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Inflation and the Current Account in the Euro Area

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The euro area current account was on average in balance over 1999-2010 period, while the average rate of inflation was close to the ECB target. In contrast, the post-2011 increase in the euro area current account surplus has been accompanied by a period of low inflation. This paper suggests that observed low inflation can be partly explained by the surplus in the external balance. I propose a version of an open-economy inflation Phillips curve showing that, in addition to output gap and inflationary expectations, inflation is also shaped by the trade balance. At an empirical level, I find a statistically significant and negative correlation between the two variables.

Introduction

From 2001 to 2010 the average inflation rate and the current account balance as a share of GDP for the euro area stood at 2.1 and -0.1 percent respectively. After 2011, average inflation stood at 1.3 percent, despite substantial monetary stimulus by the European Central Bank (ECB) and the significant decline in unemployment. Over the same period, the current account of the euro area increased from an approximate balance in 2011 to about 3 percent share of GDP at the end of 2018. This paper shows that low inflation in the euro area over the recent years can be partly explained by a persistent surplus in the external balance.

Most commonly, the dynamics of inflation are studied in a New-Keynesian style Phillips curve framework. This setup yields a forward looking equation linking current inflation to future inflationary expectations and a measure of slack in the economy (Galí 2015, Galí and Gertler 1999, Galí and Monacelli 2005).[2] With the empirical evidence in favour of the Phillips curve, recent findings point to a reduced sensitivity of inflation with respect to economic slack (IMF 2013, Blanchard et al 2015, Blanchard 2018). Furthermore, the chang-

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[2]The setup is based on a time-dependent price setting of Calvo [1983]. In contrast, in a state-dependent setting price adjustment occurs only for firms further away from the optimal price, with more firms adjusting prices in a higher inflationary environment (Gertler and Leahy 2008). Accordingly, the behaviour of prices in this framework is more flexible compared to the time-dependent pricing models. Among other approaches, Rotemberg [1982] framework is based on quadratic costs of price changes that give rise to a relation between the current inflation, expected inflation and economic activity. Mankiw and Reis [2002], assuming that some firm-level decisions are based on outdated information, derive a Phillips curve that is characterised with expectations of current variables that are based on the past information set.

ing slope of the curve falls short of explaining the post-crisis dynamics of inflation.

One reason for an inadequate performance of the standard Phillips curve, particularly in the context of the euro area, is that of an omitted variable. For instance, Ferrero, Gertler and Svensson [2010] propose a framework where, conditional on economic slack and inflationary expectations, a trade surplus is associated with lower marginal costs in the tradable goods sector. The latter, in turn, generates lower tradable inflation.[3] Working through relative sectoral demand, nontradable inflation declines as well. Accordingly, an improvement in the trade balance results in lower aggregate inflation.[4]

Building on Ferrero, Gertler and Svensson [2010], the evidence presented in this paper proposes the emergence of the euro area external surplus as a source of low inflation. In particular, a one percentage point higher trade balance to GDP ratio is associated with 40 basis points lower price inflation in a bivariate specification. Imposing further controls, a one percentage point higher trade balance to GDP ratio, on average, yields 16 basis points lower annualised inflation. Empirical evidence in favour of a nonlinear Phillips curve is also provided. Accordingly, I conclude that the low inflation and the current account surplus for the euro area are likely to disappear simultaneously.

The rest of the paper is structured as follows. Section 2 presents the analytical framework. Section 3 describes the data, while in Section 4 I discuss the empirical findings and potential implications of the results. Finally, Section 5 presents the results for the euro area panel, while Section 6 concludes.

Analytical Framework

The Phillips curve

The framework presented in this subsection is taken from Ferrero, Gertler and Svensson [2010]. There are two countries, with representative households consuming tradable and nontradable consumption goods. Tradable consumption, in turn, is a composite of home and foreign produced goods. There is home bias in consumption of tradables. Current account imbalances arise due to differences in productivity and savings, with the latter being driven by preference shocks.[5]

Households in each country consist of a continuum of workers, who are employed in the intermediate goods sector producing a differentiated tradable or nontradable good. Labor markets are local, with each worker supplying specialised skills to an intermediate good

[3] For the authors, the primary purpose of the model is the study of the US current account rebalancing.

[4] In general, it is reasonable to expect that in open economies inflation would respond to domestic absorption. In the methodological part of the paper I show that the Phillips curve is approximately linked to domestic absorption, with lower absorption yielding lower inflation.

