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Inflation Dynamics and Global Value Chains

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Abstract

The global economy has witnessed a decline in inflation and an increase in inflation synchronization since the early 1980s. This paper investigates the relationship between inflation synchronization and trade integration, and documents the strong link between inflation co-movement and Global Value Chain (GVC) participation. Using 35 years and both gross and value-added trade flows, evidence shows that an increase in production linkages, as proxied by trade in intermediate inputs, is strongly associated with higher inflation correlation. Moreover, backward GVC participation is associated with an increase in bilateral inflation co-movement while forward participation is linked with a higher correlation between domestic and worldwide inflation. The paper also finds evidence of the effect of trade integration in decreasing inflation levels.

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Inflation Dynamics and Global Value Chains

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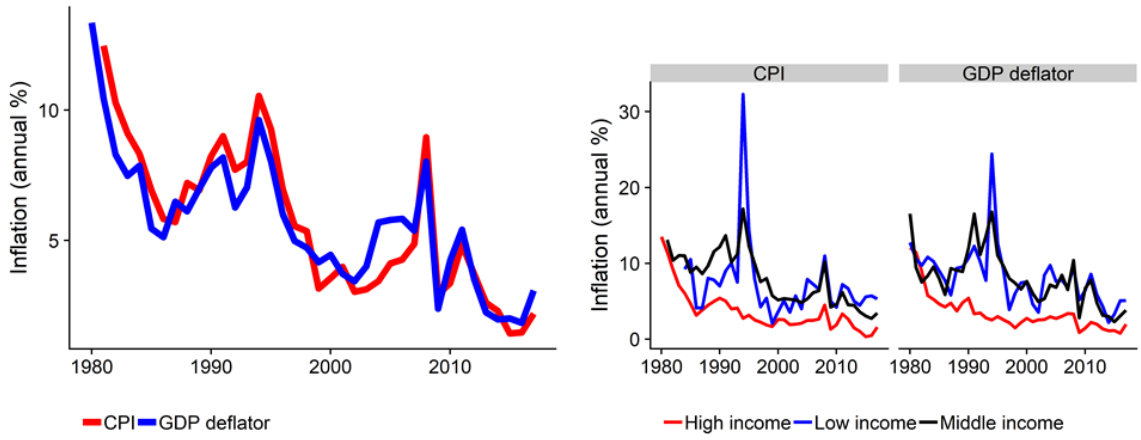
1 Introduction

To what extent does domestic inflation react to changes in foreign economic conditions? Is the widely debated "globalization of inflation" related to the rise in the interconnection of production structures across countries? The starting point for this paper is the simple observation that the global economy has witnessed a decline in inflation and an increase in inflation synchronization across countries since the early 1980s. Figure 1 plots the evolution of World inflation since 1980. Although the curves are not monotonous, the downward trend in World inflation is very clear. As many countries entered a phase of "great moderation", fluctuations in price levels seemed to be dampened.[1] Dis-aggregating this observation by income groups, one can see that the phenomenon is more pronounced for high income countries, while middle- and low-income countries have been more volatile but also display a downward trend in inflation.

Beyond characterizing the reduction in the *level* of inflation, this paper focuses on the recent evolution of the *co-movement* of inflation between countries. For this purpose we compute the correlation of inflation measures using a rolling time windows from 1980 to 2015. Figure 2 plots the evolution of inflation synchronization, measured as the averaged correlation of domestic inflation and world inflation. While inflation in the 1980s seemed to be mostly associated by domestic factors and did not exhibits strong correlation across country, the picture is very different for more recent time windows. Interestingly, the increase in inflation co-movement happened both for Consumer Price Index (CPI) and for the GDP deflator, implying that both firms and consumers experienced more synchronized price fluctuations over the past few decades.

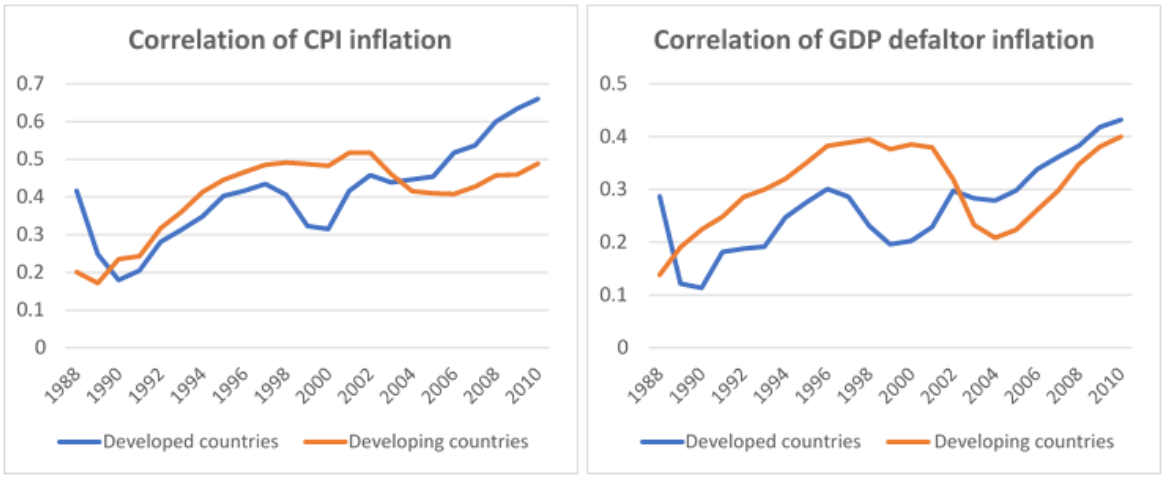
This paper investigates the relationship between inflation synchronization and trade integration, and in particular documents a strong association between several indices of Global Value Chain (GVC) participation and the co-movement of inflation. As a first step, we use gross trade flow which we separate between trade in final good and trade in goods that are used in production (which include intermediate inputs and capital goods). Controlling for country-pair fixed effects, as well as common exposition to third countries, we show that an increase in trade in goods that are used in production is significantly associated with an increase in the correlation of GDP-deflator inflation.

