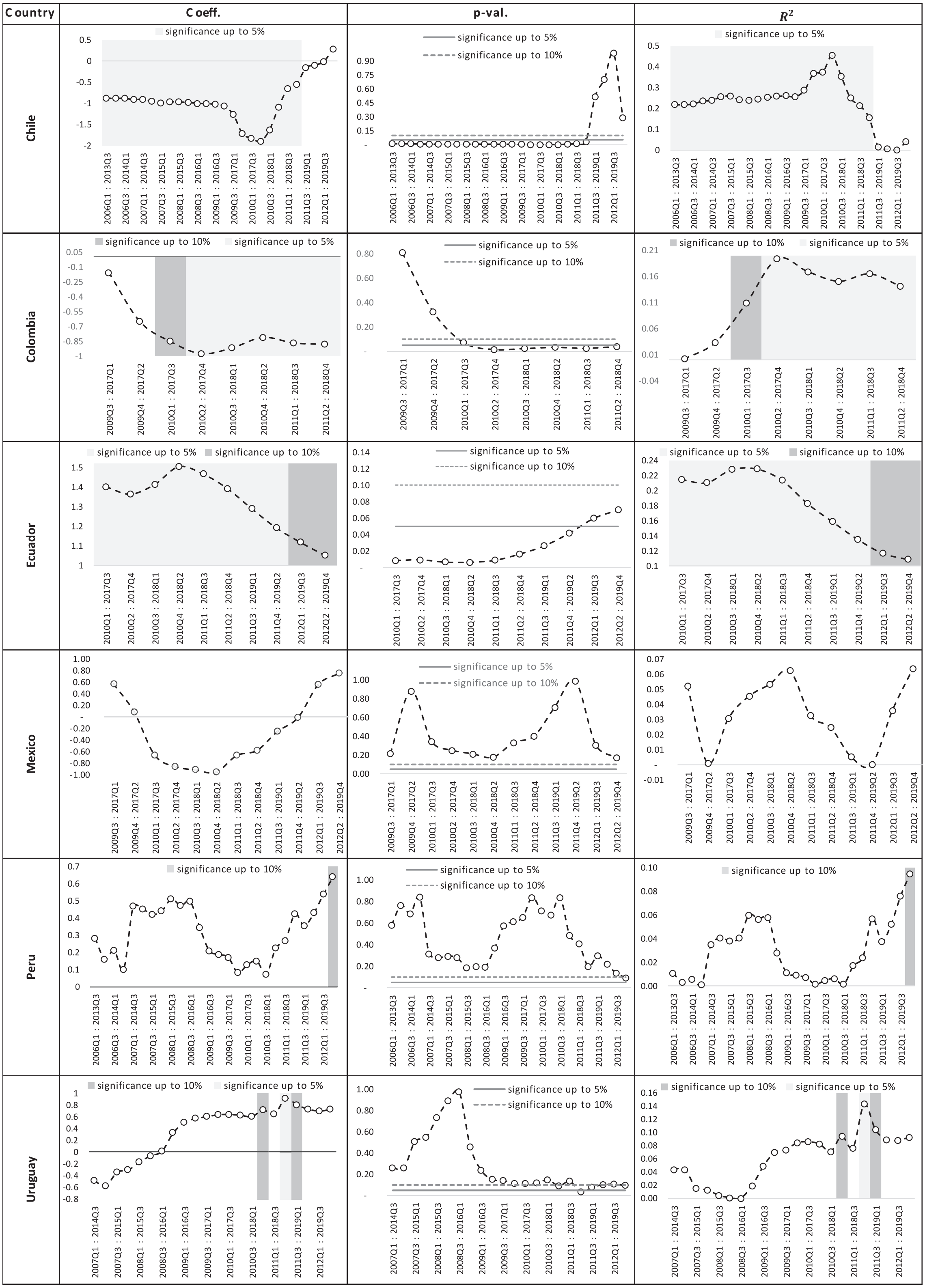

FIGURE 3 | Results of Model 2 (graphical illustrations of the rolling regression). *Note:* Less gray areas indicate significance up to 5%. Greyer areas indicate significance up to 10%.

recessionary phase. All this evidence seems to corroborate that the cyclical behavior of labor supply at the extensive margin in Latin American countries cannot be considered to be homogeneous across the different phases of the business cycle. Thus, it can be stated that Hypothesis 2 is validated.

5.4 | Test of Asymmetry: Threshold Regression Methodology

The countercyclical effect found in Model 3 is confirmed in Model 4, with strong sensitivities revealed in certain economies.

TABLE 4 | Results of Model 3.

ΔFLFPR$_t$							
Parameter		**Chile**	**Colombia**	**Ecuador**	**Mexico**	**Peru**	**Uruguay**
ΔMUR$_t$	β_1 (RES)	−0.13	2.42	4.59***	1.95***	−0.42	−0.39
	t-statistic	−0.36	1.02	4.38	2.81	−0.40	−0.59
	α_1	0.01***	−0.01	−0.02***	−0.01	0.01	0.01**
	t-statistic	3.19	−0.77	−2.83	−0.46	1.01	2.18
	Observations	31	14	18	12	24	26
	β_2 (EXP)	−3.21***	0.80	−0.49	0.20	1.35**	−1.46***
	t-statistic	−5.91	0.81	−0.49	0.19	2.08	−2.87
	α_2	−0.00	0.01***	−0.01	0.00	0.02***	−0.00
	t-statistic	−0.68	3.05	−0.97	1.12	2.91	−0.68
	Observations	25	24	22	30	32	26
Observations		56	38	40	42	56	52
R^2		0.45	0.16	0.38	0.19	0.08	0.15

Note: Δ denotes the variable at its first difference in inter-annual comparison of the same quarter. RES = recession; EXP = expansion. Significance is expressed as follows: *$p<0.10$, **$p<0.05$, ***$p<0.01$.

The threshold regression approach confirms an even more significant AWE during recessions for the female group in Ecuador when the MUR variation is greater than or equal to 0.46%. In the presence of this threshold, the variation in the FLFPR rises by 5.78 p.p. (higher by 1.19 p.p. than Model 3) for every 1 p.p. increase in the MUR variation.

On the other hand, when the variation in the MUR exceeds the 0.18% threshold, the variation in the FLFPR in Mexico rises 1.86 p.p. Although this sensitivity remains strong, compared to Model 3, it is marginally lower at 0.09 p.p. difference ($\beta_1 = 1.95$). This could imply that when a crisis reaches extreme values, access to the labor market becomes more difficult. Consequently, the AWE found for women in Mexico becomes less intense at the peak of recessions.

Regarding Colombia, as in Model 1 (and part of Model 2; between 2009Q3 and 2017Q2), in Model 3, the FLFPR is acyclical. The Model 3 coefficients in the economic expansion and recession cycles are statistically insignificant. Applying Model 4 (Table 5) under the threshold regression methodology, it is found that the FLFPR in Colombia only reacts to periods of economic recession when the variation of the MUR is equal to or higher than 0.32 p.p. The sensitivity shown by the model coefficient under this regime is very strong (almost 9 p.p.), although it only represents the relationship of the model's variables for 9 quarters. This confirms a countercyclical reaction and an AWE only in the presence of such a threshold.

This result provides new evidence to strategically address Colombian labor market dynamics effectively because although policymakers may know how the female LFP reacts in times of economic expansion according to the findings of Serrano et al. (2019), this study provides the threshold level beyond which under extreme conditions, the FLFPR responds during recessionary periods.

Allowing certain thresholds, in Uruguay and Chile, the findings of Model 3 are corroborated, although with less intensity in the magnitude of the Model 4 coefficient during economic expansions. In both countries, the procyclical effect of the FLFPR is consolidated and the EWE is supported.