[5] For the authors, the purpose of the model is to explain the US current account rebalancing and its implications for monetary policy. They consider two rebalancing scenarios: "slow burn" and "fast burn". In the first case there are no shocks and the adjustment occurs gradually, while in the second case the reversal of the current account is engineered by a revision in expected productivity.

producing firm. As is standard, each firm is a monopolistic competitor that sets prices optimally conditional on a resetting probability. While international financial markets are incomplete, intranational perfect risk sharing is assumed at a country level.

For the purpose of the current paper, I present some of the equations derived by the authors. Real domestic output is a linear combination of home tradable and nontradable output:

$$y_t = \gamma y_{Ht} + (1-\gamma) y_{Nt} \tag{1}$$

where lower case letters denote log-deviations from the steady state, $\gamma < 1$ is the weight of the tradable good in home consumption basket, while y_{Ht} and y_{Nt} represent home tradable and nontradable output respectively.

Log-linearisation of a sectoral price setting equation, combined with labour supply and demand, as well as sectoral equilibrium conditions results in a sector-specific Phillips curve. In particular, inflation in the tradable goods sector is expressed as:

$$\pi_{Ht} = \kappa(y_{Ht} - y_{Ht}^0) - \frac{\kappa}{1+\varphi}(nx_t - nx_t^0) + \beta E_t \pi_{H,t+1} \tag{2}$$

where π_{Ht} is inflation in the tradable goods sector, nx are net exports and zero superscripts denote flexible-price equilibrium values. Inflation in the nontradable sector is given by:

$$\pi_{Nt} = \kappa(y_{Nt} - y_{Nt}^0) + \beta E_t \pi_{N,t+1} \tag{3}$$

Finally, conditional on import price inflation, the aggregate inflation is a function of price changes in domestic tradable and nontradable sectors:

$$\pi_t = \gamma \pi_{Ht} + (1-\gamma)\pi_{Nt} + \mu \Delta \tau_t \tag{4}$$

where $\mu > 0$ and $\Delta\tau$ measures import price inflation.

Combining equations (1)-(4) results in:

$$\pi_t = \kappa(y_t - y_t^0) + \beta E_t \pi_{t+1} - \frac{\gamma\kappa}{1+\varphi}(nx_t - nx_t^0) + \mu\Delta\tau_t - \beta\mu E_t \Delta\tau_{t+1} \tag{5}$$

Equation (5) is a version of an open-economy inflation Phillips curve. The first two terms of the equation, in analogy with the standard closed-economy Phillips curve, suggests that inflation depends on the current output gap and expectations of future inflation.

The equation, however, also points to a negative link between the trade balance (as a share of the steady state tradable output) and inflation. In the model, the trade balance is partly linked to aggregate activity through its impact on sectoral consumption demands in each country. Conditional on the level of domestic tradable output, a higher trade surplus is associated with lower domestic absorption. Alternatively, a decline in domestic absorption that is engineered by a preference shock, for a given level of domestic tradable output, results in a trade surplus. This lower domestic absorption, working through the labor market,

pushes down the marginal cost and tradable price inflation. Hence, a trade surplus is associated with lower marginal cost and lower inflation in the tradable goods sector.

While the trade balance does not directly enter the nontradable Phillips curve, it still affects nontradable inflation. Through the sectoral relative price equation, demand for nontradables declines, resulting in lower inflation in the sector. Hence, a larger trade surplus results in lower overall inflation. It is important to observe that the linear combination of the output gap and the net export gap is a proxy for an absorption gap, whereby absorption is positively linked to the level of inflation. Finally, import price inflation enters the equation both contemporaneously and in expectations.

The Phillips curve

In line with equation (5), I estimate the following econometric specification

$$\begin{aligned}\pi_t = \quad & \gamma_1 tby_t + \gamma_2 ur_t + \gamma_3 E_t\pi_{t+s} + \gamma_4 \pi_t^{imp} \\ & + \gamma_5 ur_t^2 + \gamma_6 A_t + \gamma_7 \pi_{t-1} + u_t\end{aligned}$$

where π_t is a measure of inflation, while tby_t denotes the trade balance to GDP ratio. I consider two main specifications. In the first instance, the dependent variable is the quarter-on-quarter change in domestic HICP index, while in the second case π_t captures wage inflation.[6]

Due to the statistical challenges in measuring the output gap, I use the unemployment rate (ur_t) as a proxy for the latter. Finally, $E_t\pi_{t+s}$ and π_t^{imp} capture long-term inflationary expectations and import price inflation respectively. In alternative specifications, I include the square of the unemployment rate to allow for a nonlinearity in the Phillips curve. Changes in labor productivity (A_t) and lagged dependent variable are also included in variations to the benchmark equation.

