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ON THE TWO WAY FEEDBACK BETWEEN FINANCIAL AND TRADE OPENNESS

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ABSTRACT

This paper studies the two-way feedback between de-facto financial and trade openness. We first show that de-facto financial openness (measured by the sum of gross private capital inflows and outflows as percent of GDP) depends positively on lagged trade openness, controlling for macroeconomic and political economy factors. Next, we confirm that de-facto trade openness depends positively on lagged financial openness, using similar controls. Having empirically established (Granger) causality, we investigate the relative magnitudes of these causality structures using the decomposition test developed in Geweke (1982). Most of the linear feedback between trade and financial openness (87%) can be accounted for by Granger-causality from financial openness to trade openness (53%) and from trade to financial openness (34%). Simultaneous correlation between the two series accounts for only 13% of the total linear feedback between the two series.

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1. Introduction and overview

The purpose of this paper is to empirically investigate the presence of two-way feedbacks between financial and trade integration. There are good reasons to expect that higher trade openness would lead to greater financial openness, and vice-versa. Greater trade openness is likely to reduce the optimal financial repression, as it would increase the cost of preventing illicit capital flight via trade-misinvoicing (see Aizenman and Noy (2003) for further discussion). A channel contributing to the association between greater financial openness and higher future trade openness is vertical foreign direct investment. FDI allows multinationals to fragment production optimally, benefiting from the cost advantage associated with locating labor intensive production stages in labor abundant countries (see Gordon et al., 2001 for a comprehensive overview of vertical FDI). A by-product of this fragmentation is the growth of two-way trade: higher imports of primary and intermediate products, followed by higher exports of the upgraded products. Indeed, Gordon et. al. (2001) show that vertical FDI from the OECD to developing countries has increased substantially in the last twenty years.[1]

The positive association between trade and financial openness may also be the outcome of political economy factors, as is highlighted in Rajan and Zingales (2003). They propose an interest group theory of financial development whereby incumbents oppose financial development because it breeds competition. In these circumstances, the incumbents' opposition will be weaker when an economy allows both cross-border trade and capital flows. They predict that a country's domestic financial development should be positively correlated with trade openness, and identify the time varying nature of this association. Another interesting approach linking trade and financial openness is Portes and Rey (2003), who show that both international trade in goods and in assets are explained by similar gravity equations. Their work highlights the role of information flows and frictions in accounting for trade in goods and assets, controlling for other conventional variables.

We therefore expect to observe two-way linkages between trade and financial openness. In the next section, among other things, we examine empirically the problem of (Granger) causality empirically. Following recent literature [see Prasad, Rogoff, Wei and Kose (2003) and the references therein], we focus on the *de-facto* measures of trade and financial openness. This is accomplished by taking a reduced form approach regarding the determination of the actual openness, being the outcome of conventional economic variables, and the *de-jure* regulations.

In section 2 we estimate the level of *de facto* financial openness as a function of lagged trade openness, several macroeconomic control variables, and a vector of political-institutional variables. We apply a two-step FGLS procedure for a panel of developing and OECD countries for the years 1982-1998 using annual observations (where the sample size was determined by the availability of data and by excluding off-shore financial centers). We find that de-facto financial openness depends positively on lagged trade openness, and GDP/Capita. The budget surplus to GDP ratio is occasionally significant and always negative for developing countries, but positive and significant for the OECD countries. Including a corruption index in our regressions also yields negative and significant coefficients in almost all the iterations of the model we examined, confirming Wei's (2000) insight. For the full sample (developing and the OECD) and the developing countries sub-samples, the effect of greater democratization is negative, significant and apparently large. Any one-point increase in this index (out of the 20 points difference between full autocracy and democracy) reduces financial openness (international financial flows) by almost a one-half percentage point of GDP. The effect is about half as large when we do not control for the level of corruption.

The negative marginal association of democracy and financial openness we find is consistent with the notion that a significant share of the volume of financial flows to and from developing countries are due to diversification of political risk, as advocated by Dooley (1988). This finding also suggests that the 'home bias' in the allocation of financial assets identified by the financial literature (dealing mostly with OECD countries) may be less pronounced in developing countries – i.e. it may be attenuated by

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[1] Another channel operating in the same direction is the reliance of international trade on trade credit. Greater financial openness tends to reduce the cost of trade credit, thereby

political risk considerations affecting some developing countries. An alternative interpretation is that more democracy in a given country is also associated with better institutions, and thereby with higher marginal productivity of capital, thus reducing the incentive to buy foreign assets. This argument suggests that the political economy and efficiency aspects of the governing polity, and the quality of its institutions, deserve more careful investigation. All these issues are left for future research.