[1] The Great Moderation usually refers to the reduction in the volatility of business cycle fluctuations in developed nations starting in the mid-1980s, compared with the decades before.



Source: Word Bank's World Development Indicators database.

Figure 1: Inflation evolution

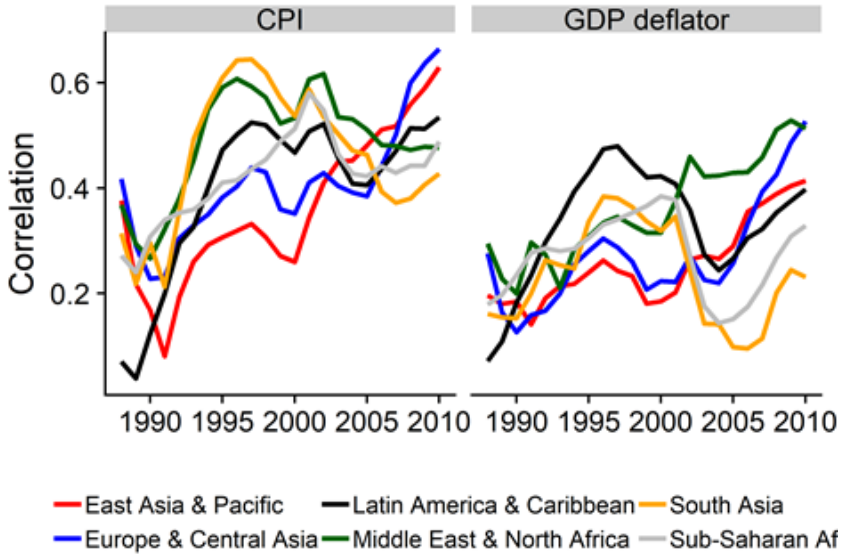


Note: We use a balanced panel of 144 countries, including 49 High income, 72 Middle Income and 23 Low income countries. Each date represents the mid-point of a 15-year rolling window. See the data section for details.
Source: Word Bank's World Development Indicators database.

Figure 2: Inflation correlation evolution by groups

Then, we refine the previous analysis and use value-added trade flow. Results show that inflation co-movement is significantly associated with value-added trade in intermediate input when this value added is absorbed in the partner's economy. However, value-added trade in final goods as well as value-added trade in intermediate inputs

that are re-exported further are both negatively linked with inflation co-movement. Finally, we use recent decomposition of GVC participation and separate 'backward" and "forward" participation. The former relates to foreign value added embedded in exports while the latter captures the domestic value added that is exported but not consumed by the direct partner (meaning that it is re-exported further). This analysis reveals that only "backward" participation is related to inflation synchronization.



Note: We use a balanced panel of countries for each region. Each date represents the mid-point of a 15-year rolling window. East Asia & Pacific 20, Europe & Central Asia 27, Latin America & Caribbean 33, Middle East & North Africa 15 North America 2, South Asia 6, Sub-Saharan Africa 41. See the data section for details.
Source: Word Bank's World Development Indicators database.

Figure 3: Inflation correlation evolution by region

Overall, the paper shows that international input–output linkages create strong links in the formation of prices, implying that inflation in one country is more likely to spill over to direct and indirect trade partners. While the concept of imported inflation has been present for a long time for the Consumer Price Index, the extension to producer prices has important policy implications for central banks: when designing their monetary policy and targeting a given inflation rate, authorities need to account for the strategies implemented by their direct and indirect trade partners. This form of inter-

dependence is reminiscent of the literature on trade and business cycle co-movement: since Frankel and Rose (1998) and Kose and Yi (2001), many papers have documented the link between international trade and GDP co-movement at business cycle frequency. More recently de Soyres and Gaillard (2019) emphasized the specific role of trade in intermediate input in the rise of business cycle synchronization across countries. In this sense, GVC participation will be associated with a rising synchronization of real economic activity and inflation across countries.

The reminder of the paper is organized as follows. Section 2 presents a brief literature review. Section 3 documents the data sources. Section 4 presents our empirical strategy. Section 5 presents our main results and section 6 concludes.

2 Literature review

The "Globalization of Inflation" is a phenomenon that has been discussed heavily in the literature over the past few years. The decline in the level and persistence of inflation after 1980 is seen as a common feature of the most industrialized economies in the world (Mumtaz and Surico, 2012). Ciccarelli and Mojon (2010) use data for 22 OECD countries and conclude that a common factor accounts for 70% of the variability of country inflation, on average. Changes in the conduct of monetary policy across the world have contributed on this regard (Rogoff, 2003). Interestingly, trade models also provide guidance on this regard. For instance, Melitz and Ottaviano (2008) develop a theory in which openness decreases average mark-ups and lowers inflation across economies experiencing an increase in integration through trade. In this section, rather than providing a complete review of the studies explaining the global synchronization of inflation, we cover the recent literature studying the link between the global inflation synchronization and trade integration.[2] While most of this empirical evidence is based on the use data for advanced economies, it allows us not only to keep the discussion limited to the scope of the paper, but also to contextualize our results based on a broader set of both develop and developing countries.

