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Keywords

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JEL Classification

E3, E5, F3

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Financial Openness and Inflation: Recent Evidence

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Introduction

A series of influential papers (e.g. Romer (1993), Lane (1997)) examine the hypothesized negative connection between trade openness and inflation in a cross-country context during the 1970s and 1980s.[1] Both authors find that inflation is indeed lower in countries more exposed to international trade. This paper explores the connection between an alternative measure of openness - financial openness - and inflation over a more recent time period that begins in 1997 and ends in 2016. Our inquiry is motivated by the occurrence of two important phenomena. Firstly, by the end of the 1990s inflation was much more subdued than in the 1970s and 1980s. The 1973-1988 sample period studied by Romer and Lane was characterised by high and volatile inflation rates. Table 1 shows that the average and standard deviation of global inflation over the 1973-1988 period stood at 9.4 and 2.9 percent, respectively. The sample period studied in this paper, 1997-2016, recorded a considerably lower average rate of inflation of 3.8 percent and a smaller standard deviation of 1.7 percent. Secondly, financial openness increased enormously during the 1990s and in the new millennium. A simple comparison of the extent of financial openness across the two sample periods reveals that average financial openness was 42 percent higher in the 1997-2016 period compared to the 1973-1988 period. Many developing and emerging countries had followed the lead of the more advanced countries

[1] The literature exploring the relationship between openness and inflation is vast and multi-faceted. Most of the contributions are empirical investigations of Romer's original hypothesis (e.g. Terra (1998)) or extensions of it (e.g. Lane (1997), Karras (1999), Temple (2002)), but there have also been an increasing number of exclusively theoretical studies of the linkage (e.g. Bowdler (2009), Daniels and VanHoose (2006), Cooke (2010), Watson (2016)). Most studies to date have concentrated on the connection between trade openness and inflation. Gruben and McLeod (2002) were among the first to argue that capital account liberalisation led to a sizeable fall in average inflation in the 1990s. Other strands of the empirical literature concentrate more on the effects of financial openness on consumption and business cycle volatility or growth (e.g. Buch et al. (2005), Bussière and Fratscher (2008)). Using a DSGE framework, Lartey (2012) shows that non-tradeable inflation is lower in a model economy where foreign capital inflows account for a larger share of total investment in the tradeable sector. Financial openness is measured as the share of foreign investment in total investment.

to liberalize their capital accounts (and reform their central banks and treasuries) in an effort to speed up the pace of financial integration. During the 1970s and 1980s many barriers to the free flow of capital had still been in place, particularly in the countries of Eastern Europe and non-industrialised countries.

In this study we examine the nexus between financial openness and inflation from a theoretical and empirical perspective. We first introduce a simple model to describe how greater financial openness lowers the cost of borrowing for producers and should therefore lead to lower inflation. In the empirical part of the paper, we test this conjecture in a cross-country context for the 1997-2016 period. For comparative purposes we also probe the existence of a linkage between trade openness and inflation. Our results point to a much closer inverse linkage between inflation and financial rather than trade openness in a sample of more than 100 countries. The evidence presented further suggests that the negative correlation between financial openness and inflation is stronger in OECD countries than non-OECD countries. A greater pace of financial rather than trade integration since the 1990s may account for these results.

At the heart of this paper are separate measures of trade as opposed to financial openness. The Swiss KOF Institute compiles and publishes separate indices of both measures that capture important characteristics of a country's openness to international trade and cross-border financial transactions. The relationship between the two measures of openness and the CPI inflation rate over the sample period is depicted in Figure 1. It is evident that financial openness and trade openness are highly correlated. Initially global CPI inflation continued its secular decline, which had started in the mid-1990s, while both trade and financial openness increased as a result of significant progress in removing barriers in

international trade and liberalizing capital accounts to provide greater access to financial markets. By the start of 1997 these trends towards greater integration of global trade and finance were well entrenched. In the wake of the Dot-Com Crisis in the early 2000s, however, the trend towards greater openness briefly stalled before resuming its upward trajectory. In 2002 global CPI inflation fell to a low of 2.9 percent but then started to increase again thereafter. Inflation peaked at the beginning of the Global Financial Crisis, plunged during the crisis, increased slightly during the early recovery phase before eventually setting off on its downward trend and settling at 2.2 percent at the end of the sample period. The behaviour of the two measures of openness in the lead-up to the Global Financial Crisis is intriguing. While financial openness peaked and started decreasing before the outbreak of the crisis, trade openness reached its up-to-then highest level when the crisis erupted and began to decline afterwards. The dip in trade openness was short-lived though. In contrast, financial openness reached a plateau during the crisis and did not deviate from it until the latter part of the sample period. For a while there was no marked difference between financial and trade openness. The two measures started drifting apart in 2013 with financial openness again surpassing trade openness as it had done during most of the sample period. Interestingly, in the lead-up to, during, and in the immediate aftermath of the Global Financial Crisis, trade openness and global inflation moved in the same direction and peaked at the same time. Such a distinct pattern is not detectable in the behaviour of financial openness and global inflation during the same time interval. Overall, the correlation over the whole sample period between openness and global inflation is much tighter for financial openness (-0.240) than for trade openness (-0.126).

In the next section we describe how financial openness affects price-setting in a simple model. Section III presents our empirical findings on the relationship between

financial openness and CPI inflation. In Section IV we check the robustness of our reported results. Instrumental variable estimation is carried out in Section V. In Section VI we briefly comment on the observed connection between trade openness and CPI inflation. Section VII concludes.