The empirical results reported above suggest *de-facto* sequencing, where greater *de-facto* trade openness is associated with larger future *de-facto* financial openness. The reverse association -- from financial openness to greater trade openness -- may hold due to different channels that were briefly discussed. Hence, we expect to find two-way positive linkages between financial and commercial openness. Our analysis in Section 3 confirms these predictions empirically. Interestingly, controlling for macroeconomic and political economy variables, we find that *de-jure* restrictions on trade and convertibility have a large adverse effect on trade openness. This is in contrast with the set of regressions explaining financial openness, where the *de-jure* restrictions on convertibility turned out to be insignificant.[2]

Having established (Granger) causality in both directions, we investigate, in section 3, the relative magnitudes of these directions of causality using the decomposition test developed in Geweke (1982). We find that almost all of the linear feedback between trade and financial openness can be accounted for by G-causality from financial openness to trade openness (53%) and from trade to financial openness (34%). The residual is due to simultaneous correlation between the two annual measures.

Section 4 concludes the paper with further interpretive remarks.

2. The Empirical model

This section reviews the data, the methodology we employ and our main results on the determinants of financial openness and causality between financial openness and commercial/trade openness. We begin by describing the data. We next discuss the model we estimate for the determination of financial openness and finally examine the question

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increasing international trade.

of causality. Throughout, we discuss the empirical exercises' relevance to the theory we developed in Aizenman and Noy (2003). An appendix provides a detailed summary of the variables, sources and samples described in this section.

2.1 The data

We measure *de facto* financial openness using the sum of total capital inflows and outflows (in absolute values) measured as a percent of gross domestic product. Capital flows are the sum of FDI, portfolio flows and other investments. This measure is exactly analogous to the standard measure of commercial openness, which we employ as an independent variable in our regressions.[3]

Tables 1A-1B describe our data for financial openness. Specifically, table 1A presents averages for financial openness for geographical regions, decades and the estimation samples we use. We find that for developing countries in general and in particular for Asian, African and Middle Eastern countries, financial openness decreased from the 1970s to the 1980s but rebounded and surpassed previous levels in the 1990s. This trend is most pronounced for the East Asian countries for which capital flows were 11.2% of GDP during the 1970s, 8.5% during the 1980s and 16.5% during the 1990s.[4] Developed economies (henceforth OECD) do not show this trend but show a continual increase in financial openness (from 7.3% to 9.3% to 16.8% for the 1970s, 1980s and 1990s respectively). Interestingly, Latin America shows a similar continuous trend in spite of the 1980s debt crisis.

For our commercial openness index, we average the sum of exports and imports as a percentage of GDP over the previous 4 years (t-1 to t-4). By averaging, we smooth out any fluctuations due to temporary changes in the terms of trade and obtain a more robust finding in our multivariate analysis with respect to the temporal effect of commercial openness on financial openness. In addition, we also investigate the dynamic

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[2] These results are consistent with the notion it's easier to prevent the smuggling of goods than to prevent illicit capital flight.

[3] Wei and Wu (2002) previously used this financial openness variable. We thank Shang-Jin Wei for making it available to us. The data originates from the IMF's *Balance of Payments Statistics* database. See also Lane and Milesi-Ferretti (2001) for insightful analysis of the net asset position of nations, based upon careful aggregations of the IMF's database.

causal structure of the interaction between commercial and financial openness using the original annual data for both.

Table 1B presents the correlation coefficients between our financial openness measure and the commercial/trade openness measure. Bi-variate analysis clearly shows a partial correlation between the two types of openness (both when commercial openness is measured annually and when it is averaged for the previous 4 years). Notably, the correlation appears to be significantly weaker for Latin American countries. The financial openness index measures gross capital flows. Accordingly, we also show, in column 3 of table 1B, the correlation of our gross flows measure with net flows (the current account). We find that there is only a weak and unstable correlation between the two (in some of our sub-samples the correlation is even negative).