Data

All series are sourced from Eurostat, and cover the period 1999Q1 to 2018Q4. The quarter-on-quarter change in the quarterly harmonised index of consumer prices (HICP) measures inflation. Labor compensation per employee is measured by the ratio between the nominal compensation of employees and the number of employees. The former is defined as total remuneration payments from employers to employees including wages, salaries, as well as employers' social contributions. Quarterly data on the trade balance are compiled by national authorities according to the sixth edition of the Balance of Payments Manual (BPM6).

[6] I have also estimated specifications with the current account instead of the trade balance. The results, available upon request, are very similar. This should be unsurprising, give the tight link between the euro area trade balance and the current account.

Finally, growth rate of labor productivity is measured by the change in real labor productivity per person (real GDP per person employed). Seasonality in all of the quarterly series is removed using the U.S. Census Bureau's X-13 seasonal adjustment procedure.

Figure 1 depicts the dynamics of headline inflation and the current account as a share of GDP for the euro area between 1999 and 2018. The rate of inflation was close to the ECB inflation target of close to but below 2 percent for most years before the onset of the Global Financial Crisis in 2008. Then inflation plummeted to levels close to zero. The subsequent recovery of inflation towards target levels was reversed in 2012 and remained subdued until 2017 when price growth picked up again. A measure of inflation excluding food and energy sectors is still to recover.

Turning to the current account, levels close to balance observed for the period before 2011 were interrupted by dips into negative territory during the inception of the euro area, and in 2008 when the euro area ran temporary current account deficits of around 1.5 percent. Post-2011, the current account turned positive reaching levels of more than 3 percent of GDP in the most recent years.

In general, there is a visibly negative relation between the current account and inflation, with the current account turning negative during upticks in inflation in 2000 and 2008, and rising to sustained positive levels during the period of low average inflation after 2012.

Euro Area Results

Econometric evidence

Table 1 presents the results from bivariate regressions.[7] Price and wage inflation are statistically and negatively correlated with both measures of the external balance. In particular, a one percentage point higher trade balance to GDP ratio is associated with 40 basis points lower price inflation. The same improvement in the trade balance results in lower wage inflation by 26 basis points.

Table 2 presents the results for the inflation Phillips curve. Column (1) presents the results from the standard specification without the trade balance, while column (2) presents those of the benchmark specification. In turn, columns (3)-(5) provide some extentions. Starting with the prime variables of interest, inflation and the trade balance are negatively correlated at conventional levels of statistical significance. Conditional on other controls, a one percentage point higher trade balance to GDP ratio, on average, yields 16 basis points lower annualised inflation. This result is in line with the proposed hypothesis of equation (5) that, conditional on a set of controls, trade surpluses are associated with periods of low inflation.

Table 2 also provides evidence on the negative relation between the unemployment rate and inflation in the euro area. In the benchmark specification in column (2), a one percent-

[7] See Pesaran and Smith [2014] on the value of bivariate regressions.

age point drop in the unemployment rate is associated with 28 basis point higher inflation rate. There is some evidence that this relation is nonlinear, since the quadratic term included in the regression is positive and marginally significant. In addition, columns (1) and (2) suggest that the aforementioned underspecification has little statistical bearing on the slope of the Philiips curve. Finally, imported inflation has a significantly positive effect on inflation, while neither long-term inflationary expectations nor productivity are statistically significant.

Figure 2 plots the dynamics of fitted annualised inflation from three competing specifications. In the standard case, labelled "Fitted: col (1)", the fitted values are based on the specification from column (1) of Table 2. The line labelled "Fitted: col (1) + tby", adds the trade balance to GDP ratio as an additional regressor to the specification from column (1). Finally, the benchmark fit ("Fitted: col (2)") is based on the specification from column (2). Over 2012-2014 period, the in-sample inflation forecast from the standard specification seems to be marginally higher than the benchmark forecast. Post-2014, the benchmark in-sample forecast outperforms the alternative by a visible margin. Furthermore, while the addition of the trade balance improves the fit of the low-frequency component of inflation, import price inflation shows a non-negligible association with the high-frequency moves of headline inflation.