II. A Simple Model

A profit-maximizing bank can raise domestic (D^D)and foreign deposits (D^F).[2] The latter deposits are in foreign currency and converted into domestic currency at the prevailing exchange rate *e*. The exchange rate is expressed in units of domestic currency per unit of foreign currency. An increase in *e* therefore indicates a depreciation of the domestic currency. The interest rate paid on domestic and foreign deposits is r_D and r_F, respectively. The bank offers loans *L* at the lending rate r_L and operates in a perfectly competitive setting. Apart from the balance sheet constraint, the bank faces another constraint that puts a limit on its ability to raise deposits abroad. Only a fraction of its loan portfolio can be sourced offshore. The profit (*PB*) maximization problem takes the following form:

$$\max_{D^D, D^F} PB = r_L L - r_D D^D - r_F e D^F \quad \text{s. t. } D^D + eD^F = L \text{ and } \bar{e} D^F \leq \gamma L \quad 0 \leq \gamma \leq 1 \qquad (1)$$

The second constraint is in effect a restriction on foreign borrowing with a lower value of the parameter γ indicating less scope for sourcing foreign deposits to fund loans.[3,4] Notice that the domestic currency value of foreign deposits is evaluated not at the current

[2] The BIS (Aldasoro et al. 2020)) reports that short-term foreign currency (US Dollar) liabilities of non-US bank stood at US$ 13 trillion before the outbreak of the GFC and again at the end of 2019. In recent years, banks headquartered in emerging countries have borrowed heavily in US Dollars.

[3] Here we are less concerned about the origin and enforcement of these limits (i.e. whether a regulator sets values for γ and $\bar{e}$). What matters is that the limits exist and that the constraint is binding. We also omit bank capital from the analysis.

[4] Gopinath and Stein (2021) use a similar constraint in a more elaborate framework where the bank must decide on the optimal volume of foreign and domestic currency deposits.

exchange rate *e* but at $\bar{e}$ which should be thought of as extremely depreciated value of the domestic currency ($\bar{e} > e$). Such rare but extreme values of the exchange rate manifest themselves during episodes of domestic distress or a global financial crisis when global financial investors dump domestic currency assets in favour of safe haven currency assets. With the domestic currency depreciating, the foreign currency liabilities of the bank increase if the bank is not fully or not hedged at all. A severe depreciation thus creates a currency mismatch as the bank makes loans exclusively to domestic customers. The higher the upper limit for the exchange rate ($\bar{e}$), the less the bank can rely on foreign currency to fund its loan portfolio.

After substituting for *L* in equation (1), we can set up the Lagrangean and derive the first-order conditions of the constrained maximization problem:

$$\mathcal{L} = r_L(D^D + eD^F) - r_D D^D - r_F eD^F - \lambda(\gamma(D^D + eD^F) - \bar{e}D^F) \quad (2)$$

$$r_L - r_D - \lambda\gamma = 0 \quad (3)$$

$$r_L e - r_F e - \lambda(\gamma e - \bar{e}) = 0 \quad (4)$$

Combining the two first-order equations by eliminating the Lagrange multiplier λ yields a relationship between the lending rate and the two deposit rates:

$$r_L = \frac{e\gamma}{\bar{e}}\, r_F + (1 - \frac{e\gamma}{\bar{e}})r_D \quad (5)$$

The lending rate is a weighted average of the interest rate paid on foreign currency deposits and domestically sourced deposits. The weight on r_F serves as a measure of financial openness as it captures two intrinsic characteristics of the bank's operating environment: the extent to which foreign-sourced deposits fund domestic loans (γ) and the potential for

domestic currency depreciation in times of economic turbulence ($\frac{e}{\bar{e}}$). For highly financially integrated economies the ratio ($\frac{e}{\bar{e}}$) is higher and much closer to unity than for less financially integrated economies. One can plausibly argue that the potential for severe exchange rate depreciation is less in economies that are closely connected to the rest of the world. Asset prices in financially open economies tend to be bellwethers of the quality of policymaking and its underlying institutional framework; that is because asset prices are free to react to news and events. In a sense, in financially open economies market forces have greater sway in imposing discipline on policymakers which is conducive to preventing a collapse of asset prices such as the exchange rate. All told, equation (5) indicates that greater financial openness results in a larger weight on the interest paid on foreign currency deposits but a smaller weight on interest paid on domestic currency deposits in the determination of the bank lending rate.

The lending rate in turn plays an important role in the pricing decision of a goods-producing firm. Consider a monopolistically competitive firm that faces the market demand curve:

$$Y = \alpha(\frac{P}{\bar{P}})^{-\varepsilon} \qquad \alpha > 0 \tag{6}$$

where *Y* = demand for the firm's output

P = the price charged by the firm

$\bar{P}$ = the price charged by competing firms

ε = constant elasticity of demand

The input used in production is loans (*L)* from the bank at the real lending rate r_L. The nominal gross cost of borrowing (per unit) amounts to $\bar{P}(1 + r_L)$.[5] The firm maximizes profit (*PF*), relying on constant returns to scale technology in production: $Y = L$:

$$\max_{Y} PF = PY - (1 + r_L)\bar{P}Y \tag{7}$$

The first-order condition sets marginal revenue equal to marginal cost:

$$(\frac{Y}{\alpha})^{-\frac{1}{\varepsilon}}\left(1 - \frac{1}{\varepsilon}\right) = 1 + r_L \tag{8}$$

Using the inverse demand function from equation (6), we can restate the above as price being set (relative to the price charged by competitors) as a mark-up over marginal cost which is the gross lending rate:

$$P^* = \frac{\varepsilon}{\varepsilon - 1}(1 + r_L)\bar{P} \tag{9}$$

Equation (9) represents the optimal price the firm sets. Clearly, this price setting equation is an oversimplification of how pricing decisions are made in practice because it ignores the existence of nominal price stickiness. With the introduction of menu cost, the firm instead minimizes a period loss function (in logs and now with time subscripts) that consists of two types of cost: the costly adjustment of the firm's price of output and the cost of charging a price that differs from the optimal price:

$$\min_{p_t} \Omega_t = (p_t - p_{t-1})^2 + c(p_t - p_t^*)^2 \qquad c > 0 \tag{10}$$

[5] We model the firm as being dependent on bank loans. This is a realistic scenario for small firms that cannot tap alternative sources of credit such as the bond or commercial paper market.