GVCs expansion and the consequent change in the nature of trade can help to

[2]For a literature review of the range of factors that could be responsible for the global synchronization of inflation see for instance Ha et al. (2019).

explain the global inflation synchronization. Trade linkages increase the exposure of domestic inflation to foreign shocks and may lower import prices. Auer et al. (2017a) find that the expansion of GVCs has not only been an important contributor to the change in inflation dynamics, and it has become a key channel through which global economic slack influences domestic inflation, by making domestic inflation more sensitive to the global output gap.

There is strong evidence of the existence of international inflation spillovers that generates inflation synchronization through trade linkages. Auer and Mehrotra (2014), in the analysis most closely related to ours, find that both headline inflation rates and producer prices move more closely together between Asian-Pacific region economies that trade more with one another.[3] They show that in closely integrated supply chains, any shock to domestic production costs or exchange rates could be easily passed through to economies in the supply chain, affecting intermediate prices in other economies. More recently, Auer et al. (2017b) show that input-output linkages account for half of the global component of producer price inflation and that this synchronization across countries is driven primarily by common sectoral shocks and input-output linkages amplify the co-movement by propagating those shocks. Andrews et al. (2018) use data for 22 OECD countries over the period 1995 to 2014 to provide evidence that rising participation in GVCs has placed downward pressure on producer price inflation, by increasing the ability of firms to substitute domestic inputs with cheaper foreign equivalents. The mechanism at work is a downward pressures on unit labour costs (raising productivity and reducing wages) in the importing country.

Regarding the the policy relevance of inflation synchronization across countries, monetary policy is the most concerned. As supply chains represent a direct link between foreign marginal costs and domestic production costs, their prevalence has a significant effect on the extent to which optimal monetary policy is inward-looking (Auer et al., 2017b). In other words, this rise the question of to what extent central banks control domestic inflation dynamics (Carney, 2017). For this reason Central banks of the mayor advanced economies now pay attention to global developments when setting domestic monetary policy (Bernanke, 2007; Draghi, 2015; Carney, 2015).

[3]In Auer and Mehrotra (2014) the Asia-Pacific region includes Australia, China, Chinese Taipei, India, Indonesia, Japan and Korea.

Moreover, the same way that GVCs generate spillover effects and amplify those effects, global inflation synchronization might require more coordinated international policies (IMF, 2018).

Finally, beyond inflation synchronization, GVCs also create strong interdependence of GDP fluctuation at business cycle frequency (de Soyres and Gaillard (2019), Gunnella et al. (2019)). Moreover, the segmentation of production across countries has a significant impact on trade elasticities (Amiti et al. (2014), de Soyres et al. (2018)). GVCs also impact the extent to which regional trade agreement divert trade flows with the rest of the world (de Soyres et al. (2019)).

3 Data Sources

The analysis is based on annual inflation data for more than 126 countries depending on the specifications, for the period 1970-2017.

3.1 Inflation

Inflation is measured at the annual frequency and the analysis are performed using two different measures: Consumer Price Index (CPI) and Gross Domestic Product Deflator (GDPD). There are key differences between those two indices. On the one hand, CPI includes all goods bought by consumers including foreign goods if the country imports final goods. As such, it is an interesting measure of price changes when one wants to focus the analysis on consumers only. On the other hand, GDP deflator measures price changes in goods and services produced in an economy, but not those imported. Moreover, the two measures have different shares of tradable goods, being higher for the CPI. Importantly, since there are production linkages between importers and non importers within each country, GDP deflator has an *indirect* exposure to imported inputs. However, GDP deflator has no exposure to imported final goods that are simply consumed by households.

When building the data set on which we perform our analysis, we are particularly interested in covering as many countries and as many low income countries as possible. The use of CPI and GDPD allows to have two (*very*) different measures, and guarantees

a wide coverage of countries over a log period of time. This data comes from the World Bank's World Development Indicators (WDI).

3.2 Data on Trade Flows

We collect data on bilateral trade flows from the Observatory of Economic Complexity (MIT). This database covers 215 countries over the period 1962-2014. The data are classified according the 4-digit Standard International Trade Classification (SITC), Revision 2. Only products and commodities are considered. Then, we aggregate these bilateral trade flows at the country-level.

To classify trade flows into final and intermediate goods, we use a concordance table from SITC Rev. 2 to Broad Economic Categories (BEC).[4] We then classify goods into five categories: primary, semi-finished goods, parts and components, capital goods, consumption goods, and a residual category called goods non-specified. We group these categories into intermediate and final goods as follows: intermediate goods are primary goods, semi-finished goods, parts and components; and final goods are consumption goods and capital goods.