As the previous theoretical discussion in Aizenman and Noy (2003) suggests, one of the determinants of *de facto* financial openness should be the legal impediments to financial flows (*de jure* financial openness). Accordingly, we include in our multivariate analysis a binary measure for restrictions on the capital account and/or the current account. Both indicators are taken from the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions.* These binary measures, which we combine to make a single 0/1 indicator of legal restrictions, are the only internationally comparable measures of de jure financial openness available for a large sample of countries and over the time period.[5]

For the political-economy determinants of financial openness, we concentrate our empirical investigation on three political-institutional measures. The motivation for examining political variables is twofold. First, Cukierman, Edwards and Tabellini (1992) argue that functioning democracies will tend to have more efficient tax collection systems. And, in our theoretical work, we concluded that the degree of tax collection costs would determine the degree of financial repression. To investigate this hypothesis we examine whether the capacity of the political system to prevent friction (and consequently mediate conflicts through the political arena and facilitate more efficient tax and other regulatory structures), is a relevant measure. Again, we expect less polarized

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[4] Our data does not completely reflect the slowdown in capital flows as a result of the Asian crisis as it only covers up to and including 1998.

societies and those in which conflicts are solved peacefully within the political system to have more efficient tax collection mechanisms in place.

First, we employ a variable that measures the degree of democratic rule. Our democracy index is taken from the *Polity IV* project and ranges from -10 (fully autocratic) to +10 (fully democratic).[6] Following the work of Wei (2000) and Dreher and Siemers (2003), we examine whether corruption matters for the degree of financial openness. To that end, we use a measure of corruption that is taken from the *International Country Risk Guide.* The data are available in monthly observations. We obtain annual observations from 1982 onward by averaging the monthly data points for each year. This index ranges from -6 (low probability/risk of encountering corruption) to 0 (high risk of corruption). Aizenman and Noy (2003) verify the robustness of the results using alternative political-institutional measures.

In order to ensure our results are not driven by a 'missing variables' bias, we include a host of macroeconomic control variables. In all regressions we use the inflation rate (changes in the CPI), per capita gross domestic product (measured in PPP dollars), the government's budget surplus (as a percent of GDP), and a world interest rate (proxied by the US Treasury Bill 1-year rate). All the macroeconomic data are taken from the World Bank's *World Development Indicators* (2001 edition). In order to examine whether the occurrence of financial crises contaminates our result, as they might systematically change the relationship between financial openness and our control variables, we also include crises measures in a number of regressions.

A priori, we see no reason to restrict our sample and therefore attempted to include all 205 countries and territories for which data are available in the 2001 edition of the World Bank's *World Development Indicators* (*WDI*). Our control variables, though, are available for only a subset of this group. Most importantly, most of the data on financial flows as well as the data on corruption are typically available only from the

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[5] A thorough description of these data is found in Glick and Hutchison (forthcoming).

[6] The "Polity IV database includes annual measures for both institutionalized democracy (DEMOC) and autocracy (AUTOC), as many polities exhibit qualities of both these distinct authority patterns….A third indicator, POLITY, is derived simply by subtracting the AUTOC value from the DEMOC value; this procedure provides a single regime score that ranges from +10 (full democracy) to -10 (full autocracy)." (Marshall and Jaggers, 2000, p. 12). We use the POLITY variable in our regressions.

1980s and only for a much smaller set of countries. Our data set is therefore an annual panel of 83 countries for the years 1982-1998.

We further investigate the robustness of our results by examining various sub-samples. Notably, we hypothesize that results for OECD countries might be different from those for developing countries. We thus repeat our regressions for developed economies – which we define as those economies that were members of the OECD in 1990. As our focus is developing countries we include most of the regression results for this sub-sample. These are defined by excluding OECD countries and island economies (as these are often used as off-shore banking centers and their level of de facto financial openness is often dramatically different from other countries). For a summary of the information described in this section including detailed data sources and sample sizes, see the appendix.

2.2 Methodology and Regression Results

Based on our theoretical work, we estimate the statistical significance of various sources of financial repression by positing a linear structure for the determination of the level of financial openness whereby:

$$(25) \qquad FO_{it} = \alpha + \beta_1 X_{it} + \beta_2 \overline{CO}_{it-1} + \beta_3 P_{it} + \varepsilon_{it} \text{ , with } \varepsilon_{it} = \rho \varepsilon_{it-1} + \mu_{it} .$$

The dependent variable (FO_{it}), financial openness for country i at time t, is assumed to be dependent on an intercept (or alternatively separate country or regional intercepts), a vector X_{it} of macroeconomic control variables, average of lagged commercial openness ($\overline{CO}_{it-1}$), a vector of political-institutional variables (P_{it}) and an error term. The variables examined are described below.

A Durbin-Watson statistic for all iterations of the model strongly indicates that the error terms are autocorrelated. The autocorrelation coefficient was estimated to be between 0.7-0.9. The error term is thus assumed to have an AR(1) structure with μ iid.[7] We estimate the model using the Prais-Winsten algorithm. The Prais-Winsten procedure is a 2SLS procedure that utilizes the estimated correlation coefficient obtained from the

[7] $E(\mu_t)=0$; $E(\mu_t^2)=\sigma_u^2$; and $Cov(\mu_t, \mu_s)=0$ for $t \neq s$.