After combining the first-order condition with the log of equation (9), we observe that the change in the price set in the current period relative to the previous period depends on the log of the mark-up factor and the borrowing rate. By extension, at the aggregate level, the borrowing rate affects the rate of inflation through the cost channel: firms adjust their prices in line with the cost of borrowing funds from banks.[6]

$$\pi_t = c(\log\frac{\varepsilon}{\varepsilon - 1} + r_{L,t}) \qquad \pi_t = p_t - p_{t-1} \tag{11}$$

where $r_{L,t} = \frac{e\gamma}{\bar{e}}\, r_{F,t} + \left(1 - \frac{e\gamma}{\bar{e}}\right) r_{D,t}$.

Our hypothesis is that the rate of inflation should be lower in more financially open economies. This hypothesis is motivated by the insights from our simple model and by an observation about interest rate differentials between the two sources of bank finance. First, our simple model suggests that the bank lending rate becomes more responsive to the interest rate on foreign currency deposits (for short, foreign interest rate) for increasing values of γ and $\frac{e}{\bar{e}}$, both of which capture essential elements of financial openness. Second, banks in financially open economies find it cheaper to borrow funds abroad, i.e. in foreign currency. According to Gopinath and Stein (2021), banks must be compensated for the risk of borrowing in foreign currency by paying lower interest on foreign currency deposits than on domestic deposits. In practice, this requirement is reflected in the exorbitant privilege which allows the issuers of dominant currencies such as the United States to issue liabilities at lower interest rates than other countries. This privilege keeps interest rates on foreign currency deposits (US Dollar) below the rate paid on domestic currency deposits in

[6] Aggregating over all firms yields $p_t = \bar{p}_t$. In his version of the costly price adjustment framework of Rotemberg (1982), Roberts (1995) has the firm choose the same price as competing firms.

economies with access to international financial markets. Owing to these facts, the lending rate in financially open economies should be lower than in countries with more insulated financial sectors. And the lower cost of borrowing in turn has a benign effect on the adjustment of prices.

III. Empirical Analysis

The simple model of the previous section describes a channel through which financial openness affects price-setting behaviour. In this section we investigate the empirical connection between the accelerating pace of global financial integration since the turn of the millennium and the rate of inflation. Our sample comprises 139 countries (137 after removing two outliers) and covers the 1997-2016 period. The cross-country dataset consists of annual observations drawn from the World Bank database (2019a, b) and the KOF (Swiss Institute of Technology). The latter compiles a comprehensive index that tracks the degree of financial openness of economies worldwide (Gygli, Haelg, and Sturm (2019)). This index will serve as our measure of financial openness. The KOF financial globalization index (measured on a scale from 0 to 100) is based on two separate, equally weighted sub-indices of *de facto* and *de jure* measures of financial openness. The *de facto* measure takes account of cross-border flows and stocks of foreign assets and liabilities, foreign direct and portfolio investment, international debt, international reserves, and international income payments. The *de jure* measure reflects the incidence of investment restrictions, international investment agreements, and, importantly, capital account openness where the

latter is measured by the Chinn-Ito index (2008). The KOF measure of financial openness is thus more comprehensive than the Chinn-Ito index.[7]

Table 2 presents summary statistics of the data used in the empirical analysis. Of some interest is the actual range of financial openness (rescaled to range from a minimum of 0 to a maximum of 1). At the low end of the scale it hovers around 0.25 and at the top end around 0.96. The mean and median are very close to each other at 0.59 indicating that the distribution is not overly skewed. Summary statistics for trade openness are not markedly different.

In line with previous investigations (e.g. Romer (1993), Lane (1997)), we carry out a cross section analysis of the empirical data. For each country we compute averages of the rate of inflation, financial openness, and a set of control variables over the 1997-2016 period. The rationale for doing so is twofold. Firstly, we do not claim that openness measures can explain short term variation in inflation caused by the business cycle. Rather, we posit openness exerts an effect on trend inflation. Secondly, and most importantly, as mentioned above, sticking with this methodology is in line with previous literature on this topic, thereby facilitating a direct comparison with earlier results. With trend inflation over the sample period as the dependent variable, the test equation takes the following form:

$$\log(\pi^{CPI}) = \alpha + \beta_1(financial\ openness) + \beta_2 \log(GDP) + \beta_3 \log(GDP\ per\ capita) + \beta_4(political\ stability) + \beta_5(exchange\ rate\ arrangement) + \beta_6(measure\ of\ central\ bank\ independence) + \beta_7(D^{IT}) + e \quad (12)$$

[7] Gräbner et al. (2021) provide a comprehensive review of existing measures of financial and trade openness largely from a methodological perspective. They do not examine the connection between openness and inflation. They do, however, explore empirically the extent to which the different measures of openness are related to economic growth but find no consistent pattern in the data.