3.3 Measures of GVC participation based on Value Added

One of the main purposes in this paper is to identify production linkages between countries. Recent advances in data collection and theoretical decomposition of trade flows have shown the various ways of measuring GVC participation.[5] In this paper, we use the recent GVC indicators from Borin and Mancini (2019). They offer a new toolkit for value-added accounting of trade flows at the aggregate, bilateral, and sectoral levels that can be used to investigate a broad set of empirical questions—including in this case an assessment of the global inflation synchronization.

Based on this gross and value-added decomposition, we analyze the association between inflation co-movement and several indices of GVC participation and trade sub-flows which are defined as described below.

[4]The concordance table from SITC Rev2 to BEC can be found on the UN Trade Statistics webpage: https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp .

[5]In particular, see Bems et al. (2011) and Johnson (2018)

First, we use a decomposition of exports based on gross flows:

- ***dagexp_fin*** is the part of share of gross exports that are final goods and hence are directly absorbed by the importer. It contains both domestic and foreign value added.

- ***dagexp_int*** is the part of share of gross exports that are intermediate inputs but are also directly absorbed by the importer, which means those are elements which are used in the destination production process and ultimately absorbed by consumer in the importing countries (i.e. not re-exported further). It contains both domestic and foreign value added.

- ***GEREF = Gross Exports - dagexp_int - dagexp_fin***. This is the share of gross exports that are re-exported further. It contains both domestic and foreign value added.

Second, we define an alternative decomposition based on value-added flows:

- ***DVA*** is the *total* amount of domestic value added embedded in gross exports.

- ***davax_fin*** is the domestic value added embedded in gross trade flows and exported as final goods. By definition, this component of the gross trade flows is directly absorbed by the importer.

- ***davax_int*** is the domestic value added embedded in gross trade flows, exported as intermediate inputs and absorbed by the importer (i.e. it accounts for the part that is either directly absorbed as well as the part which is re-exported further by the direct partner but is still ultimately re-imported back in the destination country for absorption).

- ***DVARF = DVA - davax_int - davax_fin***.
  It corresponds to the share of domestic value added in exports that is not absorbed by the direct importer. Note that this part of the DVA can be absorbed in any third country in the world, or back in the origin country. This is sometimes referred to as the forward index of GVC participation.

Finally, we define GVC participation indices as follows:

	Number of country-pairs with non missing data			
Year	**GDP deflator**	**CPI**	**Gross Trade data**	**Value Added data**
1970	139	103	215	-
1980	171	126	215	-
1990	206	166	215	189
2000	239	205	215	189
2010	248	230	215	189
2015	247	227	215	189

- ***gvcb* = *Foreign Value Added* + *Foreign Double Counting Terms***.
  This is the foreign content of exports and is sometimes referred to as the backward index of GVC participation.

- ***gvce* = *gvcb* + *DVARF***
  This first index of GVC participation accounts for both backward and forward GVC participation and is the sun of foreign content in export as well as the domestic content of export that are re-exported further.

- ***gvc_broad*** = gross exports - *davax_fin*.
  This second index of GVC participation is broader than the previous one as it also includes ***davax_int***. This index measures all exports that are either intermediate inputs or foreign content. It only excludes from gross trade flows the share of domestic value added that is exported as final good and directly consumed by the destination consumers.

4 Methodology/Empirical Strategy

While for the descriptive statistics in the first section the degree of global inflation synchronization was measured by the correlation of each country inflation and the World inflation, here we focus on the bilateral linkages and compute the correlation of country-pair inflation series.

10-year windows are used as benchmark due to the need to use no overlapping windows in the regressions. The use of 10, 15 and 20-year shows similar patterns in the evolution of the inflation correlations. The use of 10 and 15-year windows allows both to capture long-term and short-run fluctuation in the evolution of inflation correlation.

20-year windows eliminate the short-tun fluctuations that can provide important insights.

Throughout the rest of the paper, we denote by π^{GDPD} and π^{CPI} the inflation measures based on the GDP deflator and Consumer Price Index respectively. Overall, our analysis investigates the relationship between synchronization of those two inflation measures and GVC participation, and we use a variety of measures to capture the different aspects of GVC participation. The estimated equation is as follows:

$$Corr(\pi_i, \pi_j)_t = \beta_1 \log T_{ijt} + \beta_2 \ \ third(i,j) + FE_{ij} + FE_t + \varepsilon_{ijt} \tag{1}$$

where $Corr(\pi_i, \pi_j)_t$ is the correlation of the inflation measure between country i and j. T_{ijt} denotes a trade intensity index associated with an specific measure of GVC participation, t. It is necessary to construct a symmetric measure of of the variable of interest, t, relative to total GDP as follows:

$$T_{ijt} = \frac{t_{i \to j,t} + t_{j \to i,t}}{GDP_{it} + GDP_{jt}} \tag{2}$$

where $t_{j \to j}$ is the variable of interest from country j to country i, and T_{ijt} is the symmetric measure related to that variable. We include country pair, FE_{ij}, and time-window, FE_t, fixed effects in all the regressions to control for country-pair heterogeneity and global factors affecting the correlation of inflation respectively.