For instance, in Uruguay, when the demand for male employment rises during an economic expansion and the variation in the MUR does not exceed 0.12%, women are encouraged to find a job because they perceive greater opportunities to do so. Nevertheless, this effect loses intensity in the presence of this threshold, showing an increase in the FLFPR of 1.08 p.p. versus the 1.46 p.p. reflected in Model 3 (0.38 p.p. less). As for Chile, when the variation in the MUR is less than 0.82%, the variation in the FLFPR increases by 1.63 p.p. (1.58 p.p. less than in Model 3; $\beta_2 = 3.21$). This pattern could be due to the fact that Uruguayan and Chilean women moderate their access to the labor market when economic growth reaches extreme values or when they observe that their partners' opportunities to obtain employment increase considerably; that is, they continue to be encouraged to find employment, but progressively less so.

Finally, using the threshold regression approach, in Peru, the SWE identified in Model 3 remains relevant in Model 4, but to a lesser extent when the change in the MUR is less than 0.15%. For every 1 p.p. increase in the MUR, the FLFPR is reduced by 1.25 p.p. (1.35 p.p. in Model 3). Therefore, at the peaks of economic booms, some women will decide not to return to their daily household chores but to continue expanding the family income, since once inserted in the labor market, the opportunities to upgrade their employment will be greater. Beyond this assessment, the female participation rate in Peru continues to behave countercyclically in the presence of this threshold.

As a final remark, from the analysis above, it can be concluded that the endogenous switching regime thresholds strongly differ among countries. On the one hand, this observation provides supporting evidence to accept Hypothesis 3. On the other hand, the economic policy implications of these outcomes are potentially significant. Knowing the switching regime thresholds

TABLE 5 | Results of Model 4.

$\Delta FLFPR_t$							
Parameter		**Chile**	**Colombia**	**Ecuador**	**Mexico**	**Peru**	**Uruguay**
ΔMUR_t	Threshold	$\Delta MUR_t \geq 0.82\%$	$\Delta MUR_t \geq 0.32\%$	$\Delta MUR_t \geq 0.46\%$	$\Delta MUR_t \geq 0.18\%$	$\Delta MUR_t \geq 0.15\%$	$\Delta MUR_t \geq 0.12\%$
	β_1	−0.01	8.45**	5.78***	1.86**	0.37	−0.53
	t-statistic	−0.00	2.08	3.14	2.34	0.29	−0.63
	α_1	0.01	−0.04**	−0.03**	−0.00	0.00	0.01*
	t-statistic	0.50	−2.04	−2.06	−0.24	0.04	1.72
	Observations	7	9	11	9	20	20
ΔMUR_t	Threshold	$\Delta MUR_t < 0.82\%$	$\Delta MUR_t < 0.32\%$	$\Delta MUR_t < 0.46\%$	$\Delta MUR_t < 0.18\%$	$\Delta MUR_t < 0.15\%$	$\Delta MUR_t < 0.12\%$
	β_2	−1.63***	0.09	−0.37	−0.10	1.25**	−1.08**
	t-statistic	−4.56	0.13	−0.52	−0.12	2.21	−2.36
	α_2	0.01***	0.01***	−0.01	0.00	0.01***	0.00
	t-statistic	4.73	3.09	−1.47	0.93	3.30	0.36
	Observations	49	29	29	33	36	32
Total observations		56	38	40	42	56	52
R^2		0.30	0.20	0.34	0.17	0.10	0.11

Note: Δ denotes the variable at its first difference, while significance is expressed as follows: $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

with accuracy will allow policymakers to implement the appropriate policy interventions at the right time. This, in turn, will enable them to avoid policy missteps, such as overreacting or underreacting.

5.5 | Robustness Analysis

5.5.1 | Results of the Stability Test: Rolling Regression

Using rolling regressions with different window sizes, we performed a robustness analysis to assess the stability of the estimated parameters of the baseline model and strengthen the credibility of our results. Specifically, windows of 25, 30, 35, and 40 observations were used for the six countries under study. The results of this analysis are presented in Appendix C (Tables C1–C6) and indicate that the coefficient estimates shown for Model 2, with a window size of 30, maintain consistent patterns despite variations in window size, thereby reinforcing Hypothesis 1 regarding the instability of the parameters.

These findings confirm that the coefficient estimates are sensitive to economic fluctuations. The variability in magnitude, sign changes, and significance levels of the coefficients demonstrates persistent instability in the parameters over time. Therefore, our results are robust in the sense that, regardless of the window size used, the instability in the estimates persists, underscoring the importance of considering temporal variability in econometric models applied to these countries.

5.5.2 | Business Cycle Considerations

Despite the limitations in the availability of long-term data for the Latin American labor market, which can make it difficult to accurately identify business cycles, we consider it essential to analyze these dynamics. In this section, we examine the business cycle through the cyclical decomposition of the male unemployment series in the countries studied.

The time series used covered periods ranging from 9 to 14 years. While this time span may be considered insufficient by traditional standards, we believe that it is possible to extract valuable information within these constraints. According to Zanin and Marra (2012), a business cycle can be adequately identified within a horizon of 7 to 11 years. Faced with these limitations, we seek to reinforce the validity of our results. By applying cyclical decomposition methods, we demonstrate that it is feasible to capture the business cycles of these economies, allowing us to deepen the understanding of their dynamics and provide significant information on the Latin American labor market.

In Appendix D (Figure D1), we present the unemployment series along with their estimated trends and cyclical components obtained using the Hodrick and Prescott (1997) (HP) filter for the six countries analyzed. The filtering results reveal variations in the duration and magnitude of economic cycles, allowing us to identify phases of expansion and contraction in each economy. Thus, despite the limited length of the series, complete cycles can be observed in all countries, with observations of periods of economic expansion along with others characterized by economic contraction.

Chile and Mexico show marked expansion and contraction phases with defined economic cycles. Ecuador and Colombia also show defined cyclical dynamics despite limitations in the length of their series. In the case of Uruguay and Peru, the cyclical component is noisier, but observations associated with growth phases and others with recession phases can also be seen.

Based on this empirical evidence, we can conclude that filtering the series effectively enables the detection of expansionary and contractionary phases of the business cycle, even with sample periods ranging from 9 to 14 years. These cyclical phases are clearly visible, justifying the use of our database for analyzing economic fluctuations. Although the sample size is limited, the methodology employed allows us to estimate significant patterns that offer valuable insights into the cyclical dynamics of the economies under study.

TABLE 6 | Results of Model 5.

$\Delta FLFPR_t$							
Parameter		**Chile**	**Colombia**	**Ecuador**	**Mexico**	**Peru**	**Uruguay**
ΔMUR_t	β_1 (RES)	0.17	−1.59	3.81***	1.54***	−1.17	0.37
	t-statistic	0.51	−1.00	4.39	2.65	−1.41	0.67
	Observations	31	14	18	12	24	26
	β_2 (EXP)	−2.35***	−0.03	−1.26	−0.38	0.95*	−0.92**
	t-statistic	−5.56	−0.04	−1.59	−0.45	1.74	−2.04
	Observations	25	24	22	30	32	26
	α	0.01**	0.01**	−0.01**	0.00	0.01**	0.00
	t-statistic	2.15	2.17	−2.67	0.57	2.85	0.99
Observations		56	38	40	42	56	52
R^2		0.39	0.04	0.35	0.16	0.06	0.08

Note: Δ denotes the variable at its first difference in inter-annual comparison of the same quarter. RES = recession; EXP = expansion. Significance is expressed as follows: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

5.5.3 | Implications of the Regime for Model 3 and Model 4

To ensure the robustness of our results, we re-estimated models 3 and 4 using a single intercept, rather than one for each regime, to assess whether the intercept specification significantly impacted the conclusions. In this context, the intercept represents the change in the female labor force participation rate when there are no changes in male unemployment. Theoretically, while changes in FLFPR in response to MUR changes may be due to cyclical factors captured by the slopes, the secular trend of the participation rate should be influenced by structural factors. Below, the re-estimated models are described through Equations (5) and (6), with their results shown in Tables 6 and 7.

$$\Delta FLFPR_{jt} = \alpha + \beta_{1j} D_1 \Delta MUR_{jt} + \beta_{2j} D_2 \Delta MUR_{jt} + \varepsilon_{jt} \quad (5)$$

Regarding Model 3, we observe that the results did not present significant changes compared to Model 5. The countercyclical patterns in the recessionary phases of the cycle in Ecuador (AWE) and Mexico (AWE) are maintained, as well as in the expansionary phases for Peru (SWE). In Uruguay and Chile, the procyclical effect in the expansionary phases of the economic cycle (EWE in both cases) remained. Colombia, for its part, continued to show cyclical behavior in both economic regimes. The crucial difference was that the beta coefficient in Model 5 marginally reduced the intensity of the effect between the variables for some countries, but the statistical significance and the sign of the coefficient remained unchanged. This dynamic suggests that the model redistributes part of the variation that was previously explained by differences in intercepts toward the slope coefficient.