$\log(\pi^{CPI})$= natural log of average CPI inflation in a country over the sample period.[8] Financial openness of a country's economy is represented by the average of the KOF financial globalization index over the sample period.

Naturally there are other factors that affect the rate of inflation. log (GDP) captures the terms of trade (or real exchange rate) effect. Lane (1997) hypothesizes that this effect is negative and moves in line with the level of GDP. Per capita real GDP (in log form) captures the level of development of a country. The more advanced a country is, the better its ability to raise revenue through taxes other than the printing press, resulting in lower inflation. The third control variable is a political stability index based on the likelihood of politically motivated instability and violence.[9] Greater political stability is conjectured to lead to lower inflation. To account for the possible effect of exchange rate regimes on inflation, we also employ a time-varying measure of the exchange rate arrangement developed by Iltzetzki et al. (2016) in the test equation. The final control variables are central bank independence (CBI), proxied by the average turnover of governors over the sample period, a *de facto* measure, and a distinction between inflation-targeting and non-inflation targeting central banks. Greater central bank independence (lower turnover of governors) and an explicit commitment to targeting inflation should be associated with lower inflation outcomes.

Table 3 shows the empirical estimates of the relevant coefficients, their standard errors and the usual regression diagnostics. We estimate different variants of the test equation, beginning with a simple specification and adding one explanatory variable at a time. Inspection of the reported coefficient estimates of financial openness reveals that

[8] The natural log transformation is used to reduce the positive skew of the dependent variable (as suggested by Romer (1993)).
[9] The original scale ranging from -2.5 to 2.5 is adjusted to a scale of 1 to 5 for easier interpretation.

they are consistently negative and statistically significant in all estimated specifications. CPI inflation is inversely related to the degree of financial openness. The coefficient estimates in column 1 imply that average inflation falls from 21 percent for a financially closed economy to 12 percent when financial openness equals 0.25 and further to 6.5 percent when financial openness increases to 0.5. Average inflation drops to 3.6 percent for a highly financially open economy of 0.75.[10]

The inverse linkage between financial openness and CPI inflation is robust to the inclusion of several control variables in the regression equation, some of which are systematically related to the inflation rate. A case in point are the measures that capture stability aspects of the institutional framework and exchange rate arrangements in the countries under study. In the larger sample of 137 countries political stability is inversely related to the rate of inflation, although its effect wanes if the sample size decreases due to the addition of a *de facto* measure of central bank independence. An increase in the turnover of governors, a potential source of instability in managing monetary affairs, is positively related to inflation in columns 3 - 7. [11] Exchange rate arrangements seem to matter. Greater nominal exchange rate flexibility is positively correlated with inflation. The terms of trade effect is apparent in the negative coefficient on log GDP.

IV. Robustness Checks

[10] The average rates of inflation (for trade openness ranging from 0 to 0.75) reported by Romer are 18, 14, 11, and 8 percent. The calculations of the average rate of inflation reported are based on: $\pi^{CPI} = e^{(intercept+coeff*fo)}$ where *fo* stands for financial openness. These calculations do not include the effects of both log (GDP) and log (GDPcap) on average inflation and are meant to convey just how sensitive average inflation is to the degree of financial openness.

[11] We employ this measure of (lack of) central bank independence for comparative purposes and because it is available for more than 100 countries. Both Romer (1993) and Lane (1997) use the reported turnover rate in the empirical parts of their paper. An alternative measure of CBI for 82 of the countries included in this study is considered later.

The remainder of the table presents the results of a few robustness checks. To examine the potential downward effect on inflation by the widespread adoption of explicit inflation targets in nearly 30 countries over the sample period, we add a dummy variable (D^{IT}) to the regression.[12] As indicated in column (5), the estimated coefficient, while negative, is not significantly different from zero. Thus there is no evidence to suggest that inflation in countries with explicit inflation targets was lower than in non-inflation targeting countries. The final two columns employ alternative measures of financial openness and central bank independence. According to column (6), the Chinn-Ito index of capital account openness (CI open) bears no systematic negative relationship to inflation in a sample of 104 countries. In yet a smaller sample of 82 countries for which a *de jure* measure of central bank independence (CBIW) compiled by Dincer and Eichengreen (2014) is available, the estimated coefficient on CBIW is positive and statistically significant. This is a surprising result and contrary to expectations as greater central bank independence, all things equal, is expected to lead to lower inflation. It must be borne in mind, however, that the CBIW is not a *de facto* index but based on an expanded set of *de jure* measures first reported by Cukierman, Webb, and Neyapti (1992). As such the index may not capture operational aspects that matter for inflation outcomes. Another change in this smaller sample of 82 countries pertains to the estimated coefficient on the indicator variable marking out the inflation targeting countries. It is negative and statistically significant which implies that CPI inflation was lower in those countries where the primary objective of monetary policy is low and stable inflation.

[12] $D^{IT} = 0$ for non-inflation targeting central banks; $D^{IT} = x$ for inflation-targeting central banks where $0 < x \leq 1$. For a central bank that began to target inflation at some point during the sample period, x represents the number of years since adoption of inflation targeting relative to the length of the sample period. A list of the inflation-targeting countries and the adoption dates of the regime appears in Ilzetzki et al. (2017).