It is important to recognize that two countries i and j can be exposed to a common third country k through trade linkages which would influence inflation in both i and j over and beyond the direct trade linkages. Indeed, even controlling for country-pair fixed effects cannot completely alleviate such a concern regarding the presence of a "global factor", since the common exposure to a third market could be time varying and be more present in some time windows that others. To account for such a "third country" effect, we define the following *third country* indicators, separating the common exposure due to similarity in import sources from the exposure due to similarity in

export destinations:[6]

$$third_{IM}(i,j) = \Big(2 - \sum_k \Big|\frac{im(i,k)}{IM(i)} - \frac{im(j,k)}{IM(j)}\Big|\Big).0.5 \tag{3}$$

$$third_{EX}(i,j) = \Big(2 - \sum_k \Big|\frac{ex(i,k)}{EX(i)} - \frac{ex(j,k)}{EX(j)}\Big|\Big).0.5 \tag{4}$$

Those indices always lie between 0 and 1, and are equal to 0 whenever there is exactly no overlap between countries i and j import sources / export destinations. Indices are equal to 1 in the case where countries i and j have *exactly* the same geographical exposure to import / export markets. They also capture unobserved characteristics regarding the trade frictions and trade policies.

It is also interesting to explore the link between the level of inflation and GVC participation. In other words, whether the expansion of GVCs has contributed the synchronized reduction in global inflation observed in figure 1. For this purpose, the estimated equation is the following:

$$\pi_{it} = \beta_1 \log T_{it} + FE_i + FE_t + \varepsilon_{it} \tag{5}$$

Note that equation 4 is country-centric, with the dependent variable being the level of inflation in country i, π_{it}. Accordingly, the the trade intensity indices included in the regression, T_{it}, are country specific and in relative terms to GDP, as follows:

$$T_{it} = \frac{t_{i \to World,t}}{GDP_{it}} \tag{6}$$

Finally, note that fixed effects included in equation , FE_i and FE_t, control for the country and time dimensions. And it is not necessary to account for third country effects.

[6]We actually use the indices computed in de Soyres and Gaillard (2019), where they are utilized in an analysis of GDP rather than inflation synchronization.

5 Results

This section presents the results, both from a country-pair and country-centric perspective. Our goal is to analyze the link between GVC participation and both the level (for each country) and the synchronization (for each country-pair) of inflation.

GVC and the synchronization of inflation across country-pairs

In table 1, we use within country-pair variations and control for country-pair fixed effects as well as third country exposure to investigate the link between trade in intermediate inputs and the correlation of inflation for each pair of country. Results in column (1) show that the correlation of GDP deflator (GDPD) inflation increases when total trade proximity increases. This result is indicative that the determinants of GDPD inflation might not be domestic only, and that higher trade integration is associated with a link in the formation on prices. Moreover, we can dis-aggregate this results and separate total trade into trade in final goods and trade in intermediate inputs. Doing so, column (2) unveils an interesting insight about the specific role of Global Value Chains. While an increase in final good trade is *not* associated with any significant change in inflation co-movement, the effect we observed through total trade is actually solely driven by trade in intermediate inputs.

This result is not very surprising since GDP deflator is defined net of imports. While imported final goods for consumption are simply not taken into account in the construction of GDP deflators, the effect of imported input can still have an impact through the effect of cost shocks on the prices of other firms down the production chain. Overall, our results show that GVC integration as proxied by trade in intermediate inputs creates a link between inflation fluctuation between countries and confirms the view that in a world with production sharing across countries, the determinants of inflation are not purely domestic anymore.

Following results presented in table 1, in table 2 we extend the analysis by using value-added data for trade flows instead of gross trade flows. Doing so is important because, for example, gross import flows might contain value added produce in a third country, in which case domestic inflation would be more likely to be synchronized not with the *direct* import partner but with the country of origin of value added. Looking at column (1), we first find that the finding related to total trade is *reversed*: while an

Table 1: Country-pair correlation regressions

	(1) GDPD	(2) GDPD
log total	0.010*	
	(0.006)	
log int-cap		0.012**
		(0.006)
log fin		-0.004
		(0.005)
third ex	0.004	0.009
	(0.059)	(0.059)
third im	-0.289***	-0.290***
	(0.071)	(0.071)
N	15564	15564
R2	0.400	0.400
Time windows	5	5
Country pairs	6202	6202
Time FE	YES	YES
CP FE	YES	YES

Standard errors clustered by country-pair in parentheses
Note: observations with non-overlapping 10-year windows.
* $p < .1$, ** $p < .05$, *** $p < .01$

increase in trade proximity using gross trade flows is associated with an increase in the synchronization of inflation, we now find a negative association between value-added trade and inflation correlation. Column (2), however, delivers new and interesting insight which allows us to better understand the negative coefficient in column (1): inflation correlation is actually *increasing* with the value added exported as intermediate and absorbed by the direct partner, but it is *decreasing* with value-added trade in final goods as well as with the value-added trade in intermediate that are re-exported further. Again, when two countries trade intermediate inputs that are absorbed by one another, then such a production link is indeed associated with higher co-movement of inflation.

Findings in table 2 confirm the insights from table 1, and both analysis feature a

Table 2: Country-pair correlation regressions

	(1) GDPD	(2) GDPD
log index davax tot	-0.126***	
	(0.016)	
log index davax fin		-0.048**
		(0.022)
log index davax int		0.061***
		(0.025)
log index DVARF		-0.137***
		(0.021)
N	25692	25403
R2	0.575	0.575
Time windows	2	2
Country pairs	14823	14648
Time FE	YES	YES
CP FE	YES	YES

Standard errors clustered by country-pair in parentheses
Note: observations with non-overlapping 10-year windows.
* $p < .1$, ** $p < .05$, *** $p < .01$

positive and significant association between bilateral inflation correlation and cross-country production, as proxied either by total gross trade in intermediate inputs, or by value-added trade in intermediate inputs that are ultimately absorbed by the trade partner. The negative association between re-exported import and domestic inflation reveals that inflation dynamics and the association between two countries' inflation does not only depend on how much they trade, but also on who is the ultimate consumer for those trade flows. Table 3 shows that the same results hold for the correlation of CPI inflation.