From an economic policy perspective, this suggests that while both models show a significant and consistent relationship regarding the cyclical response of female labor supply in various contexts, the model with two intercepts may provide a clearer representation of the intensity of the effect across different economic periods. This would help policymakers to be better prepared when implementing strategies to mitigate the estimated patterns in the different phases of the economic cycle (DWE/EWE—AWE/SWE). Therefore, it is important to carefully evaluate the model specification and consider the theoretical and empirical implications when interpreting the results.

$$\Delta \mathrm{FLFPR}_t^j = \alpha^j + \sum_{m=1}^{2} \beta_m^j \cdot 1_m\left(\Delta \mathrm{MUR}_t^j, \gamma\right) \cdot \Delta \mathrm{MUR}_t^j + \varepsilon_t^j \quad (6)$$

Similar findings emerged from the estimation of Model 6. Compared to Model 4, the results remained significantly consistent, with the sign and significance of the effects remaining for most countries. A lower intensity in the threshold effects continued to be observed for some countries that had already exhibited this dynamic concerning models 3 and 5. This suggests that when an economic crisis or expansion reaches extreme values, the studied patterns may continue to be present but at an increasingly slower rate.

However, the results observed for Colombia in Model 4 should be interpreted with caution. When a single intercept is included in Model 6, the AWE observed in Model 4 during the recessionary

TABLE 7 | Results of model 6.

ΔFLFPR$_t$							
Parameter		Chile	Colombia	Ecuador	Mexico	Peru	Uruguay
ΔMUR$_t$	Threshold	$\Delta MUR_t \geq 0.82\%$	$\Delta MUR_t \geq 0.32\%$	$\Delta MUR_t \geq 0.46\%$	$\Delta MUR_t \geq 0.18\%$	$\Delta MUR_t \geq 0.15\%$	$\Delta MUR_t \geq 0.12\%$
	β_1	−0.21	−1.51	3.18***	1.51**	−1.14	0.34
	t-statistic	−0.61	−1.03	3.88	2.65	−1.41	0.62
	Observations	7	9	11	9	20	20
	Threshold	$\Delta MUR_t < 0.82\%$	$\Delta MUR_t < 0.32\%$	$\Delta MUR_t < 0.46\%$	$\Delta MUR_t < 0.18\%$	$\Delta MUR_t < 0.15\%$	$\Delta MUR_t < 0.12\%$
	β_2	−1.64***	−0.16	−0.58	−0.30	0.93*	−0.89**
	t-statistic	−4.62	−0.20	−0.81	−0.38	1.74	−2.03
	Observations	49	29	29	33	36	32
	α	0.01***	0.01**	−0.01*	0.00	0.01***	0.00
	t-statistic	4.79	2.44	−1.95	0.72	2.88	1.11
Total observations		56	38	40	42	56	52
R^2		0.30	0.04	0.30	0.16	0.06	0.08

Note: Δ denotes the variable at its first difference, while significance is expressed as follows: $^*p<0.10$, $^{**}p<0.05$, $^{***}p<0.01$.

phases of the economic cycle in Colombia disappears. This suggests that while a countercyclical response in female labor force participation (LFP) is observed in Colombia, it only occurs at very extreme thresholds of the economic cycle, with a few observations of this effect (9 out of 38). Therefore, the findings for this country should be approached with caution.

Beyond this specific aspect, the robustness analysis confirms that our findings are consistent and independent of the intercept specification in the model. Although estimating the model with two constant terms results in slightly more pronounced effects, the direction and significance of these effects remain unchanged when using a single constant term, further reinforcing the credibility of the estimated relationships.

6 | Discussion of Results

The results of this research provide new evidence on the cyclical behavior of female LFP in Latin America and are summarized in Table 8. In the first place, we test in which countries the AWE/SWE or the DWE/EWE hypotheses prevail. This provides a general overview of the cyclical pattern of the female labor supply at the extensive margin in the group of Latin American countries selected in this study. However, the objective of this research is to explore further and assess whether this cyclical behavior remains more or less stable over time and whether it shows a certain symmetry in the upward and downward phases of the business cycle.

One of the key contributions of this study is the evidence that these effects can vary across different periods of analysis. This result was obtained when employing the rolling regression methodology to evaluate parameter stability over time, thereby validating Hypothesis 1 proposed in Section 2.

The previous result could be anticipating the existence of cyclical asymmetries and diverse reactions of the FLFPR when disaggregating the analysis periods into expansionary and recessionary cycles. Thus, we tested Hypothesis 2 and found it to be validated. We define the SWE hypothesis as the countercyclical behavior of FLFPR in expansionary phases (i.e., the counterpart of the AWE in recessionary cycles) and, in the same vein, the EWE as the procyclical pattern where the economy is booming (i.e., the counterpart of the DWE). Evidence of all these effects on different countries is found.

Finally, we not only examine whether FLFPRs react asymmetrically throughout the business cycle, but we also delve deeper into this question. We carry out a threshold regression, in which these thresholds are determined endogenously. This allows us to identify some situations in which FLFPRs react differently to extreme values of the business cycle. In this way, we find evidence that Hypothesis 3 is met.

TABLE 8 | Research findings.

			Reaction Female LFP rate				
			Exogenous switching regimes (Equation 3)				
			Countercyclical		Procyclical		
Country	Baseline model (Equation 1)	Effect of β with rolling regression (Equation 2)	RES AWE	EXP SWE	RES DWE	EXP EWE	Threshold regression (Equation 4)
Chile	DWE/EWE	Unstable; DWE/EWE is maintained. Procyclical	—	—	—	X	EWE is maintained but loses strength above a certain threshold.
Colombia	n.a.	Unstable; DWE/EWE appears. Procyclical	—	—	—	—	AWE occurs during recessions but only at extreme thresholds.
Ecuador	AWE/SWE	Unstable; AWE/SWE is maintained. Countercyclical	X	—	—	—	AWE is maintained but intensifies above a certain threshold.
Mexico	AWE/SWE	Stable	X	—	—	—	AWE is maintained but diminishes above a certain threshold.
Peru	n.a.	Unstable; AWE/SWE is maintained. Countercyclical	—	X	—	—	SWE is maintained but loses strength above a certain threshold.
Uruguay	n.a.	Unstable; AWE/SWE appears. Countercyclical	—	—	—	X	EWE is maintained but loses strength above a certain threshold.

Note: n.a. indicates not available.

Regarding the results for different countries, it can be stated that during periods of recession, Ecuador and Mexico showed a countercyclical FLFPR, thus reaffirming an AWE with this trend. Nonetheless, it was found that in Ecuador, the AWE intensifies for MUR variations of at least 0.46 p.p., causing FLFPR variations close to 6%. On the other hand, in expansionary phases, a procyclical behavior of the FLFPR was observed in Uruguay and Chile, confirming the EWE. Meanwhile, in Peru, a SWE was noted, suggesting a countercyclical FLFPR in this context. It is important to note that the reaction decreased in intensity for these three countries beyond the established threshold. In other words, when an economic expansion reaches extreme levels, the EWE or SWE may still occur, but at an increasingly lower rate.