A further robustness check subdivides the whole sample of 137 countries into two groups. The first group consists of the 35 OECD countries while the second group includes the remaining 102 countries.[13] Financial markets are thinner in less advanced countries, and as a result, the effect of financial openness on inflation outcomes might be more limited in these countries. Inspection of the coefficients on financial openness in the second row of Table 4 reveals that the inverse relationship between financial openness and average CPI inflation is present in the data for both groups of countries. There is, however, clear evidence that the downward effect of greater financial openness on inflation in OECD countries is roughly twice the size of same in the non-OECD countries. This result supports the conjecture that greater depth of financial markets combined with more competitive pricing of goods and services in more advanced countries compared to emerging and developing countries exerts greater downward pressure on inflation. Of note is also the difference in the regression intercepts – statistically insignificant for the OECD countries but highly significant in the non-OECD countries – and the differing effects of the control variables on inflation in the two sets of countries. While the terms of trade effect *(log GDP)* and state of development/prosperity effect (*log GDP per capita)* are negative and statistically significant in the OECD countries both effects are absent in the data for non-OECD countries. Instead, institutional factors such the exchange rate arrangement and central bank independence appear to matter in the non-OECD countries. Greater tolerance of exchange rate flexibility and a higher turnover of central bank governors are positively related to CPI inflation in emerging and less developed countries.

[13] Colombia and Costa Rica became official members of OECD only in 2020 and 2021, respectively. Both countries are therefore classified as non-OECD countries.

Other robustness checks such as replacing *(log GDP)* and (*log GDP per capita)* with the respective *change* do not weaken the strong inverse linkage between financial openness and CPI inflation.

V. Instrumental Variables (IV) Estimation

Concern about the existence of a potential endogeneity bias associated with OLS estimation calls for the application of instrumental variables estimation. At issue is whether financial openness is truly exogenous and not the outcome of decisions made by the political and business establishment in a country to cater to their self-interest. Romer (1993) chose land area as an instrument in his empirical work. We follow his example and use the logarithm of land area (square km) as an instrument in the IV estimation. The results of the instrumental variable estimation appear in Table 5. Inspection of the coefficients on financial openness reveals that the negative association between financial openness and CPI inflation still prevails. Notice though that the size of the estimated coefficients and the standard errors increase markedly. The bias and imprecision with which the coefficients are estimated are likely to be the direct consequence of land area being a weak instrument. Evidence consistent with this interpretation comes from the first stage regression: for all specifications estimated the F-statistic on the exclusion restriction for the instrument is below the rule-of-thumb value of 10 suggested by Staiger and Stock (1997). Under these circumstances, it is difficult to decide which estimation strategy produces more reliable point estimates of the linkage between financial openness and CPI inflation.[14] What is

[14] Romer (1993) also reports larger IV than OLS coefficient estimates. In our case the observed size differences are larger, a fact that we attribute to land area being a comparatively weaker instrument in our study than Romer's. We also tried population as an alternate instrument. Like land area it proved to be a weak instrument.

important, however, is the following conclusion. The robustness checks yield no evidence that casts doubt on the strong inverse connection between financial openness and average CPI inflation in more than 100 countries.

VI. A Comparison with Trade Openness

As described in the introduction, previous contributions to the literature concentrated on trade openness as a potential important factor driving inflation. KOF also compiles a measure of trade openness, which is distinct from financial openness, for countries around the globe. The KOF trade globalization index encompasses *de facto* and *de jure* measures of trade openness. The *de facto* index considers trade in goods, trade in services (both measured as a share of GDP), and trade partner diversity; the *de jure* index is compiled from information on trade regulations, tariffs and taxes as well as trade agreements.

In this section, we re-estimate the earlier regression equation with trade openness replacing financial openness. The sample of countries remains the same as does the sample period. The econometric results appear in Table 6.

Inspection of the second row of Table 6 shows that trade openness is not systematically correlated with CPI inflation. Apart from the terms of trade effect, which seems to be more pronounced if paired with trade openness, and a few other nuanced differences, the coefficient estimates of Table 6 are roughly similar to those of Table 3.[15] Interestingly though, the adjusted R^2 is consistently higher in the estimated specification that includes KOF financial openness rather than trade openness. This fact speaks to the

[15] Looking at the experience of OECD and non-OECD countries in isolation produces results similar to those reported in Table 6. These results are available on request from the authors.

growing relative importance of global financial integration in influencing macroeconomic objectives such as price stability.

VII. Conclusion

Romer (1993) and Lane (1997) are influential studies of the linkage between trade openness and inflation in the 1970s and 1980s. In this paper we focus on an alternative measure of openness, financial openness, and analyse its co-movement with inflation in more than 100 countries after the rapid dismantling of capital controls in the 1990s and the ensuing greater pace of global financial integration. Our empirical analysis shows that, of the two measures of openness, the one tracking the exposure of the financial system in a country to the outside world is more closely related to the behaviour of inflation. We find a strong systematic inverse link between financial openness and CPI inflation over the 1997-2016 sample period. The results reported in this paper lend credence to the argument that inflation in financially open economies is indeed lower. They are consistent with the view that the relative expansion of domestic financial services sectors and their closer integration with the global financial architecture in more recent times have had a salutary effect on consumer price increases around the world. Advanced, emerging, and developing countries appear to have benefited from greater financial openness and the lower average CPI inflation associated with it.

The present study is very much in the spirt of Romer (1993) and Lane (1997) whose empirical work focuses on sample-based averages of the relevant variables. Further study of the empirical linkage between financial openness and CPI inflation could analyse panel data. As pointed out by Romer (1993), this approach, however, is likely to worsen the endogeneity problem and would thus necessitate a search for suitable instruments.