Durbin-Watson statistic from the first-stage OLS regression as the initial autocorrelation value and reiterates a second-step FGLS till convergence (typically 2-3 iterations).[8]

Table 3 includes results for our benchmark regressions. For the first stage regression, the R^2 is between 0.20 and 0.67 depending on the exact specification and sample used.[9] For the second stage, the model converges very quickly (within two iterations) and most of the coefficients for the benchmark control variables are robust to the inclusion and exclusion of other variables. In column (1) of table 3, which includes the full sample (829 observations), we already observe many of the results that remain throughout the various specifications.

In examining the independent variables, we first turn to our control macro-variables. The coefficient for per-capita GDP is always significantly positive – i.e., an increase in GDP per capita increases financial openness (except for a regression containing only OECD countries in which the coefficient is insignificant). We find that an increase domestic per capita GDP of PPP$1000 will facilitate a 0.14 to 2.28 percentage points increase in the volume of capital flows (as percent of GDP). The ratio of budget surplus to GDP is typically significant and always negative for developing countries. A bigger budget deficit will increase *de facto* financial openness. Again, this result does not hold for our OECD sub-sample; for this case, reported in table 3 column (2), the budget surplus coefficient is positive and significant.[10] The inflation rate and the world interest rate (proxied by the US T-Bill rate) are always insignificantly different from zero. But, as with the previous results, the coefficients for inflation and the world interest rate seem to be different for the OECD sub-sample; although these are still insignificant for standard significance levels, the effect of inflation on financial openness

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[8] For technical details see Greene (2000, pp. 546-550) and Greene (2002, E7 pp. 4-7).

[9] The higher R^2 values are generally for the models that include more political/institutional variables and for the developing and OECD sub-samples.

[10] The disparity between the impacts of budget surplus in developing and OECD countries may be explained by the differential cyclical patterns of fiscal policy. In contrast to the OECD countries, fiscal policy tends to be pro-cyclical in developing countries: i.e., government spending drops and taxes increase during recessions. Financial crises tend to lead to recessions in developing countries, inducing abrupt fiscal adjustment, reducing fiscal deficits. These observations may lead to the positive association between smaller budget deficits and lower *de*

is larger (and negative) for the OECD countries and the effect of the US T-Bill rate is smaller. Both these results correspond with our intuition. We also include a binary variable for the 1990s and as expected given the information presented in table 1A, the coefficient for this variable is always positive and significant; i.e., the 1990s saw an across-the-board increase in financial openness (increased capital flows). This increase in capital flows is found to be between 1.3 and 4.9 percent of GDP.

Additionally, we find that the trade openness coefficient (ratio of exports and imports to GDP) is always positive and highly significant. As this variable describes the average openness over the previous four years, we find that a history of more commercial openness will increase financial openness significantly. This result is robust to all the iterations we present in table 3 and elsewhere.

Before discussing our empirical analysis of the political-economy determinants of international financial flows, we note that including the corruption variable in our regressions also yields negative and significant coefficients in almost all the iterations of the model.[11] Similar results from different data are analyzed in detail in Wei (2000) and Dreher and Siemers (2003).

We also find that the nature of the political regime affects the degree of financial openness. An index that describes the nature of the political regime (the index runs between 10 – full democracy and –10 – full autocracy) yields several interesting results. For the full sample (table 3 column 1) and the developing countries sub-samples (table 3 column 3) the coefficient for this variable is negative, significant and apparently large.[12] Any one-point increase in this index (out of the 20 points difference between full autocracy and democracy) reduces financial openness (international financial flows) by almost one-half a percentage point of GDP. The effect is about half as large when we do not control for the level of corruption (reported in table 3 column 4).

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facto financial openness [see Gavin, Hausmann, Perotti and Talvi (1996), Aizenman, Gavin and Hausmann (2000) and Talvi and Vegh (2000)].

[11] Once more, this result does not hold for the OECD sub-sample (reported in table 3 column 2). In this case, the coefficient is still positive but insignificant. Variability of the corruption variable for the OECD sub-sample is much lower.

[12] For the OECD sample (table 3 column 2), the coefficient has the same sign and magnitude but is statistically insignificant.