The most striking case is that of Colombia, where the FLFPR was acyclical throughout the analysis, even when the study was disaggregated by expansionary and recessionary cycles. The FLFPR was only countercyclical, validating an AWE when very extreme variations in the MUR occurred. Therefore, the labor market in that country should be observed with caution since the FLFPR reacts sensitively to increases in the MUR of more than 0.32 p.p.

7 | Conclusions and Policy Implications

The findings of this study have important implications for labor policy design in Latin America. Given the variability and asymmetry in LFP's reaction to changes in the economic cycle, policies must be adapted and tailored to each country and economic context, as labor strategies that were effective in the past may not be so in the present due to changes in labor market dynamics.

Policies must remain flexible and respond to the specific motivations that lead women to enter the labor market in different economic contexts. During recessions, for example—considering the cases of Ecuador and Mexico (with marked AWE)—entering the labor market may be a survival strategy to compensate for the loss of employment or income of the household head. In this context, policies should focus on providing immediate support, such as emergency employment programs and strengthened social safety nets. On the other hand, during economic expansions, as observed in Chile and Uruguay, women may be attracted by better job opportunities and higher wages. Here, policies should focus on promoting professional development, career advancement opportunities, and reducing gender wage gaps.

In Peru, a SWE was identified during economic expansions, evidenced by a decrease in FLFPR as the probability of finding work increased. Improved household financial situation reduces the need for women to contribute additional income. To counteract this phenomenon, policies in Peru should focus on promoting and maintaining FLFPR even during economic expansions. It is essential to implement measures that facilitate work-life balance, such as access to quality childcare services and the promotion of flexible working hours. Additionally, encouraging women's workforce continuity through programs that value their contribution is vital.

Although the case of Colombia should be approached with some caution, it underscores the need for proactive and structural policies. Given that FLFPR remains generally acyclical but can react strongly to extreme increases in the male unemployment rate (more than 0.32 p.p.), authorities must strengthen the resilience of female labor market participation before such crises occur. Policies should focus on enhancing women's access to education and vocational training, promoting gender equality in hiring practices, and supporting female entrepreneurship. Additionally, implementing countercyclical fiscal measures that incentivize the hiring of women and fostering public-private partnerships to create employment opportunities can help absorb increased female labor supply during severe downturns. By anticipating economic fluctuations and preparing comprehensive response mechanisms, Colombia can minimize the distortions associated with the AWE and promote more stable and sustainable female participation in the labor market.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Endnotes

[1] See the next section for a detailed definition of these effects.

[2] Center for Distributive, Labor, and Social Studies (CEDLAS, for its acronym in Spanish).

[3] Due to limited access to information, the study focuses on adults between 25 and 64 years old.

[4] As will be detailed later, we refer to inter-annual variations. That is, variations with respect to the same quarter of the previous year.

[5] Inter-annual variation with respect of the same quarter of the previous year.

[6] Although there is an emerging literature analyzing the AWE/SWE and DWE/EWE using cointegration techniques (i.e., estimating long-run relationships), our approach is closer to the seminal works that aimed at accounting short-run sensitivities.

[7] For a more precise reference to the estimates displayed in Figure 3, see Appendix B, Table B1.

[8] For the case of other countries such as Australia, Evans (2018) also found the same results.

[Correction added on 12 June 2025, after online publication: The endnotes has been renumbered in this version.]

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Appendix A

In this appendix, we present a summary of the literature review on the cyclical behavior of female LFP across different countries (Table A1). The table classifies studies based on the author, data used, country of analysis, econometric approach applied, and the cyclical reaction of the female LFP rate.

TABLE A1 | Literature review on female LFP rate and the business cycle.

Authors	Data	Econometric approach: over the period	Reaction female LFP rate
Cerrutti (2000)	Permanent Household Survey for the metropolitan area of Buenos Aires Years: 1991–1994 Frequency: monthly Country: Argentina	Cross-sectional and panel data.	Countercyclical: AWE/SWE
Martín-Román and de Blas (2002)	OCDE Statistics: Labor Market and Social Issues Years: 1972–1997 Countries: Germany, the United Kingdom, France and Spain	Cointegration techniques.	Countercyclical: AWE/SWE for France Procyclical: DWE/EWE for Germany, the United Kingdom, and Spain.
Başlevent and Onaran (2003)	Labor force survey Years: 1988–1994 Country: Turkey	Bivariate probit model estimation.	Countercyclical: AWE/SWE
Fernandes and De Felício (2005)	Household survey Years: 1985, 1993 and 1999 Country: Brazil	Panel data estimation.	Countercyclical: AWE/SWE
Lee and Cho (2005)	Household surveys, metropolitan level of disaggregation Years: 1997–1998 Country: South Korea	Estimation of earnings functions using the Mincer approach.	Procyclical: DWE/EWE
Paz (2009)	Permanent Household Survey Years: 2003–2007 Country: Argentina	Balanced panel estimation using probit models.	Procyclical: EWE/DWE
Gonzaga and Reis (2011)	Household surveys Years: 1991–2002 Frequency: Monthly Country: Brazil	Probabilistic model	With unemployed husbands Countercyclical: AWE/SWE Impact of changes in wages Procyclical: DWE/EWE
Hernández and Romano (2011)	Household surveys (national and urban) Years: 1987–2009 Frequency: quarterly Country: Mexico	Pseudo-panel model, cohort analysis and weighted least squares estimation.	Countercyclical: AWE/SWE
Congregado et al. (2014)	Time series data Years: 1976–2012 Frequency: quarterly Country: Spain	VEC and threshold cointegration models.	Countercyclical: AWE/SWE

(Continues)

TABLE A1 | (Continued)

Authors	Data	Econometric approach: over the period	Reaction female LFP rate
De Oliveira et al. (2014)	Household surveys Years: 2002–2013 Country: Brazil	Probabilistic model	Countercyclical: AWE/SWE
Lee and Parasnis (2014)	Panel time series data Years:1993–2008 for OECD countries and 1995–2006 for developing countries	System Generalized Method of Moments (GMM)	OECD Procyclical: DWE/EWE Developing countries Countercyclical: AWE/SWE
Addabbo et al. (2015)	EU Household surveys on income and living conditions Years: 2007–2012 Countries: Italy and Spain	Estimation of labor supply models under a probit approach.	Countercyclical: AWE/SWE for Spain Procyclical: DWE/EWE for Italy
Martinoty (2015)	Household surveys Years: 2000–2002 Country: Argentina	Linear probability model and IV estimation	Countercyclical: AWE/SWE
Gałecka-Burdziak and Pater (2016)	Time Series Years: 1994–2014 Frequency: quarterly Country: Poland	Application of filters, spectral analysis, unobserved component model approach, time-varying parameters and frequency-domain regression.	Countercyclical: AWE/SWE
Mankart and Oikonomou (2016)	Current Population Survey Years: 1980–2015 Country: United States	Linear Probability Model	Countercyclical: AWE/SWE
Bredtmann et al. (2018)	Longitudinal data from the EU Statistics on Income and Living Conditions Years: 2004–2011 Aggregate sample of 28 European countries	Probit model estimation.	Countercyclical: AWE/SWE
Cardona-Sosa et al. (2018)	Social Longitudinal Survey Years: 2007–2010 Country: Colombia	Panel data estimation and Probabilistic model	Countercyclical: AWE/SWE
Evans (2018)	Australian Bureau of Statistics time series data Years: 1986–2014 Frequency: monthly Country: Australia	Multivariate model estimation of unobserved components and application of filtering techniques.	Procyclical: DWE/EWE
Serrano et al. (2019)	Household surveys Years: 1987–2014 Countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela.	Panel data approach. Fixed effects estimation at country and population group levels.	Countercyclical: SWE/AWE

(Continues)

TABLE A1 | (Continued)