Turning to wage inflation results in Table 3, trade balance, while negative across all columns, is statistically significant at conventional levels in only two specifications. The estimates provide stronger evidence in favour of a nonlinear wage Phillips curve, with approximately similar levels of magnitude as in the case of price inflation. In contrast to price inflation estimates, labor productivity growth has significantly positive effect on wage inflation: a one percentage point higher growth rate in labor productivity yields to 63 basis points higher wage inflation. Finally, while import prices have a positive impact on domestic wages, the coefficient on long-term inflationary expectations is statistically insignificant.[8]

Implications

The evidence presented in this paper suggests that low inflation in the euro area over the recent years can be partly explained by the surplus in the external balance. Based on bivariate regressions, a balancing of external trade suggests a rate of inflation higher by 120 basis points. Conditional on further controls, the same rebalancing shows a rate of inflation higher by 80 basis points.

Turning to rebalancing, Galstyan [2019a] finds that the primary culprit to the euro area current account surplus are corporates followed by the government sector. In a follow-up paper, Galstyan [2019b] points to likely temporary factors in shaping the euro area external imbalances, with corporate profits contributing to the accumulation of foreign assets. Furthermore, the paper implies that lack of upward wage pressures in the euro area tends to further expand the current account surplus. A combination of all these findings suggests

[8] Regressions with the current account balance yield similar results. These are available upon request.

that the euro area current account surplus could unwind with a redistribution of income from corporate profits to labor income. The redistribution could be directly reflected in higher wages paid, or increased investment and higher demand for labor and, consequently, higher aggregate compensation of employees.[9] Finally, the same redistribution of income is expected to put an upward pressure on wages, raising the euro area rate of inflation.[10]

Extensions: Euro Area Panel

As a further robustness test, this section addresses the link between the trade balance and inflation in a panel of euro area countries. Before turning to the econometric evidence it is instructive to observe the cross-sectional correlation between the average current account to GDP ratio and inflation for individual euro area member states presented in Figure 3. The negative relation between the current account and inflation suggested in Figure 1 is also evident in the cross-section. Countries which ran current account surpluses on average during 1999 to 2018 tend to have experienced lower levels of average inflation. For example, while Germany averaged a current account surplus of 5 percent of GDP during the period under consideration, it also experienced subdued average levels of inflation of around 1.5 percent. This contrasts with countries like Spain which ran a current account deficit of 3 percent of GDP on average and inflation rates above 2 percent.

Table 4 presents the results of panel regressions. In columns (1) and (2) the dependent variable is price inflation, while in columns (3) and (4) the dependent variable is wage inflation. Furthermore, columns (1) and (3) refer to specifications with country fixed effects, while columns (2) and (4) refer to specifications without country fixed effects. All specifications include time fixed effects to control for factors that are common to all euro area member states, such as monetary policy, common inflationary expectations, global inflation etc.

In the panel of euro area countries, both price and wage inflation are negatively associated with the trade balance at conventional levels of statistical significance. While lower unemployment rate still transmits into higher inflation, the evidence in favour of a nonlinear relation is absent. Finally, the coefficient on the labor productivity is positive and statistically significant in wage regressions only.

[9] The evidence presented in Galstyan [2019a] suggests that a higher level of public spending could also aid in a reduction of the euro area current account surplus.

[10] The recent increase in wages has yet to result in inflationary buildup. In a simple bivariate threshold regression, with the unemployment rate being the threshold variable, I find that the wage-inflation passthrough is nonlinear, and is conditional on the stage of the cycle. In particular, for unemployment rate below the estimated threshold of 8.4 percent, there is a significant markup in place and the passthrough is high: a one precent higher wage inflation translates into 1.9 percent higher price inflation. For higher unemployment rate, however, the estimated markup is substantially lower, with lower passthrough coefficient of 0.4 reflecting a possible squeeze on corporate profit margins. These results are available upon request.

Conclusion

From 2001 to 2010 the euro area current account was on average in balance, while the average rate of inflation was close to the ECB target. In contrast, the post-2011 increase in the euro area current account surplus has been accompanied by a prolonged period of low inflation. Based on Ferrero, Gertler and Svensson [2010], I propose a version of an open-economy inflation Phillips curve showing that, in addition to output gap and inflationary expectations, inflation is also shaped by the trade balance. At an empirical level, I find a statistically significant and negative correlation between the two variables. Hence, the evidence presented in this paper suggests that low inflation in the euro area over the recent years can be partly explained by the surplus in the euro area external balance.