Appendix

List of countries included in the study:

Albania
Algeria
Angola
Armenia
Australia
Austria
Azerbaijan
Bahamas, The
Bahrain
Bangladesh
Barbados
Belarus
Belgium
Benin
Bhutan
Bolivia
Botswana
Brazil
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Chile
China
Colombia
Congo, Dem. Rep.
Costa Rica
Cote d'Ivoire
Croatia
Czech Republic
Denmark
Dominica
Dominican Republic
Ecuador
Egypt, Arab Rep.
El Salvador
Equatorial Guinea
Estonia
Ethiopia
Fiji
Finland
Gambia, The
Germany
Ghana
Greece
Grenada
Guatemala
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong SAR, China
Hungary
Iceland
India
Indonesia
Iran, Islamic Rep.
Iraq
Ireland
Israel
Italy
Jamaica
Jordan
Kazakhstan
Kenya
Korea, Rep.
Kuwait
Kyrgyz Republic
Lao PDR
Latvia
Lithuania
Luxembourg
Macao SAR, China
Madagascar
Malawi
Malaysia
Mali
Malta
Mauritania
Mauritius
Mexico
Moldova
Mongolia
Morocco
Netherlands
New Zealand
Niger
Nigeria
Norway
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Romania
Russian Federation
Rwanda
Samoa
Saudi Arabia
Senegal
Serbia
Seychelles
Singapore
Slovak Republic
Slovenia
Solomon Islands
South Africa
Spain
Sri Lanka
St. Lucia
St. Vincent & the Grenadines
Sweden
Switzerland
Tanzania
Thailand
Togo
Trinidad and Tobago
Tunisia
Turkey
Uganda
Ukraine
United Kingdom
United States
Uruguay

France	Myanmar	Vanuatu
Gabon	Nepal	Vietnam
		West Bank and Gaza
		Zambia

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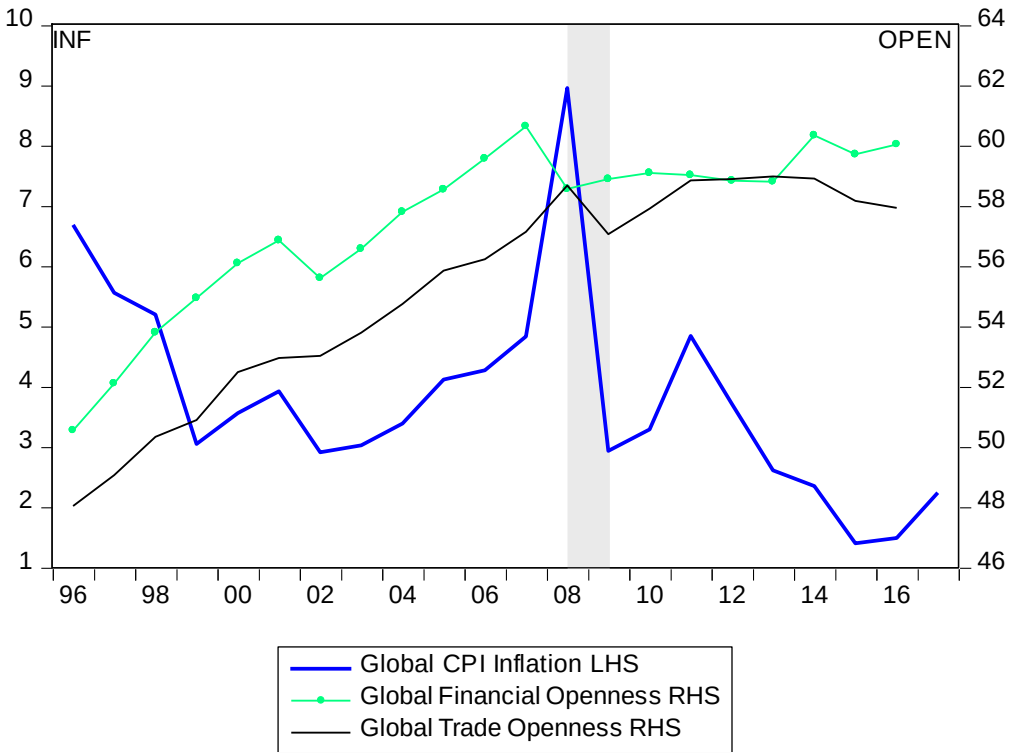
Figure 1 Global Openness and CPI Inflation over the Sample Period (1997-2016):



Sources: KOF, World Bank.

Notes:

1. The bar denotes the height of the Global Financial Crisis (2008-09).
2. Openness is measured on a scale from 0 to 100.
3. Global inflation is measured as an annual percentage change of the aggregate world CPI.
4. Corr (F O, CPI IINF) = -0.240), Corr (T O, CPI INF)=-0.126. Corr (F O, T O)=0.92 where F O = Financial Openness and T O = Trade Openness.

Table 1: Global Inflation and Financial Openness: the 1973-1988 vs. the 1997-2016 Period

	1973-1988	1997-2016
Average Global Inflation (%)	9.4	3.8
Std. Deviation of Global Infl. (%)	2.9	1.7
Average Financial Openness	40.6	57.8
Std. Dev. of Financial Openness	3.5	2.3

Sources: World Bank, Haver Analytics, OECD, KOF.

Notes:

1. Annual data in percent. Global Inflation is defined as median inflation in 168 countries in a given year.
2. KOF Financial Openness is measured on a scale from 0 to 100.