Authors	Data	Econometric approach: over the period	Reaction female LFP rate
Congregado et al. (2021a)	Time Series Years: 1995–2019 Frequency: quarterly Country: Poland	Multivariate unobserved component model and VAR models.	Negative wage income shock Countercyclical: AWE/SWE Positive job search time shock Procyclical: DWE/EWE
Ontaneda Jiménez et al. (2022)	National Survey on Employment, Unemployment and Underemployment Years: 2000–2019 Country: Ecuador	Data analysis in pseudo panels.	Countercyclical: AWE/SWE
Cammeraat et al. (2023)	Panel data Years: 1999–2015 Country: Netherlands	Differences-in-difference	Countercyclical: AWE/SWE
Maridueña-Larrea and Martín-Román (2024)	Time Series Years: 2006–2019 Frequency: quarterly Country: Brazil, Chile, Ecuador, Mexico, Peru and Uruguay.	Cointegration analysis with VAR models	Countercyclical: AWE/SWE for Brazil, Chile and Uruguay
Paternesi Meloni (2024)	Panel data Years: 1960–2019 Country: set of 33 OECD countries	SVAR methods for panel data	Procyclical: DWE/EWE

Authors	Data	Econometric approach: expansionary and recessionary cycle	Reaction Female LFP rate: Countercyclical		Reaction Female LFP rate: Procyclical	
			AWE	SWE	DWE	EWE
Darby et al. (2001)	Labor force for OECD countries Years: 1970–1995 Countries: US, France, Japan and Sweden	Seemingly Unrelated Regression estimations.	—	—	X	—
Parker and Skoufias (2004)	National Survey of Urban Employment Years: 1994–1995; 1998–1999 Frequency: quarterly Country: Mexico	Cross-sectional probit equation estimation.	X	—	—	X
Congregado et al. (2020)	Labor force survey Years: 1995–2016 Frequency: quarterly Country: Poland	Estimation of thresholds and time-varying parameters.	X	X	—	—

Abbreviations: AWE, added worker effect; DWE, discouraged worker effect; EWE, encouraged worker effect; SWE, subtracted worker effect.

Appendix B

This appendix presents the results of Model 2 for the six countries under study (Table B1).

TABLE B1 | Results of model 2 (point estimates of the rolling regression).

	Chile			Colombia			Ecuador			Mexico			Peru			Uruguay		
Period	**Coeff.**	***p*-val.**	**R^2**	**Coeff.**	***p*-val.**	**R^2**	**Coeff.**	***p*-val.**	**R^2**	**Coeff.**	***p*-val.**	**R^2**	**Coeff.**	***p*-val.**	**R^2**	**Coeff.**	***p*-val.**	**R^2**
2006Q1:2013Q3	−0.88	0.01	0.22	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.28	0.58	0.01	n.a.	n.a.	n.a.
2006Q2:2013Q4	−0.88	0.01	0.22	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.16	0.76	0.00	n.a.	n.a.	n.a.
2006Q3:2014Q1	−0.88	0.01	0.22	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.21	0.68	0.01	n.a.	n.a.	n.a.
2006Q4:2014Q2	−0.91	0.01	0.23	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.10	0.84	0.00	n.a.	n.a.	n.a.
2007Q1:2014Q3	−0.90	0.01	0.24	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.47	0.31	0.03	−0.49	0.26	0.04
2007Q2:2014Q4	−0.94	0.00	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.45	0.28	0.04	−0.57	0.26	0.04
2007Q3:2015Q1	−0.99	0.00	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.42	0.29	0.04	−0.34	0.51	0.02
2007Q4:2015Q2	−0.96	0.01	0.24	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.44	0.28	0.04	−0.31	0.55	0.01
2008Q1:2015Q3	−0.97	0.01	0.24	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.51	0.18	0.06	−0.17	0.73	0.00
2008Q2:2015Q4	−0.98	0.00	0.24	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.47	0.20	0.06	−0.06	0.89	0.00
2008Q3:2016Q1	−1.00	0.00	0.25	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.50	0.19	0.06	0.01	0.97	0.00
2008Q4:2016Q2	−1.01	0.00	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.34	0.37	0.03	0.33	0.46	0.02
2009Q1:2016Q3	−1.02	0.00	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.21	0.57	0.01	0.50	0.23	0.05
2009Q2:2016Q4	−1.07	0.00	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.19	0.61	0.01	0.57	0.15	0.07
2009Q3:2017Q1	−1.26	0.00	0.29	−0.16	0.81	0.00	n.a.	n.a.	n.a.	0.57	0.22	0.05	0.17	0.65	0.01	0.60	0.14	0.07
2009Q4:2017Q2	−1.71	0.00	0.37	−0.65	0.32	0.03	n.a.	n.a.	n.a.	0.08	0.88	0.00	0.08	0.84	0.00	0.64	0.11	0.08
2010Q1:2017Q3	−1.83	0.00	0.37	−0.85	0.07	0.11	1.40	0.01	0.21	−0.66	0.35	0.03	0.13	0.71	0.00	0.64	0.11	0.09
2010Q2:2017Q4	−1.90	0.00	0.45	−0.97	0.01	0.19	1.37	0.01	0.21	−0.86	0.25	0.05	0.15	0.67	0.01	0.63	0.12	0.08
2010Q3:2018Q1	−1.63	0.00	0.35	−0.92	0.02	0.17	1.41	0.01	0.23	−0.91	0.21	0.05	0.07	0.84	0.00	0.60	0.15	0.07
2010Q4:2018Q2	−1.09	0.00	0.25	−0.81	0.03	0.15	1.51	0.01	0.23	−0.95	0.18	0.06	0.23	0.48	0.02	0.72	0.09	0.09
2011Q1:2018Q3	−0.65	0.01	0.21	−0.87	0.02	0.17	1.47	0.01	0.21	−0.67	0.33	0.03	0.27	0.41	0.02	0.64	0.13	0.08
2011Q2:2018Q4	−0.55	0.03	0.15	−0.88	0.04	0.14	1.39	0.02	0.18	−0.58	0.40	0.02	0.42	0.20	0.06	0.91	0.04	0.14
2011Q3:2019Q1	−0.16	0.52	0.01	n.a.	n.a.	n.a.	1.29	0.03	0.16	−0.25	0.71	0.00	0.35	0.30	0.04	0.81	0.08	0.10
2011Q4:2019Q2	−0.10	0.70	0.01	n.a.	n.a.	n.a.	1.19	0.04	0.14	−0.01	0.99	0.00	0.43	0.22	0.05	0.73	0.10	0.09
2012Q1:2019Q3	−0.01	0.98	0.00	n.a.	n.a.	n.a.	1.12	0.06	0.12	0.56	0.31	0.04	0.54	0.13	0.08	0.70	0.11	0.09
2012Q2:2019Q4	0.28	0.29	0.04	n.a.	n.a.	n.a.	1.05	0.07	0.11	0.75	0.17	0.06	0.64	0.09	0.09	0.73	0.10	0.09

Notes: n.a. indicates not available. Less grey areas indicate significance up to 5%. Greyer areas indicate significance up to 10%

Appendix C

In this appendix, we present the results of Model 2 with different window sizes (Tables C1–C6). Windows of 25, 30, 35, and 40 observations were used for the six countries under study.

TABLE C1 | Results of Model 2 (point estimates) for different window sizes in Chile.