In a way, the current environment with low inflation and high external surplus is reminiscent to the presence of both internal and external imbalances on the Swan diagram (Temin and Vines 2014). In this framework the imbalances can be restored via fiscal and monetary expansions. On the other hand, higher corporate profits, if translated into higher domestic investments and increased labor compensation, could also stimulate aggregate demand and aid the correction of imbalances. Hence, the findings in this paper, combined with those of Galstyan [2019a] and Galstyan [2019b], suggest that both external and internal imbalances are likely to unwind simultaneously.

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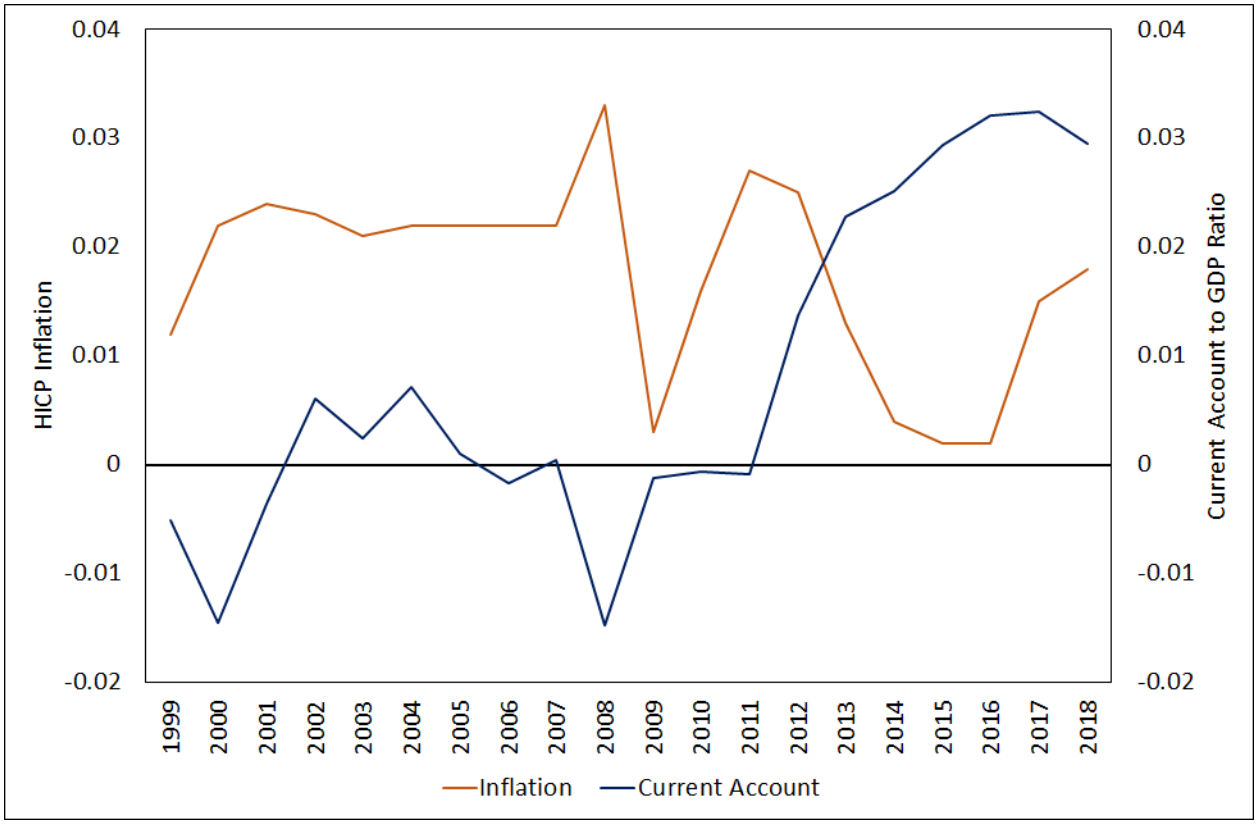
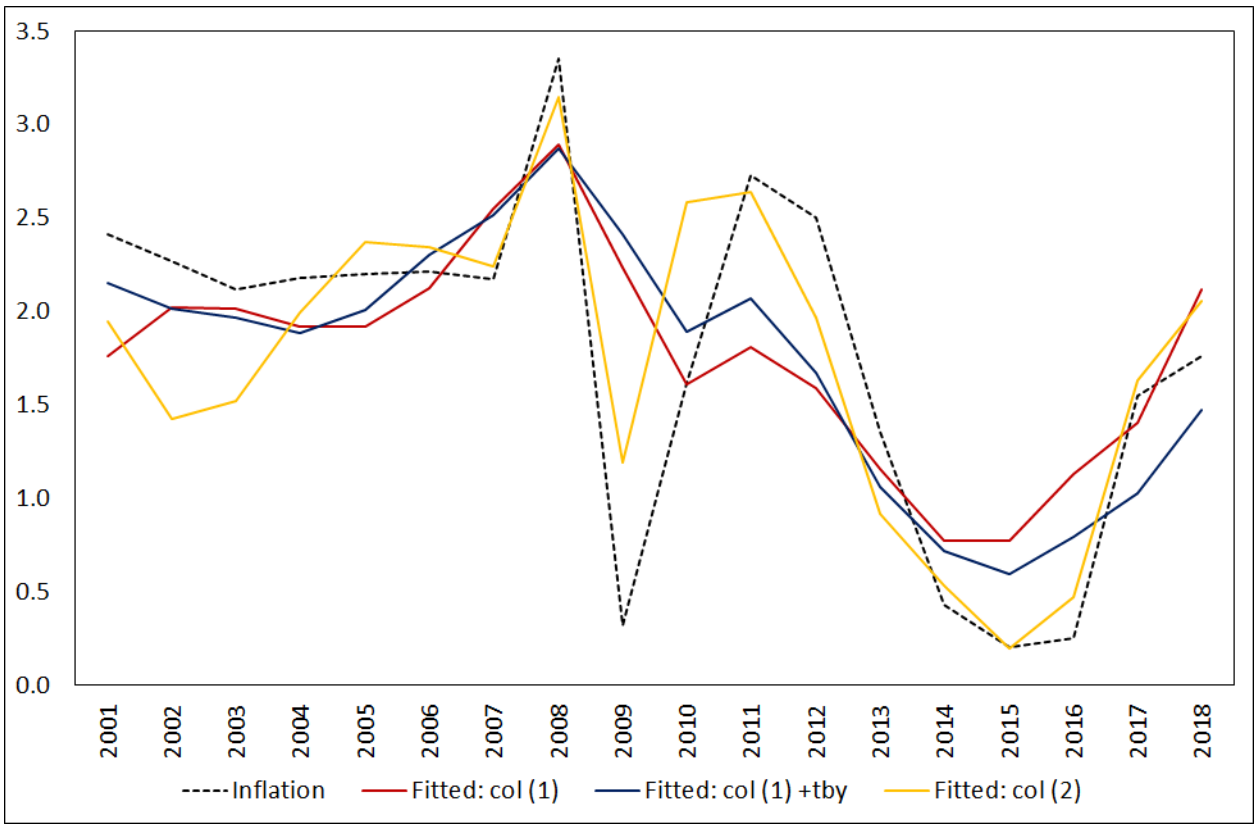
Figure 1: Dynamics of Inflation and the Current Account