Since the results for the OECD sub-sample are consistently different, and our theoretical modeling is focused on developing countries, we give most attention to the developing countries sub-sample (these include all non-OECD countries that are not islands/financial-centers). Columns 5 and 6 in table 3 repeat our specification for the developing countries sample but exclude the regime variable in column 5 and both the regime and corruption measures in column 6. In both cases, we find that all the other results reported above remain robust to these omissions.

Table 4 presents information on the quantitative significance of our findings for the benchmark model. For the sample of developing countries, we find that a one standard deviation increase in the commercial openness is associated with a 9.5 percentage points increase in de-facto financial openness (percent of GDP), a one standard deviation increase in the democratization index reduces financial openness by 3.5 percentage points, and a one standard deviation increase in corruption is associated with a reduction of financial openness by 3.1 percentage points. Similarly, the corresponding associations for the whole sample are 12.3, 3.1 and 2.9. Furthermore, a developing country will have higher financial openness (measured as 3 additional percentage points of GDP), were it to have the median level of trade openness of an OECD country; would be 2.2% less open were it as democratic as the typical OECD country; and 4% more open to financial flows were it less corrupt as the typical developed country is.

In column (7) of table 3 we re-estimate our benchmark specification (column 3) but also include the *de-jure* measure of financial openness. Interestingly, the coefficient for this binary measure of restrictions on the capital and current accounts combined is not significant in this specification nor in other specifications we ran. Our main results with respect to commercial openness and the political regime remain significant even when the *de jure* measure is included; though the corruption coefficient is no longer significant reflecting a correlation between corruption and the decision by the authorities to use financial repression.[13]

[13] The same results are obtained if a binary index for restrictions only on the current (or capital) account is included.

2.3 Robustness of Main Results

In addition to the specifications discussed above, Aizenman and Noy (2003) includes other specifications that examine different aspects of the political-institutional climate. We also tested a number of alternative specifications of our empirical model in order to verify the robustness of our results. Because of space considerations we do not include the full specifications in our tables but all these results are available upon request.

First, we hypothesized that financial crises (either banking or currency crises) might significantly affect the level of financial openness in general and more specifically the use of financial repression for generating government revenues. Interestingly, in all iterations of the model we attempted, none of the coefficients for the crises variables comes out significant for the developing countries sample (nor for the other samples).[14]

Second, besides including the average of past commercial openness, we also included in our specification the contemporaneous TRADE/GDP variable and obtained the following: In all cases, the lagged commercial openness variable remains positive and highly significant. For the developing countries sample as well as the whole sample, the lagged average is positive and highly significant with a now larger coefficient (0.20 and 0.21 respectively) while the contemporaneous variable is negative and significant. For the OECD sample, the lagged average is still positive and highly significant while the contemporaneous variable is now positive but insignificant. The sum of the two coefficients (summarizing the effect of commercial openness both past and present) is 0.05, 0.06, and 0.09, for the developing, OECD and the whole sample, respectively. This sum is always positive and highly significant for the three different samples.[15]

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[14] We utilized a number of variants of these binary indicators (currency crisis and banking crisis, their onset year only, and these separately or together in the same specification) and we never reject the null (no effect). For currency crises, our indicator is identified by periods in which an index, composed of a weighted average of the real exchange rate and foreign reserves, changed dramatically – by more than 2 standard deviations. This measure is described in detail and evaluated in Hutchison and Noy (2002). The banking crisis binary indicator is taken from Caprio and Klingebiel (1999) and is analyzed in Arteta and Eichengreen (2002) and Hutchison and Noy (forthcoming).

[15] One possible interpretation is that major recessions in developing countries (potentially triggered by capital flight) are associated with a drop in commercial openness, as would be the case if the drop in imports dominated any increase in exports. Likewise, capital flight may increase financial openness. It is difficult to provide a better rationale for it without desegregating financial openness into its various sub accounts.

As the political and institutional variables we use do not vary sufficiently over time we do not present results for the model estimated with country effects. Typically, the goodness of fit is higher but the independent political-institutional variables lose most of their statistical significance (as would be expected). We include regional effects (binary variables for Latin America and East Asia) in our large and developing countries samples. Time effects do not provide any additional explanatory power besides a significant finding for the 1990s (reported above).