Window size: 25			Window size: 30			Window size: 35			Window size: 40		
Period	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2
2009Q4:2012Q2	−0.92***	0.26									
2010Q1:2012Q3	−0.86**	0.24									
2010Q2:2012Q4	−0.85**	0.23									
2010Q3:2013Q1	−0.88**	0.23									
2010Q4:2013Q2	−0.88**	0.23									
2011Q1:2013Q3	−0.92**	0.24	2008Q3:2013Q3	−0.88***	0.22						
2011Q2:2013Q4	−0.98***	0.26	2008Q4:2013Q4	−0.88***	0.22						
2011Q3:2014Q1	−0.99***	0.27	2009Q1:2014Q1	−0.88***	0.22						
2011Q4:2014Q2	−1.01***	0.28	2009Q2:2014Q2	−0.91***	0.23						
2012Q1:2014Q3	−1.01***	0.28	2009Q3:2014Q3	−0.9***	0.24						
2012Q2:2014Q4	−1.04***	0.30	2009Q4:2014Q4	−0.94***	0.26	2007Q2:2014Q4	−0.9***	0.24			
2012Q3:2015Q1	−1.02***	0.27	2010Q1:2015Q1	−0.99***	0.26	2007Q3:2015Q1	−0.89***	0.22			
2012Q4:2015Q2	−1***	0.25	2010Q2:2015Q2	−0.96***	0.24	2007Q4:2015Q2	−0.87***	0.21			
2013Q1:2015Q3	−1.04***	0.25	2010Q3:2015Q3	−0.97***	0.24	2008Q1:2015Q3	−0.88***	0.21			
2013Q2:2015Q4	−1.23***	0.27	2010Q4:2015Q4	−0.98***	0.24	2008Q2:2015Q4	−0.88***	0.21			
2013Q3:2016Q1	−1.7***	0.35	2011Q1:2016Q1	−1***	0.25	2008Q3:2016Q1	−0.91***	0.22	2006Q1:2016Q1	−0.88***	0.21
2013Q4:2016Q2	−1.75***	0.35	2011Q2:2016Q2	−1.01***	0.26	2008Q4:2016Q2	−0.97***	0.24	2006Q2:2016Q2	−0.88***	0.21
2014Q1:2016Q3	−1.89***	0.44	2011Q3:2016Q3	−1.02***	0.26	2009Q1:2016Q3	−0.98***	0.25	2006Q3:2016Q3	−0.89***	0.22
2014Q2:2016Q4	−1.7***	0.37	2011Q4:2016Q4	−1.07***	0.26	2009Q2:2016Q4	−0.99***	0.24	2006Q4:2016Q4	−0.9***	0.22
2014Q3:2017Q1	−1.17***	0.28	2012Q1:2017Q1	−1.26***	0.29	2009Q3:2017Q1	−1***	0.25	2007Q1:2017Q1	−0.91***	0.22
2014Q4:2017Q2	−0.73***	0.30	2012Q2:2017Q2	−1.71***	0.37	2009Q4:2017Q2	−1.02***	0.25	2007Q2:2017Q2	−0.94***	0.22
2015Q1:2017Q3	−0.59**	0.22	2012Q3:2017Q3	−1.83***	0.37	2010Q1:2017Q3	−1.03***	0.25	2007Q3:2017Q3	−0.99***	0.24
2015Q2:2017Q4	−0.2	0.03	2012Q4:2017Q4	−1.9***	0.45	2010Q2:2017Q4	−1.03***	0.26	2007Q4:2017Q4	−1***	0.24

(Continues)

TABLE C1 | (Continued)

Window size: 25			Window size: 30			Window size: 35			Window size: 40		
Period	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2
2015Q3:2018Q1	−0.07	0.00	2013Q1:2018Q1	−1.63***	0.35	2010Q3:2018Q1	−1.07***	0.25	2008Q1:2018Q1	−0.99***	0.24
2015Q4:2018Q2	0.04	0.00	2013Q2:2018Q2	−1.09***	0.25	2010Q4:2018Q2	−1.25***	0.28	2008Q2:2018Q2	−1***	0.24
2016Q1:2018Q3	0.36	0.07	2013Q3:2018Q3	−0.65***	0.21	2011Q1:2018Q3	−1.67***	0.35	2008Q3:2018Q3	−1.01***	0.24
2016Q2:2018Q4	0.3	0.05	2013Q4:2018Q4	−0.55**	0.15	2011Q2:2018Q4	−1.79***	0.36	2008Q4:2018Q4	−1.03***	0.25
2016Q3:2019Q1	0.62*	0.13	2014Q1:2019Q1	−0.16	0.01	2011Q3:2019Q1	−1.87***	0.43	2009Q1:2019Q1	−1.02***	0.24
2016Q4:2019Q2	0.61*	0.12	2014Q2:2019Q2	−0.1	0.01	2011Q4:2019Q2	−1.65***	0.36	2009Q2:2019Q2	−1.07***	0.25
2017Q1:2019Q3	0.46	0.07	2014Q3:2019Q3	−0.01	0.00	2012Q1:2019Q3	−1.11***	0.25	2009Q3:2019Q3	−1.26***	0.27
2017Q2:2019Q4	0.53	0.10	2014Q4:2019Q4	0.28	0.04	2012Q2:2019Q4	−0.67***	0.21	2009Q4:2019Q4	−1.68***	0.35

Note: Significance is expressed as follows: *$p<0.10$, **$p<0.05$, ***$p<0.01$.

TABLE C2 | Results of Model 2 (point estimates) for different window sizes in Colombia.

Window size: 25			Window size: 30			Window size: 35		
Period	Coeff.	R^2	Period	Coeff.	R^2	Period	Coeff.	R^2
2013Q2:2015Q4	0.5	0.02						
2013Q3:2016Q1	−0.13	0.00						
2013Q4:2016Q2	−0.47	0.03						
2014Q1:2016Q3	−0.77*	0.11						
2014Q2:2016Q4	−0.81*	0.13						
2014Q3:2017Q1	−0.68	0.11	2012Q1:2017Q1	−0.16	0.00			
2014Q4:2017Q2	−0.74*	0.12	2012Q2:2017Q2	−0.65	0.03			
2015Q1:2017Q3	−0.72	0.10	2012Q3:2017Q3	−0.85*	0.11			
2015Q2:2017Q4	−0.77*	0.11	2012Q4:2017Q4	−0.97**	0.19			
2015Q3:2018Q1	−0.77	0.10	2013Q1:2018Q1	−0.92**	0.17			
2015Q4:2018Q2	−0.7	0.08	2013Q2:2018Q2	−0.81**	0.15	2010Q4:2018Q2	−0.43	0.02
2016Q1:2018Q3	−0.63	0.08	2013Q3:2018Q3	−0.87**	0.17	2011Q1:2018Q3	−0.88	0.06
2016Q2:2018Q4	−0.56	0.09	2013Q4:2018Q4	−0.88**	0.14	2011Q2:2018Q4	−1.05**	0.16

Note: Significance is expressed as follows: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE C3 | Results of Model 2 (point estimates) for different window sizes in Ecuador.

Window size: 25			Window size: 30			Window size: 35		
Period	Coeff.	R^2	Period	Coeff.	R^2	Period	Coeff.	R^2
2013Q4:2016Q2	1.36**	0.18						
2014Q1:2016Q3	1.51**	0.23						
2014Q2:2016Q4	1.55***	0.26						
2014Q3:2017Q1	1.61***	0.27						
2014Q4:2017Q2	1.5**	0.23						
2015Q1:2017Q3	1.34**	0.19	2012Q3:2017Q3	1.4***	0.21			
2015Q2:2017Q4	1.26**	0.18	2012Q4:2017Q4	1.37***	0.21			
2015Q3:2018Q1	1.18**	0.15	2013Q1:2018Q1	1.41***	0.23			
2015Q4:2018Q2	1.36**	0.16	2013Q2:2018Q2	1.51***	0.23			
2016Q1:2018Q3	1.39**	0.18	2013Q3:2018Q3	1.47***	0.21			
2016Q2:2018Q4	1.76***	0.26	2013Q4:2018Q4	1.39**	0.18	2011Q2:2018Q4	1.4***	0.19
2016Q3:2019Q1	1.96***	0.28	2014Q1:2019Q1	1.29**	0.16	2011Q3:2019Q1	1.34***	0.18
2016Q4:2019Q2	2.03***	0.29	2014Q2:2019Q2	1.19**	0.14	2011Q4:2019Q2	1.35***	0.19
2017Q1:2019Q3	1.75**	0.23	2014Q3:2019Q3	1.12*	0.12	2012Q1:2019Q3	1.26**	0.17
2017Q2:2019Q4	1.67**	0.21	2014Q4:2019Q4	1.05*	0.11	2012Q2:2019Q4	1.15**	0.14

Note: Significance is expressed as follows: *$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

TABLE C4 | Results of Model 2 (point estimates) for different window sizes in Mexico.