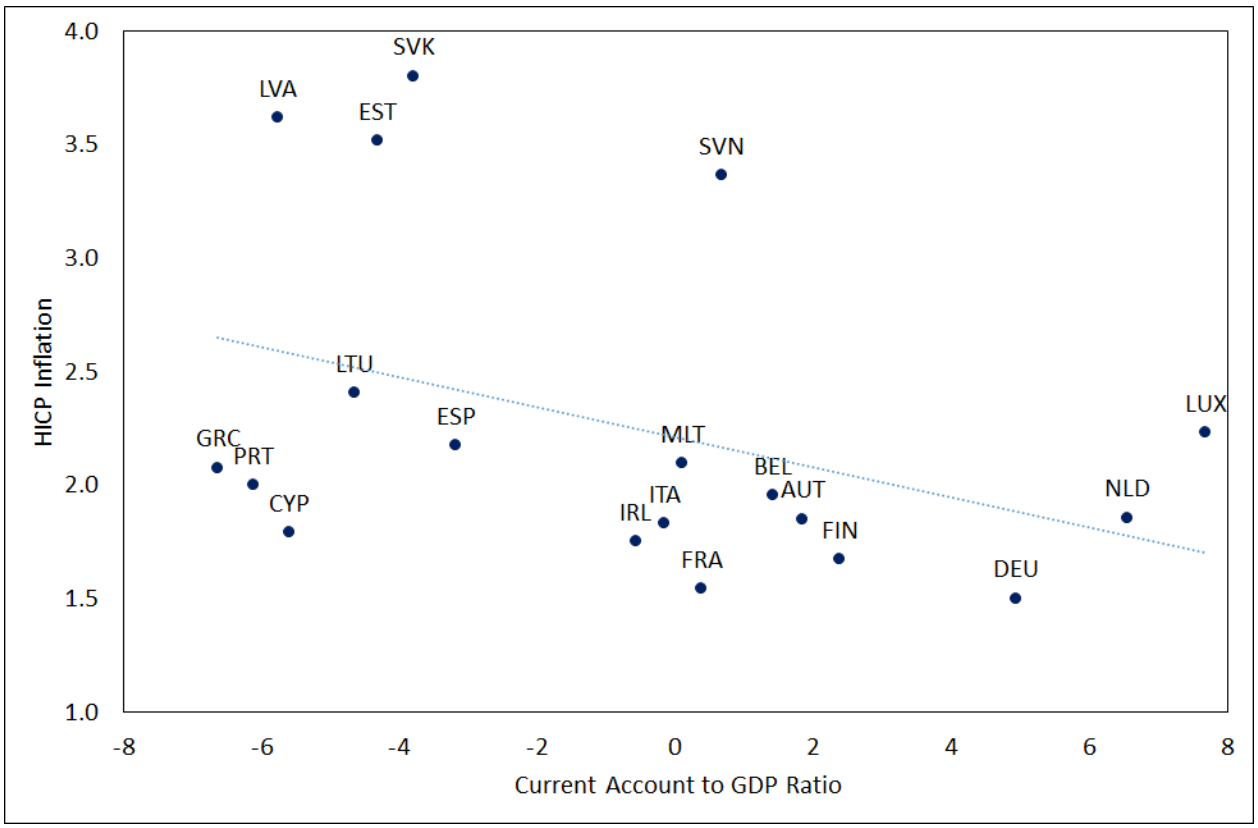
Note: The figure shows the dynamics of the euro area current account to GDP ratio and inflation. Source: Eurostat and author's calculations.