3. Granger Causality and Geweke's Decomposition of Linear Feedback

In the previous section we established that past trade openness Granger-causes financial openness (see Granger, 1969 and Sims, 1972 for a discussion of G-causality). As we suspect that causality might also run from past financial openness to present trade openness we also estimate the opposite specification:

$$(26) \qquad CO_{it} = \gamma + \delta_1 X_{it} + \delta_2 \overline{FO}_{it-1} + \delta_3 FO_{it-1} + \delta_4 P_{it} + \eta_{it}$$

We use the same assumptions, estimation methodology, definition of variables and samples as before. Results for several specifications are reported in table 6. Our focus in this paper is the determination of financial openness and we therefore concentrate our attention on the financial openness index. In all the specifications reported in table 6 it appears apparent that financial openness is not only Granger-caused by trade openness but that financial openness also Granger-causes trade openness. These results hold whether we examine a one-year lag of the financial openness measure (columns 1-3), or 4-year average of past financial openness for the various sub-samples previously described.

In Granger (1969), the possibility of simultaneous causality between the two time series is assumed away by arguing that it is always possible to divide the time series into shorter periods. This should enable the researcher to identify accurately the exact chronology of effects and do away with the correlations in the contemporaneous data series. Wei (1982) also points to the problems inherent in identifying causality structures for flow variables that are aggregated over time periods. As we employ annual data, and since financial flows respond quickly to exogenous shocks, it is reasonable to expect that our data will also contain what appears to be instantaneous causality between trade and

financial openness. Furthermore, Granger's (1969) approach does not allow us to estimate and compare the relative magnitudes of causality between the two time series.

Geweke (1982) suggests a methodology to distinguish between (temporal) causality from *x* to *y*, from *y* to *x* and simultaneous causality between the two. We briefly describe the methodology and provide results.[16]

First we estimate the following 5 equations using a panel fixed-effects least squares estimation for our developing countries sample.

$$(27) \qquad FO_{it} = \alpha_i^1 + \sum_{s=1}^{p} \beta_{1s}^1 FO_{it-s} + \sum_{s=0}^{p} \beta_{2s}^1 CO_{it-s} + \varepsilon_{it}^1$$

$$(28) \qquad FO_{it} = \alpha_i^2 + \sum_{s=1}^{p} \beta_{1s}^2 FO_{it-s} + \sum_{s=1}^{p} \beta_{2s}^2 CO_{it-s} + \varepsilon_{it}^2$$

$$(29) \qquad FO_{it} = \alpha_i^3 + \sum_{s=1}^{p} \beta_{1s}^3 FO_{it-s} + \varepsilon_{it}^3$$

$$(30) \qquad CO_{it} = \alpha_i^4 + \sum_{s=1}^{p} \beta_{1s}^4 CO_{it-s} + \sum_{s=1}^{p} \beta_{2s}^4 FO_{it-s} + \varepsilon_{it}^4$$

$$(31) \qquad CO_{it} = \alpha_i^5 + \sum_{s=1}^{p} \beta_{1s}^5 CO_{it-s} + \varepsilon_{it}^5$$

Next, following Geweke's (1982) notation we define $F_{CO \to FO}$ as the linear feedback (i.e. G-causality) from trade openness to financial openness, $F_{FO \to CO}$ as the G-causality from financial openness to trade openness, and $F_{FO \bullet CO}$ as the instantaneous linear feedback between the two series.[17] $F_{FO,CO}$, defined as the total measure of linear dependence between the two series, is therefore given by:

$$(32) \qquad F_{FO,CO} = F_{FO \to CO} + F_{CO \to FO} + F_{FO \bullet CO}.$$

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[16] Readers may also consult Geweke (1984) and Granger (1988). The only applications we are aware of which apply this methodology to macro-economic data series are Chong and Calderón (2000) and Calderón and Liu (2003). Other approaches to identifying causality in macroeconomics will typically rely on an instrumental variable methodology. An excellent book length treatment of the issue of causality in macroeconomics is Hoover (2001).

[17] Geweke (1982) prefers the term 'linear feedback'. Pierce (1982), in a comment on Geweke's work, argues that a more appropriate term to describe the measures defined in our equations (32)-(35) would be 'G-causality.' Zellner (1982), in another comment, argues that the word 'causality' should not be used if it is only based on statistical observed relationships rather than together with economic theory. We use the term 'G-causality' throughout as it is more familiar to the economics profession. Hoover (2001) provides an extended discussion of the problems inherent with the usage of this term.