Window size: 25			Window size: 30			Window size: 35		
Period	Coeff.	R^2	Period	Coeff.	R^2	Period	Coeff.	R^2
2013Q2:2015Q4	0.53	0.04						
2013Q3:2016Q1	−0.07	0.00						
2013Q4:2016Q2	−1.28	0.10						
2014Q1:2016Q3	−1.55*	0.13						
2014Q2:2016Q4	−1.36	0.11						
2014Q3:2017Q1	−1.39*	0.12	2012Q1:2017Q1	0.57	0.05			
2014Q4:2017Q2	−1.02	0.08	2012Q2:2017Q2	0.08	0.00			
2015Q1:2017Q3	−0.74	0.04	2012Q3:2017Q3	−0.66	0.03			
2015Q2:2017Q4	−0.67	0.03	2012Q4:2017Q4	−0.86	0.05			
2015Q3:2018Q1	−0.7	0.04	2013Q1:2018Q1	−0.91	0.05			
2015Q4:2018Q2	−0.24	0.01	2013Q2:2018Q2	−0.95	0.06	2010Q4:2018Q2	0.67	0.07
2016Q1:2018Q3	−0.14	0.00	2013Q3:2018Q3	−0.67	0.03	2011Q1:2018Q3	0.22	0.01
2016Q2:2018Q4	0.23	0.01	2013Q4:2018Q4	−0.58	0.02	2011Q2:2018Q4	−0.54	0.02
2016Q3:2019Q1	0.51	0.03	2014Q1:2019Q1	−0.25	0.00	2011Q3:2019Q1	−0.43	0.01
2016Q4:2019Q2	0.8	0.08	2014Q2:2019Q2	−0.01	0.00	2011Q4:2019Q2	−0.19	0.00
2017Q1:2019Q3	0.98*	0.13	2014Q3:2019Q3	0.56	0.04	2012Q1:2019Q3	−0.01	0.00
2017Q2:2019Q4	1.38**	0.20	2014Q4:2019Q4	0.75	0.06	2012Q2:2019Q4	0.3	0.01

Note: Significance is expressed as follows: *$p<0.10$, **$p<0.05$, ***$p<0.01$.

TABLE C5 | Results of Model 2 (point estimates) for different window sizes in Peru.

Window size: 25			Window size: 30			Window size: 35			Window size: 40		
Period	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2
2009Q4:2012Q2	0.27	0.01									
2010Q1:2012Q3	0.07	0.00									
2010Q2:2012Q4	−0.13	0.00									
2010Q3:2013Q1	0.04	0.00									
2010Q4:2013Q2	0.38	0.02									
2011Q1:2013Q3	0.35	0.02	2008Q3:2013Q3	0.28	0.01						
2011Q2:2013Q4	0.31	0.02	2008Q4:2013Q4	0.16	0.00						
2011Q3:2014Q1	0.45	0.04	2009Q1:2014Q1	0.21	0.01						
2011Q4:2014Q2	0.62	0.08	2009Q2:2014Q2	0.1	0.00						
2012Q1:2014Q3	0.63	0.09	2009Q3:2014Q3	0.47	0.03						
2012Q2:2014Q4	0.61	0.08	2009Q4:2014Q4	0.45	0.04	2007Q2:2014Q4	0.34	0.02			
2012Q3:2015Q1	0.51	0.05	2010Q1:2015Q1	0.42	0.04	2007Q3:2015Q1	0.24	0.01			
2012Q4:2015Q2	0.4	0.04	2010Q2:2015Q2	0.44	0.04	2007Q4:2015Q2	0.21	0.01			
2013Q1:2015Q3	0.25	0.02	2010Q3:2015Q3	0.51	0.06	2008Q1:2015Q3	0.07	0.00			
2013Q2:2015Q4	0.23	0.01	2010Q4:2015Q4	0.47	0.06	2008Q2:2015Q4	0.35	0.02			
2013Q3:2016Q1	0.19	0.01	2011Q1:2016Q1	0.5	0.06	2008Q3:2016Q1	0.37	0.03	2006Q1:2016Q1	0.26	0.01
2013Q4:2016Q2	0.2	0.01	2011Q2:2016Q2	0.34	0.03	2008Q4:2016Q2	0.33	0.03	2006Q2:2016Q2	0.13	0.00
2014Q1:2016Q3	0.22	0.02	2011Q3:2016Q3	0.21	0.01	2009Q1:2016Q3	0.32	0.02	2006Q3:2016Q3	0.07	0.00
2014Q2:2016Q4	0.17	0.01	2011Q4:2016Q4	0.19	0.01	2009Q2:2016Q4	0.45	0.05	2006Q4:2016Q4	0.03	0.00
2014Q3:2017Q1	0.25	0.03	2012Q1:2017Q1	0.17	0.01	2009Q3:2017Q1	0.4	0.04	2007Q1:2017Q1	0.29	0.02
2014Q4:2017Q2	0.24	0.03	2012Q2:2017Q2	0.08	0.00	2009Q4:2017Q2	0.39	0.04	2007Q2:2017Q2	0.29	0.02
2015Q1:2017Q3	0.39	0.05	2012Q3:2017Q3	0.13	0.00	2010Q1:2017Q3	0.27	0.02	2007Q3:2017Q3	0.28	0.02
2015Q2:2017Q4	0.26	0.02	2012Q4:2017Q4	0.15	0.01	2010Q2:2017Q4	0.13	0.00	2007Q4:2017Q4	0.26	0.01
2015Q3:2018Q1	0.23	0.02	2013Q1:2018Q1	0.07	0.00	2010Q3:2018Q1	0.09	0.00	2008Q1:2018Q1	0.36	0.03
2015Q4:2018Q2	0.45	0.05	2013Q2:2018Q2	0.23	0.02	2010Q4:2018Q2	0.14	0.00	2008Q2:2018Q2	0.36	0.03
2016Q1:2018Q3	0.62	0.09	2013Q3:2018Q3	0.27	0.02	2011Q1:2018Q3	0.11	0.00	2008Q3:2018Q3	0.4	0.03
2016Q2:2018Q4	0.6	0.08	2013Q4:2018Q4	0.42	0.06	2011Q2:2018Q4	0.16	0.01	2008Q4:2018Q4	0.3	0.02
2016Q3:2019Q1	0.59	0.08	2014Q1:2019Q1	0.35	0.04	2011Q3:2019Q1	0.22	0.01	2009Q1:2019Q1	0.2	0.01
2016Q4:2019Q2	0.75*	0.14	2014Q2:2019Q2	0.43	0.05	2011Q4:2019Q2	0.23	0.01	2009Q2:2019Q2	0.23	0.01
2017Q1:2019Q3	0.48	0.05	2014Q3:2019Q3	0.54	0.08	2012Q1:2019Q3	0.31	0.03	2009Q3:2019Q3	0.21	0.01
2017Q2:2019Q4	0.54	0.06	2014Q4:2019Q4	0.64*	0.09	2012Q2:2019Q4	0.31	0.03	2009Q4:2019Q4	0.15	0.00

Note: Significance is expressed as follows: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

TABLE C6 | Results of Model 2 (point estimates) for different window sizes in Uruguay.