Table 2: Summary Statistics for the Sample Period 1997-2016

Summary Statistics, using the observations 1 - 137					
Variable	Mean	Median	S.D.	Min	Max
Log (CPI inflation)	-3.07	-3.13	0.887	-5.37	-0.259
Trade Openness	0.566	0.558	0.163	0.264	0.949
Financial Openness	0.596	0.587	0.163	0.246	0.955
Log(GDP per capita)	9.09	9.24	1.16	6.41	11.2
Log(GDP)	24.5	24.3	2.19	19.9	30.3
Political Stability	2.48	2.50	0.896	0.237	3.95
Exchange Rate Arrangement	1.98	2.00	0.841	1.00	4.00
Central Bank Independence	0.168	0.150	0.0859	0.00	0.600

Note: Missing observations have been dropped.

Sources: World Bank: CPI inflation, real GDP per capita (constant 2010 US$), GDP (constant 2010 US$), central bank independence, political stability.

KOF: Financial openness, trade openness. Both are annually composed indices as part of the larger KOF Globalisation index. Trade openness comprises trade in goods, trade in services, trade partner diversity, trade regulations, trade taxes, tariffs and trade agreements. Financial Openness comprises FDI, portfolio investment, international debt, international reserves, international income payments, investment restrictions, capital account openness, and international investment agreements. More information on how the index is compiled can be found in Gygli et al. (2019).

Ilzetzki et al. (2016): Exchange Rate Arrangement (ERA). The coarse ERA measure ranges from a low of 1 which denotes a peg to 5 which applies to a freely falling exchange rate. Values in between describe a crawling peg (2), a managed float (3), and a clean float (4).

Political Stability is taken from the Worldwide Governance Indicators. It measures the perceptions of the likelihood of political instability and/or politically motivated violence in units of a standard normal distribution rescaled to 1 to 5.

Central Bank Independence (CBI) is the average Central Bank Governor turnover for the period. The intuition is that the higher the turnover the less independent the central bank.

The entries in the table are based on data for 137 countries. Japan and Brunei were dropped from the sample because of extremely low CPI inflation rates. As a result, the sample size decreases from 139 to 137.

Table 3: Financial Openness and CPI Inflation

OLS Estimates Dependent Variable: Log(CPI inflation)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-1.565** (0.731)	-1.091 (0.686)	-0.859 (0.602)	-0.138 (0.722)	-0.563 (0.855)	0.084 (0.846)	-0.349 (0.892)
Financial Openness	-2.331*** (0.592)	-1.780*** (0.633)	-1.557*** (0.547)	-1.588** (0.679)	-1.509** (0.656)		-2.005*** (0.737)
Log(GDP)	0.047 (0.032)	-0.004 (0.034)	-0.077** (0.030)	-0.072** (0.031)	-0.070** (0.031)	-0.080** (0.030)	-0.105*** (0.037)
Log(GDP per capita)	-0.139 (0.100)	-0.015 (0.105)	0.062 (0.086)	-0.044 (0.107)	-0.016 (0.109)	-0.150 (0.106)	0.047 (0.103)
Political Stability		-0.279*** (0.101)	-0.303*** (0.092)	-0.166* (0.099)	-0.180* (0.094)	-0.190** (0.092)	-0.266*** (0.083)
ERA			0.402*** (0.080)	0.202** (0.082)	0.283** (0.120)	0.329*** (0.124)	0.519*** (0.144)
CBI				1.614** (0.738)	1.543** (0.749)	1.515* (0.780)	
D^{IT}					-0.315 (0.245)	-0.403 (0.258)	-0.643** (0.260)
CI open						-0.054 (0.049)	
CBIW							0.976*** (0.311)
n	137	137	137	108	108	104	82
Adj. R^2	0.27	0.30	0.42	0.46	0.46	0.45	0.52
Log L	-154	-151	-137	-99.4	-98.4	-95.4	-71.2

Notes:

1. * (**) [***] denotes statistical significance at 10 (5) and [1] percent level, respectively. Standard error estimates are based on the Huber-White-Hinkley estimation procedure.
2. Adding the turnover of central bank governors (CBI), an inverse measure of central bank independence, reduced the sample size from 137 to 108 countries due to the unavailability of this measure for mostly developing countries. Capital account openness (CI open) is measured by the Chinn- Ito index and available for 104 of the countries included in our sample. Employing the CBIW measure of central bank independence developed by Dincer and Eichengreen (2014) causes the sample size to shrink further to 82.

Table 4: Financial Openness and CPI inflation. OECD vs non-OECD countries

OLS Estimates Dependent Variable: Log(CPI inflation)						
Sub-Group	**OECD countries**			**Non-OECD countries**		
	(1)	(2)	(3)	(1)	(2)	(3)
Constant	0.005 (1.227)	-0.013 (1.114)	-0.014 (1.139)	-3.426*** (1.006)	-2.562*** (0.972)	-2.337** (1.053)
Financial Openness	-2.766** (1.223)	-2.407** (1.131)	-2.404** (1.141)	-1.283* (0.690)	-1.314** (0.597)	-1.456** (0.618)
Log(GDP)	-0.059 (0.045)	-0.075* (0.041)	-0.075* (0.041)	0.113*** (0.042)	-0.040 (0.048)	-0.025 (0.044)
Log(GDP per capita)	-0.545** (0.249)	-0.567** (0.243)	-0.567** (0.247)	-0.166 (0.106)	0.069 (0.086)	
Political Stability					-0.207** (0.105)	-0.052 (0.104)
ERA		0.079 (0.063)	0.079 (0.062)		0.625*** (0.124)	0.361*** (0.148)
CBI			0.022 (1.500)			1.796** (0.782)
n	35	35	35	102	102	73
Adj. R^2	0.56	0.56	0.54	0.13	0.38	0.26
Log L	-18.0	-17.4	-17.4	-121.0	-103.0	-71.6

1. For the OECD countries the log of (GDP per capita) was centered around its mean to produce economically sensible estimates of the intercept.
2. The dummy variable for the inflation targeting countries is not systematically related to CPI inflation in either set of countries. Hence the estimated coefficients are not reported.
3. The equality of the coefficients on financial openness in the two subsamples can be tested in the whole sample by assigning D=1 to an OECD country and D=0 otherwise. Adding the interaction term D*(financial openness) and examining the resulting coefficient reveals that it is negative and statistically significant at the 5 percent level. This implies that the negative effect of financial openness on CPI inflation is stronger in OECD countries.