Given these definitions, Geweke (1982) concludes the following:

(33) $F_{FO\rightarrow CO} = \log[\text{var}(\varepsilon_{it}^{5}) / \text{var}(\varepsilon_{it}^{4})]$

(34) $F_{CO\rightarrow FO} = \log[\text{var}(\varepsilon_{it}^{3}) / \text{var}(\varepsilon_{it}^{2})]$

(35) $F_{FO\bullet CO} = \log[\text{var}(\varepsilon_{it}^{2}) / \text{var}(\varepsilon_{it}^{1})]$

Geweke (1982) shows that the null hypothesis (H_0: F=0) can be statistically examined using the χ^2 distribution. In estimating (27)-(31), we started with three lags (p=3) of the independent variables in each regression and reduced step-wise the number of lags using the Akaike Information criterion. In all cases, it turned out that a single lag (p=1) contained all the information required to estimate the model. Consequently, we set p=1 throughout. Table 7 provides our results for distinguishing among the different channels of causality between the two series. Most of the linear feedback between trade and financial openness (87%) can be accounted for by Granger-causality from financial openness to trade openness (53%) and from trade to financial openness (34%). Simultaneous correlation between the two only accounts for 13% of the total linear feedback between the two series.

When we repeated this algorithm using the same methodology, but including in regressions (27)-(31) the control variables previously described (as in table 3 column 3), we obtained qualitatively and quantitatively very similar results for the feedback measures. The lower panel of table 7 also presents the same decomposition exercise for the developed (OECD) country sample. As expected, given the previous differences, the results are indeed qualitatively distinct. Most notably, the simultaneous feedback between the two series is no longer dominated by the temporal causality we identified. Rather, the G-causality from financial openness to trade openness is significantly weaker, the G-causality from trade to finance is somewhat more important, and the contemporaneous correlation now accounts for a full one-third of the overall feedback between the two series.

4. Concluding remarks

Our analysis indicates that the *de-facto* financial openness of developing countries is a complex endogenous variable, systematically impacted by economic and political economy factors which include commercial openness, the political regime and

corruption. For the sample of developing countries, we find that a one standard deviation increase in the commercial openness index is associated with a 9.5 percent increase in de-facto financial openness (international financial flows as percent of GDP), a one standard deviation increase in the democratization index reduces financial openness by 3.5 percent, and a one standard deviation increase in corruption is associated with a 3 percent reduction of financial openness (see table 4).

We show that *de-facto* financial openness is the outcome of both efficiency and political economy considerations; and equally we show that *de facto* commercial openness also depends on our *de facto* measure of financial openness. In this paper we extend the results presented in Aizenman and Noy (2003) and show that a decomposition of the causality between the two series can be implemented. Second, we show that most of the feedback between the two series is attributable to a standard Granger causality with the channel from finance to trade being somewhat stronger than the channel from trade to finance. Simultaneous feedback (for annual data) between the series is relatively unimportant.

While *de-facto* financial openness is a useful concept, it combines capital flows motivated by political economy considerations with those motivated by efficiency considerations. A remaining empirical challenge is to disaggregate *de-facto* financial openness into its various components. Our theoretical discussion in Aizenman and Noy (2003), for example, might apply for foreign direct investment (FDI) but might not be relevant for equity finance. More generally, since each type of flow can be taxed differently with varying degrees of efficiency in tax collection (as the first model suggests) and faces different degrees of expropriation risk (as the second model suggests), one can expect the determinants of openness for each type of flow to be different and the causality between trade and finance to operate differently. Therefore, constructing different financial openness indicators using quantity data for the different types of financial flows (FDI, equity, official, bank lending, etc.) appears to be an obvious next step.

References

Aizenman, J., M. Gavin and R. Hausmann, (2000) "Optimal Tax and debt Policy With Endogenously Imperfect Creditworthiness", *Journal of International Trade & Economic Development*, Volume 9 Number: 4, pp. 367 – 395.

_____ P. Guidotti. (1994): "Capital controls, collection costs, and domestic public debt," *Journal of International Money and Finance* , February, pp. 41 - 54.

_____ and I. Noy. (2003) "Endogenous financial openness: efficiency and political economy considerations," NBER Working paper number 10144.

Akerlof, G. A. and P. M. Romer, **"**Looting: The Economic Underworld of Bankruptcy for Profit.**"** *Brookings Papers on Economic Activity*, 2, pp. 1-60 and 70-74, (1993).

Alesina, A. And G. Tabellini (1989) "External Debt, Capital Flight, and Political Risk", *Journal of International Economics*, 27: 199-220.

Anderson, J. E. and S.J. Marcouiller, (1998): "Autarky and Anarchy: Endogenous Predation and Trade," working paper, Boston College.

Arteta, Carlos and Barry Eichengreen (2002). "Banking Crises in Emerging Markets: Presumptions and Evidence" in M. Blejer and M. Skreb (eds.), *Exchange Rate and Financial Vulnerability in Emerging Markets*, MIT Press.