Window size: 25			Window size: 30			Window size: 35			Window size: 40		
Period	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2	**Period**	**Coeff.**	R^2
2010Q4:2013Q2	−0.67*	0.11									
2011Q1:2013Q3	−0.74	0.08									
2011Q2:2013Q4	−0.52	0.03									
2011Q3:2014Q1	−0.51	0.03									
2011Q4:2014Q2	−0.09	0.00									
2012Q1:2014Q3	0.02	0.00	2009Q3:2014Q3	−0.49	0.04						
2012Q2:2014Q4	0.06	0.00	2009Q4:2014Q4	−0.57	0.04						
2012Q3:2015Q1	0.66	0.04	2010Q1:2015Q1	−0.34	0.02						
2012Q4:2015Q2	0.82	0.07	2010Q2:2015Q2	−0.31	0.01						
2013Q1:2015Q3	0.54	0.04	2010Q3:2015Q3	−0.17	0.00						
2013Q2:2015Q4	0.59	0.06	2010Q4:2015Q4	−0.06	0.00	2008Q2:2015Q4	−0.4	0.04			
2013Q3:2016Q1	0.53	0.06	2011Q1:2016Q1	0.01	0.00	2008Q3:2016Q1	−0.38	0.03			
2013Q4:2016Q2	0.55	0.06	2011Q2:2016Q2	0.33	0.02	2008Q4:2016Q2	−0.25	0.01			
2014Q1:2016Q3	0.54	0.06	2011Q3:2016Q3	0.5	0.05	2009Q1:2016Q3	−0.23	0.01			
2014Q2:2016Q4	0.63	0.08	2011Q4:2016Q4	0.57	0.07	2009Q2:2016Q4	0.03	0.00			
2014Q3:2017Q1	0.71	0.10	2012Q1:2017Q1	0.6	0.07	2009Q3:2017Q1	0.02	0.00	2007Q1:2017Q1	−0.36	0.04
2014Q4:2017Q2	0.57	0.06	2012Q2:2017Q2	0.64	0.08	2009Q4:2017Q2	0.16	0.00	2007Q2:2017Q2	−0.29	0.02
2015Q1:2017Q3	0.83*	0.13	2012Q3:2017Q3	0.64	0.09	2010Q1:2017Q3	0.44	0.04	2007Q3:2017Q3	−0.15	0.00
2015Q2:2017Q4	0.84*	0.12	2012Q4:2017Q4	0.63	0.08	2010Q2:2017Q4	0.6	0.07	2007Q4:2017Q4	−0.12	0.00
2015Q3:2018Q1	0.76	0.10	2013Q1:2018Q1	0.6	0.07	2010Q3:2018Q1	0.55	0.06	2008Q1:2018Q1	0.01	0.00
2015Q4:2018Q2	0.84*	0.13	2013Q2:2018Q2	0.72*	0.09	2010Q4:2018Q2	0.61	0.07	2008Q2:2018Q2	0.06	0.00
2016Q1:2018Q3	0.93**	0.16	2013Q3:2018Q3	0.64	0.08	2011Q1:2018Q3	0.67*	0.09	2008Q3:2018Q3	0.22	0.01
2016Q2:2018Q4	0.95**	0.16	2013Q4:2018Q4	0.91**	0.14	2011Q2:2018Q4	0.69*	0.09	2008Q4:2018Q4	0.5	0.04
2016Q3:2019Q1	0.82*	0.11	2014Q1:2019Q1	0.81*	0.10	2011Q3:2019Q1	0.61	0.07	2009Q1:2019Q1	0.59	0.06
2016Q4:2019Q2	0.67	0.09	2014Q2:2019Q2	0.73	0.09	2011Q4:2019Q2	0.59	0.06	2009Q2:2019Q2	0.54	0.05
2017Q1:2019Q3	0.73	0.11	2014Q3:2019Q3	0.7	0.09	2012Q1:2019Q3	0.61	0.07	2009Q3:2019Q3	0.52	0.05
2017Q2:2019Q4	0.66	0.08	2014Q4:2019Q4	0.73*	0.09	2012Q2:2019Q4	0.48	0.04	2009Q4:2019Q4	0.53	0.05

Note: Significance is expressed as follows: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Appendix D

In this appendix, we present the seasonally adjusted unemployment series along with their estimated trends and cyclical components obtained using the Hodrick and Prescott (1997) (HP) filter for the six countries analyzed. A $\lambda = 1.600$ was applied following the recommendations of Hodrick and Prescott (1997) for quarterly data. The time series used are seasonally adjusted using the EViews 10 software with the Census X-12 seasonal adjustment method.

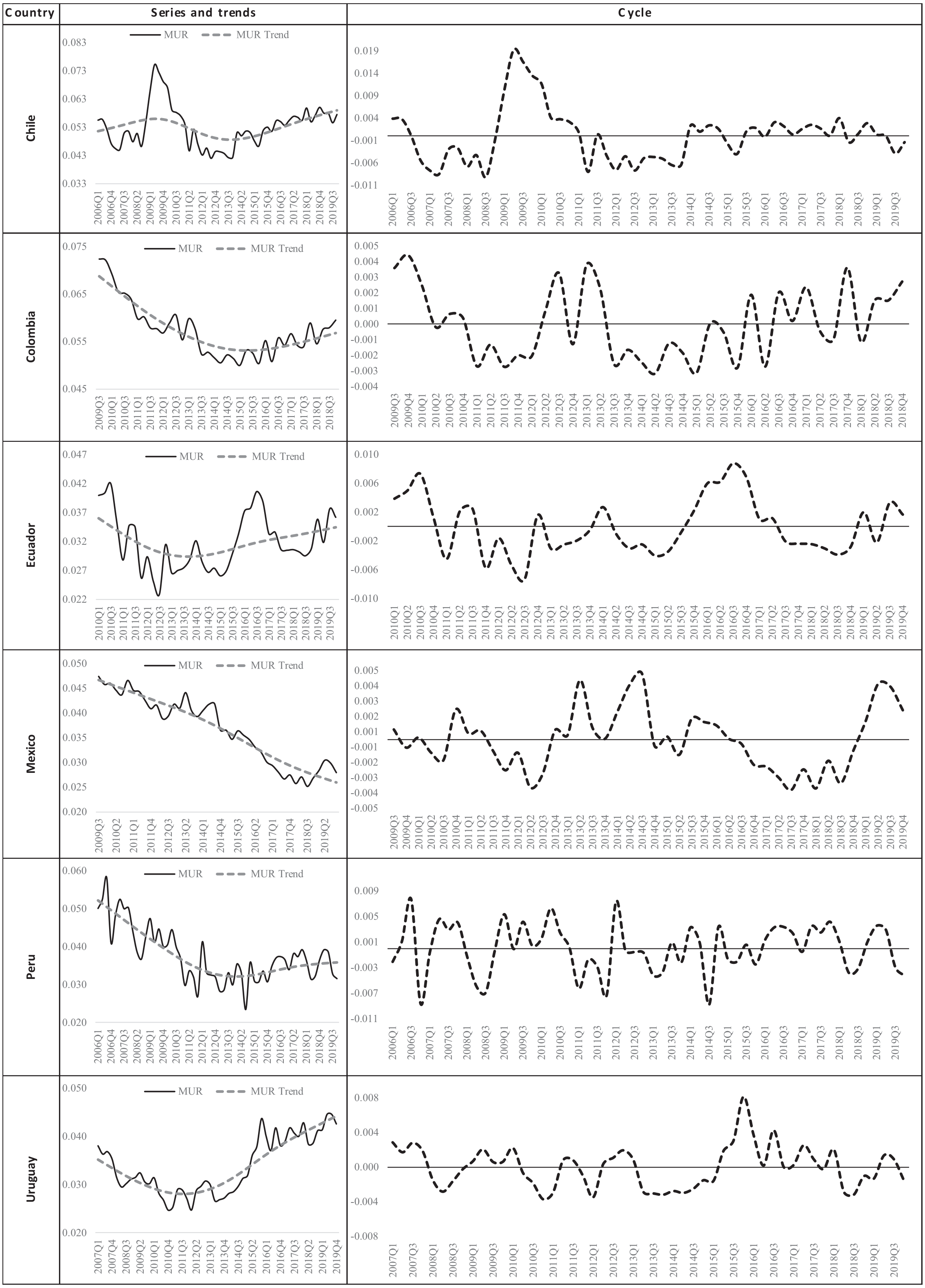

FIGURE D1 | Cycle of the MUR by country.
Source: CEDLAS (2022). Own elaboration.