Table 5: Financial Openness and CPI Inflation (Instrumental Variable Estimation)

TSLS Estimates Dependent Variable: Log(CPI inflation)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-2.936*** (1.089)	-2.945** (1.161)	-1.835* (0.990)	-1.922 (1.426)	-2.152 (1.396)	-4.437 (7.663)	-1.365 (1.230)
Financial Openness	-6.736** (2.780)	-6.728** (2.675)	-4.138* (2.234)	-5.951* (3.282)	-5.964* (3.268)		-4.350** (2.135)
Log(GDP)	0.032 (0.046)	0.034 (0.046)	-0.053 (0.041)	-0.037 (0.050)	-0.036 (0.051)	-0.042 (0.162)	-0.087* (0.050)
Log(GDP per capita	0.340 (0.322)	0.333 (0.237)	0.238 (0.172)	0.300 (0.293)	0.318 (0.285)	0.769 (1.529)	0.221 (0.179)
Political Stability		0.010 (0.178)	-0.151 (0.156)	0.071 (0.195)	0.067 (0.194)	0.203 (0.644)	-0.180 (0.123)
ERA			0.378*** (0.091)	0.168 (0.106)	0.207 (0.149)	-0.097 (0.728)	0.504*** (0.144)
CBI				0.857 (1.157)	0.813 (1.152)	-1.196 (5.250)	
D^{IT}					-0.155 (0.273)	-0.167 (1.067)	-0.548** (0.233)
CI open						-1.783 (2.658)	
CBIW							1.378*** (0.484)
n	137	137	137	108	108	104	82
1st Stage F-stat	6.66	8.53	7.56	3.92	3.80	0.42	5.15
Log L	-448	-435	-423	-298	-297	-541	-198

Notes: 1. Log (land area) is used as an instrument.
2. White heteroscedasticity-consistent standard errors.
3. The bias of the IV estimator relative to the OLS estimator in the simple bivariate model below is $\frac{plim\,\widehat{\beta}^{IV}-\beta}{plim\,\widehat{\beta}^{OLS}-\beta}=\frac{Corr(z,u)}{Corr\,(z,x)\,Corr(x,u)}$. Here we see that the ratio exceeds one, i.e. the bias of the IV estimator is greater than the bias of the OLS estimator, if for *Corr(z,u) ≠ 0,* the correlation between the potentially endogenous regressor *x* and the instrumental variable *z* is very low. Thus in case of a weak instrument the bias of the *IV* estimator could be worse than the bias of the *OLS* estimator. Along with the fact that a weak instrument causes large standard errors, instrumental variable estimation may thus be 'a cure worse than the disease'. It is for this reason that we report the first stage F-statistic in the auxiliary regression where x is regressed on z. As a rule of thumb, an F-statistic below 10 is regarded to be a sign of a weak instrument (Staiger and Stock (1997)). Hausman tests also fail to reject the null hypothesis that financial openness is an exogenous regressor.

$y = \beta x + u$ *z* is an instrument; *u* is an error term; *y* is the dependent variable; *x* is a potentially endogenous regressor.

Table 6: Trade Openness and CPI Inflation

OLS Estimates Dependent Variable: log(CPI inflation)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	-0.891 (0.720)	-0.400 (0.623)	-0.212 (0.571)	0.532 (0.687)	0.037 (0.882)	0.155 (0.868)	0.558 (0.884)
Trade Openness	-0.423 (0.563)	0.142 (0.568)	0.337 (0.559)	-0.629 (0.595)	-0.471 (0.590)	-0.384 (0.684)	-0.728 (0.722)
Log(GDP)	0.048 (0.033)	-0.016 (0.033)	-0.090*** (0.029)	-0.089*** (0.030)	-0.085*** (0.031)	-0.083*** (0.031)	-0.133*** (0.036)
Log(GDP per capita)	-0.343*** (0.093)	-0.152 (0.102)	-0.072 (0.090)	-0.125 (0.096)	-0.098 (0.100)	-0.125 (0.109)	-0.039 (0.109)
Political Stability		-0.390*** (0.107)	-0.409*** (0.100)	-0.217* (0.111)	-0.236** (0.107)	-0.171* (0.096)	-0.320*** (0.081)
ERA			0.419*** (0.082)	0.199** (0.086)	0.289** (0.132)	0.314*** (0.128)	0.534*** (0.161)
CBI				1.729** (0.733)	1.679** (0.744)	1.416* (0.791)	
D^{IT}					-0.338 (0.268)	-0.381 (0.262)	-0.720** (0.311)
CI open						-0.047 (0.054)	
CBIW							0.774** (0.334)
n	137	137	137	108	108	104	82
Adj. R^2	0.19	0.26	0.39	0.43	0.43	0.45	0.47
Log L	-161	-155	-141	-102	-101	-95.2	-78.8