Table 4 comes back to the use of gross trade indicators but this time constructed using data from Borin and Mancini (2019) based on EORA data. The goal of separating the (gross) export flows that are directly absorbed from the share that is re-exported further. Results in column (1) show that the correlation of CPI inflation increases when two countries trade more intermediate inputs, which confirms the insight from

Table 3: Country-pair correlation regressions (APPENDIX)

	(1) CPI	(2) CPI	(3) CPI
log index davax tot	0.017		
	(0.022)		
log index davax fin		-0.105***	-0.052*
		(0.030)	(0.029)
log index vax int		0.128***	
		(0.034)	
log index davax int			0.110**
			(0.037)
log index DVARF			-0.057*
			(0.030)
N	18220	18214	17989
R2	0.630	0.630	0.629
Time windows	2	2	2
Country pairs	11435	11432	11275
Time FE	YES	YES	YES
CP FE	YES	YES	YES

Standard errors clustered by country-pair in parentheses
Note: observations with non-overlapping 10-year windows.
* $p < .1$, ** $p < .05$, *** $p < .01$

the analysis above albeit with different data. Interestingly, when disentangling gross trade flows of intermediates into the part that is ultimately absorbed by the importer and the part that is re-exported further, the analysis show that this positive link is exclusively due to the directly absorbed part. This result confirms the finding from table 3 and means that when looking at both gross and value added trade flows, the synchronization of inflation between two countries is mostly related to the trade flows that are absorbed rather than re-exported further – which could be indicative of more rigidity in the production chains designed for primarily serve domestic consumption rather than foreign consumers. In table 7 in appendix, we provide the results for the same analysis using CPI inflation as dependent variable instead of GDP deflator. Results are virtually unchanged.

Table 4: Country-pair correlation regressions

	(1) CPI	(2) CPI
log index dagexp fin	-0.141***	-0.070
	(0.050)	(0.050)
log index exp int	0.140***	
	(0.052)	
log index dagexp int		0.129*
		(0.069)
log index GEREF		-0.076
		(0.052)
third ex	-0.187	-0.177
	(0.123)	(0.123)
third im	-0.407***	-0.409***
	(0.151)	(0.151)
N	7992	7992
R2	0.607	0.606
Time windows	2	2
Country pairs	4767	4767
Time FE	YES	YES
CP FE	YES	YES

Standard errors clustered by country-pair in parentheses
Note: observations with non-overlapping 10-year windows.
* $p < .1$, ** $p < .05$, *** $p < .01$

GVC and the level of inflation

Now we turn to the country-centric regressions to explore the link between GVC participation and the *level* of inflation. In this case the GVC indices are created by aggregating the trade flows from the exporter perspective. That is to say, the link between each country and the rest of the World is what that country exports to all its trade partners. Such an analysis has been developed in Andrews et al. (2018). The basic argument is that integration into GVCs might contribute to lower inflation via downward pressures on labor costs by raising productivity and reducing wages in the importing country, especially when low-wage countries are integrated in supply chains.

Moreover, it might also lower producer price inflation by increasing firms' abilities to substitute domestic for foreign inputs.

Table 5 studies this link using gross trade data in column (1) and value added trade data in column (2). Results show that, controlling for each country's average level of inflation as well as global changes in inflation for each time window, an increase in trade in both final goods and intermediate goods re-exported further (forward linkages) is indeed associated with a downward pressure on the level of the GDP deflator inflation. This is in line with global inflation trend observed in figure 1. Column (2) confirms these results when using trade in value-added terms. Turning to columns (3) and (4), we use more "standard" GVC participation indicators to analyze the link between GVC and inflation level. The negative coefficients of these indices suggest that greater GVC integration contributed to the decrease in inflation levels. Again, those results also hold when using CPI inflation as the dependent variable, as shown in table 8 in appendix.