Figure 2: In-Sample Projections of Euro Area Inflation



Note: The figure shows actual as well as fitted values of the euro area inflation (annualised) from three different empirical specifications. Col (1) and Col (2) refer to the fitted values from columns (1) and (2) of Table 2. For consistency, all series are based on seasonally adjusted quarterly data. Author's calculations.

Figure 3: Cross-Sectional Correlation Between Inflation and the Current Account



Note: The scatterplot shows the cross-sectional correlation between the average current account to GDP ratio and inflation for euro area member states. The averages are computed over 1999-2018. Author's calculations.

Table 1: Bivariate Associations

	π_t	π_t	π_t^w	π_t^w
tby_t	-0.102		-0.065	
	(0.027)***		(0.016)***	
cay_t		-0.082		-0.059
		(0.025)***		(0.014)***
Constant	0.006	0.005	0.006	0.006
	(0.001)***	(0.000)***	(0.000)***	(0.000)***
Observations	80	80	80	80
R-squared	0.187	0.165	0.139	0.152

Notes: In columns one and two the dependent variable is the quarter-on-quarter rate of change in the euro area HICP, π_t; in columns three and four the dependent variable is the quarter-on-quarter rate of change in the euro area compensation per employee, π_t^w. tby_t is the balance of goods and services relative to GDP, while cay_t is the current account to GDP ratio. All variables are measured at quarterly frequency, and are seasonally adjusted using the U.S. Census Berueau's X-13 adjustment procedure. All specifications are estimated by OLS. Robust standard errors in parentheses. ***, **, * denote significance at 1, 5, and 10 percent.

Table 2: Inflation Phillips Curve

	(1)	(2)	(3)	(4)	(5)
tby_t		-0.037	-0.042	-0.042	-0.035
		(0.017)**	(0.017)**	(0.017)**	(0.017)**
ur_t	-0.105	-0.070	-0.447	-0.440	-0.383
	(0.026)***	(0.018)***	(0.220)**	(0.224)*	(0.230)
$E_t\pi_s$	1.043	0.705	0.513	0.489	0.346
	(0.581)*	(0.374)*	(0.402)	(0.407)	(0.406)
π_t^{imp}		0.101	0.102	0.104	0.103
		(0.012)***	(0.011)***	(0.012)***	(0.012)***
ur_t^2			1.958	1.926	1.690
			(1.130)*	(1.145)*	(1.170)
A_t				-0.023	-0.029
				(0.063)	(0.053)
π_{t-1}					0.119
					(0.069)*
Constant	-0.005	-0.002	0.020	0.020	0.019
	(0.010)	(0.007)	(0.015)	(0.015)	(0.016)
Observations	80	75	75	75	75
R-squared	0.206	0.710	0.720	0.721	0.730