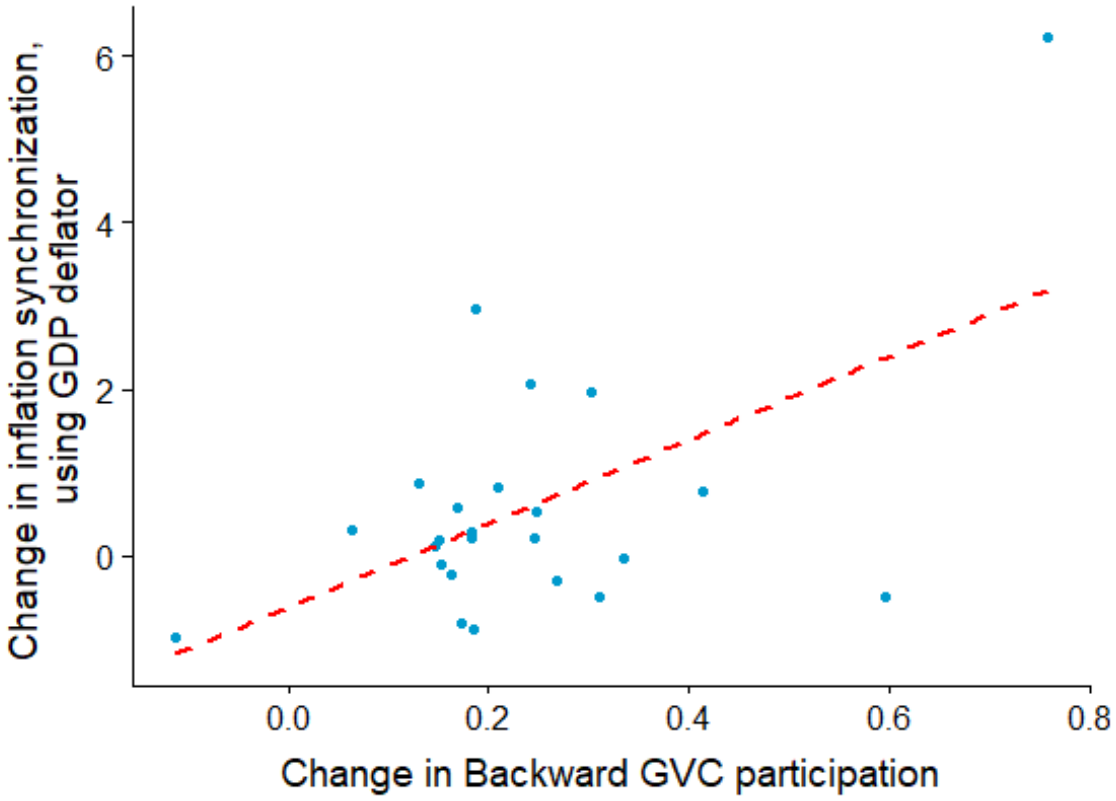
Graphical representation of some results

In an effort to make our results more accessible for a wide audience, we present our main insights in figures 4 and 5.

First, focusing on backward GVC participation, figure 4 shows the strong association between an increase in bilateral inflation correlation using the GDP delfator and bilateral backward participation. In this graph, each dot is a pair of World Bank Region, with the vertical axis representing the change in inflation correlation between domestic CPI inflation and World inflation between 2001 and 2011, while the horizontal axis represents the change in backward GVC participation for the same period. This representation, in changes, allows to control for country fixed effects in an intuitive way since the only variation that is used is the *within region pair* change in both inflation correlation and GVC participation.

Second, figure 5 shows that stronger backward GVC participation (in the horizontal axis) is associated with an increase in CPI inflation correlation (in vertical axis) between each country and the World. Inflation correlation, here, means the correlation between domestic inflation and world inflation, and the positive slope implies that an increase in

backward GVC participation is correlated with an increase in CPI inflation correlation with the World. Again, the figure is plotted in change between 2001 and 2011, so that only *within country* variations are used for identification of the slope.

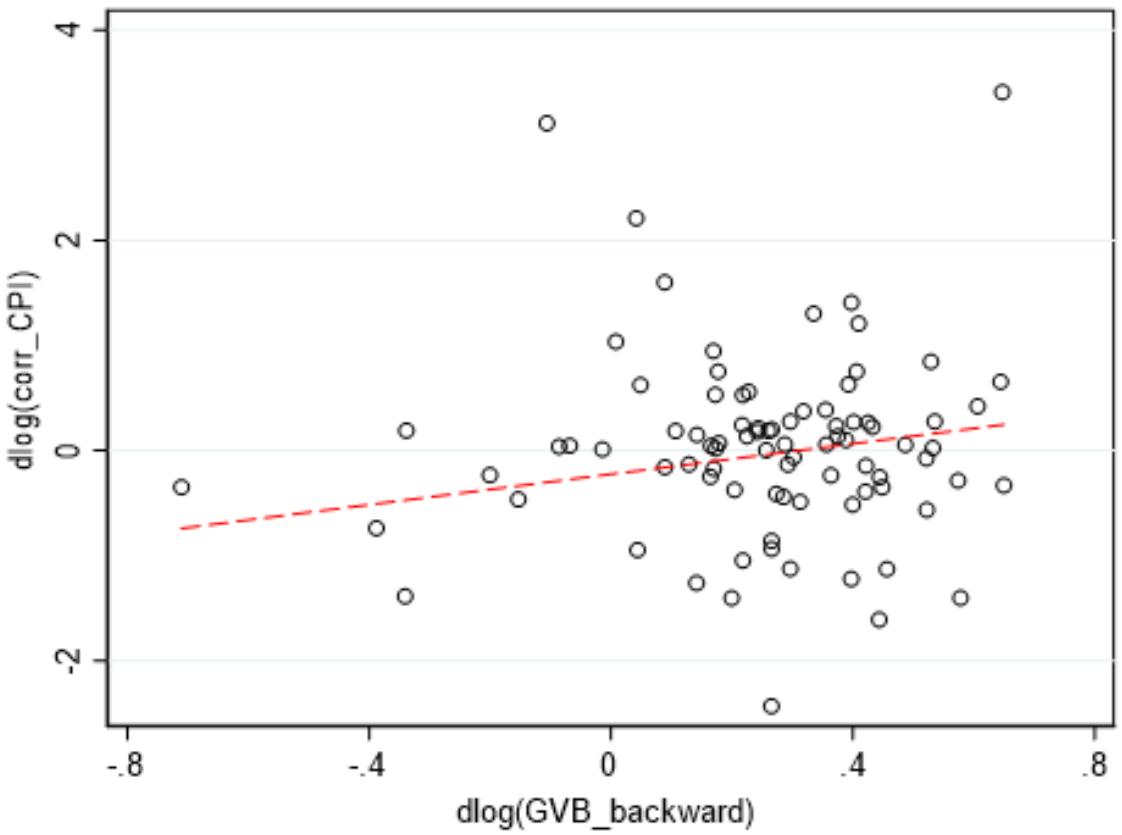


Note: each dot is a pair of regions, according to the 6 regions defined by the WB and axis represent the changes of inflation correlation using GDP deflator (vertical) and backward GVC participation (horizontal) between 2001 and 2011. Inflation data comes from the World Development Indicators while GVC participation indices come from Borin and Mancini (2019).

Figure 4: GVC backward participation and globalization of GDP Deflator inflation (2001-2011)

6 Concluding remarks

The global economy has witnessed a decline in inflation and an increase in inflation synchronization across countries since the early 1980s. While this trend seems more pronounced for developed economies, developing countries also display this downward



Note: each dot is a country. Axis represent the changes of inflation correlation using the Consumer Price Index (vertical) and backward GVC participation (horizontal) between 2001 and 2011. Inflation data comes from the World Development Indicators while GVC participation indices come from Borin and Mancini (2019).

Figure 5: GVC backward participation and CPI inflation synchronization (2001-2011)

trend.

Beyond the reduction in the level of inflation, this paper focuses on the recent evolution of the co-movement of inflation between countries. We investigate the relationship between inflation synchronization and trade integration. Thanks to the use of as very detailed database, We show a strong association between several indices of Global Value Chain participation and the co-movement of inflation. This analysis reveals that only "backward" participation is related to inflation synchronization.

Table 5: Country-centric regression in levels

	(1) GDPD	(2) GDPD	(3) GDPD	(4) GDPD
log index dagexp finx	-1.823**			
	(0.819)			
log index dagexp intx	3.477**			
	(1.432)			
log index exp rexpx	-2.463*			
	(1.292)			
log index davax finx		-1.788**		
		(0.797)		
log index davax intx		3.168**		
		(1.431)		
log index vax rexpx		-2.410*		
		(1.281)		
log index gvce broadx			-0.877*	
			(0.502)	
log index gvcx				-1.191**
				(0.511)
N	833	830	833	833
R2	0.281	0.281	0.271	0.274
Time windows	5	5	5	5
Countries	177	177	177	177
Time FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

Standard errors in parentheses

Note: observations with non-overlapping 5-year windows.

The GVC indices used in this table are computed from the exporter side.

* $p < .1$, ** $p < .05$, *** $p < .01$

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Additional tables

Table 6: Country-pair correlation regressions

	(1) GDPD	(2) GDPD	(3) GDPD	(4) GDPD
log index dagexp fin	-0.054	-0.057		
	(0.040)	(0.040)		
log index dagexp int		0.015		
		(0.059)		
log index GEREF		-0.172***		
		(0.040)		
log index exp int	-0.173***			
	(0.043)			
log index davax tot			-0.179***	
			(0.029)	
log index davax fin				-0.063*
				(0.038)
log index vax int				-0.128***
				(0.040)
third ex	-0.083	-0.074	-0.094	-0.094
	(0.101)	(0.101)	(0.101)	(0.101)
third im	-0.190	-0.187	-0.194	-0.177
	(0.123)	(0.123)	(0.123)	(0.123)
N	10144	10144	10142	10138
R2	0.541	0.542	0.539	0.539
Time windows	2	2	2	2
Country pairs	5713	5713	5711	5709
Time FE	YES	YES	YES	YES
CP FE	YES	YES	YES	YES

Standard errors clustered by country-pair in parentheses

Note: observatios with non-overlapping 10-year windows.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 7: Country-pair correlation regressions

	(1) CPI	(2) CPI
log index davax tot	0.024	
	(0.036)	
log index davax fin		-0.102**
		(0.048)
log index vax int		0.123**
		(0.049)
third ex	-0.171	-0.182
	(0.123)	(0.123)
third im	-0.425***	-0.415***
	(0.152)	(0.152)
N	7990	7986
R2	0.606	0.606
Time windows	2	2
Country pairs	4765	4762
Time FE	YES	YES
CP FE	YES	YES

Standard errors clustered by country-pair in parentheses

Note: observations with non-overlapping 10-year windows.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 8: Country-centric regression in levels

	(1) CPI	(2) CPI	(3) CPI	(4) CPI
log index dagexp finx	0.508			
	(0.806)			
log index dagexp intx	-0.281			
	(1.313)			
log index exp rexpx	-0.141			
	(1.241)			
log index davax finx		0.504		
		(0.762)		
log index davax intx		-0.347		
		(1.297)		
log index vax rexpx		-0.028		
		(1.204)		
log index gvce broadx			-0.105	
			(0.508)	
log index gvcx				-0.182
				(0.491)
N	721	719	721	721
R2	0.245	0.245	0.244	0.245
Time FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

Standard errors in parentheses

Note: observations with non-overlapping 5-year windows.

The GVC indices used in this table are computed from the exporter side.

* $p < .1$, ** $p < .05$, *** $p < .01$