Notes: The dependent variable is the quarter-on-quarter rate of change in the euro area HICP, π_t. tby_t is the balance of goods and services relative to GDP; ur_t is the unemployment rate; π_t^{imp} refers to total Industry (excluding construction) import price inflation; $E_t\pi_s$ captures 5 year ahead expectations of inflation; A_t is the quarter-on-quarter growth rate in labor productivity. All variables are measured at quarterly frequency, and are seasonally adjusted using the U.S. Census Berueau's X-13 adjustment procedure. All specifications are estimated by OLS. Robust standard errors in parentheses. ***, **, * denote significance at 1, 5, and 10 percent.

Table 3: Wage Phillips Curve

	(1)	(2)	(3)	(4)	(5)
tby_t		-0.02	-0.026	-0.025	-0.038
		(0.017)	(0.016)	(0.015)*	(0.015)**
ur_t	-0.089	-0.076	-0.478	-0.530	-0.703
	(0.015)***	(0.015)***	(0.244)*	(0.216)**	(0.238)***
$E_t\pi_s$	0.406	0.276	0.071	0.230	0.212
	(0.282)	(0.298)	(0.310)	(0.312)	(0.305)
π_t^{imp}		0.025	0.026	0.014	0.016
		(0.011)**	(0.011)**	(0.008)*	(0.008)**
ur_t^2			2.087	2.300	3.066
			(1.261)	(1.120)**	(1.197)**
A_t				0.159	0.157
				(0.048)***	(0.052)***
π_{t-1}^w					-0.329
					(0.137)**
Constant	0.006	0.007	0.030	0.030	0.042
	(0.005)	(0.006)	(0.015)**	(0.014)**	(0.014)***
Observations	80	75	75	75	75
R-squared	0.236	0.332	0.355	0.424	0.494

Notes: The dependent variable is the quarter-on-quarter rate of change in the euro area compensation per employee, π_t^w. tby_t is the balance of goods and services relative to GDP; ur_t is the unemployment rate; π_t^{imp} refers to total Industry (excluding construction) import price inflation; $E_t\pi_s$ captures 5 year ahead expectations of inflation; A_t is the quarter-on-quarter growth rate in labor productivity. All variables are measured at quarterly frequency, and are seasonally adjusted using the U.S. Census Berueau's X-13 adjustment procedure. All specifications are estimated by OLS. Robust standard errors in parentheses. ***, **, * denote significance at 1, 5, and 10 percent.

Table 4: Euro Area Panel Evidence

	π_t	π_t	π_t^w	π_t^w
tby_t	-0.007	-0.017	-0.032	-0.065
	(0.001)***	(0.004)***	(0.006)***	(0.013)***
ur_t	-0.024	-0.040	-0.070	-0.179
	(0.012)**	(0.014)***	(0.044)	(0.053)***
ur_t^2	0.046	0.076	0.038	0.305
	(0.043)	(0.047)	(0.184)	(0.221)
A_t	-0.012	-0.022	0.353	0.294
	(0.013)	(0.016)	(0.078)***	(0.067)***
π_{t-1}	0.542	0.439		
	(0.046)***	(0.049)***		
π_{t-1}^w			0.618	0.178
			(0.132)***	(0.138)
Country FE	No	Yes	No	Yes
Time FE	Yes	Yes	Yes	Yes
Observations	1,228	1,228	1,228	1,228
R-squared	0.635	0.662	0.291	0.374

Notes: In columns one and two the dependent variable is the quarter-on-quarter rate of change in the euro area HICP, π_t; in columns three and four the dependent variable is the quarter-on-quarter rate of change in the euro area compensation per employee, π_t^w. tby_t is the balance of goods and services relative to GDP; ur_t is the unemployment rate; A_t is the quarter-on-quarter growth rate in labor productivity. All variables are measured at quarterly frequency, and are seasonally adjusted using the U.S. Census Berueau's X-13 adjustment procedure. All specifications are estimated by OLS. Robust standard errors in parentheses. ***, **, * denote significance at 1, 5, and 10 percent.

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