Beck, Thorsten, Asli Demirgüç-Kunt and Ross Levine (2001). "New tools in comparative political economy: The Database of Political Institutions," *World Bank Economic Review* 15(1): 165-176.

Bekaert, G, C. R. Harvey and C. Lundblad, (2001). "Does financial liberalization spur growth?" NBER Working paper #8245.

Boyce, J. K., and L. Ndikumana (2001): "Is Africa a Net Creditor? New Estimates of Capital Flight from Severely Indebted Sub-Saharan African Countries, 1970-1996." *Journal of Development Studies*, 38(2), 27-

Calderón, César and Lin Liu (2003). "The direction of causality between financial development and economic growth." *Journal of Development Economics,* 72, 321– 334.

Caprio Gerard and Daniela Klingebiel (1999). Episodes of Systemic and Borderline Financial Crises. Manuscript (October).

Chong, Alberto and César Calderón (2000). "Causalilty and Feedback Between Instittutional Measures and Economic Growth." *Economics and Politics*, 12(1), 69-81.

Cukierman, Alex, Sebastian Edwards and Guido Tabellini (1992). "Seigniorage and Political Instability." *American Economic Review*, 82(3), June, 537-555.

Dooley, M. (1988). "Capital Flight: A Response to Differences in Financial Risks," *IMF Staff Papers*, September 1988.

_____ (1996): "A Survey of Literature on Controls Over International Capital Transactions," *IMF Staff Papers*, 43(4):639-687.

_____,M. and K. Kletzer (1994) "Capital Flight, External Debt and Domestic Policies," *Federal Reserve Bank of San Francisco Review*, Summer 1994, pp. 24- 38.

Dreher, Axel and Lars-H.R. Siemers (2003). "The Intriguing Nexus Between Corruption and Capital Account Restrictions", mimeo, June.

Gavin, M., R. Hausmann, R. Perotti and E. Talvi (1996) 'Managing Fiscal Policy in Latin America and the Caribbean: Procyclicality, Volatility, and Limited Creditworthiness', mimeo, Inter-American Development Bank.

Geweke, John (1982). "Measurement of Linear Dependence and Feedback Between Multiple Time Series." *Journal of the American Statistical Association*, 77(378), 304-313.

Geweke, John (1984). "Measures of Conditional Linear Dependence and Feedback Between Time Series." *Journal of the American Statistical Association*, 79(388), 907-915.

Giovannini, A. and M. de Melo (1993). "Government Revenue from Financial Repression," *American Economic Review* 83, 953-63.

Glick, Reuven and Michael Hutchison (forthcoming). "Capital Controls and Exchange Rate Instability in Developing Economies." *Journal of International Money and Finance*.

Granger, Clive W. J. (1969). "Investigating Causal Relations by Econometric Models and Cross-spectral methods." *Econometrica*, 37(3), 424-438.

Granger, Clive W. J. (1988). "Some recent developments in a concept of causality," *Journal of Econometrics*, 39, 199-212.
Greene, W. (2000). *Econometric Analysis*. Prentice-Hall, New Jersey.
Greene, W. (2002). Linear models for panel data. *LIMDEP Econometric Modeling Guide* Volume 1. Plainview, NY: Econometric Software, Inc.
Gordon H. Hanson, G. H., R. J. Mataloni and M. J. Slaughter (2001). "Expansion Strategies of U.S. Multinational Firms," NBER Working paper 8433.
Henry, P. B., (2003). "Capital Account Liberalization, The Cost of Capital, and Economic Growth", *American Economic Review*, 93(2), May, pp. 91-96.
Hoover (2001). *Causality in Macroeconomics.* Cambridge University Press, Cambridge, UK.
Hutchison, Michael and Ilan Noy (2002). "Output Costs of Currency and Balance of Payments Crises in Emerging Markets," *Comparative Economic Studies*, XLIV(2), Summer.
Hutchison, Michael and Ilan Noy (forthcoming). "How Bad Are Twins? Output Costs of Currency and Banking Crises" *Journal of Money, Credit and Banking*.
Keefer, Philip (2002). "DPI2000: Database of Political Institutions: Changes and Variable Definitions". Mimeo, The World Bank.
Kletzer K. and R. Kohli (2001). "Financial Repression and Exchange Rate Management in Developing Countries: Theory and Empirical Evidence for India," IMF working paper 01/103.
Lane, Philip R., and Giani Maria Milesi-Ferretti (2001). "The External Wealth of Nations: Measures of Foreign Assets and Liabilities for Industrial and Developing Nations," *Journal of International Economics,* Vol. 55, pp. 263–94.
Marshall, Monty G and Keith Jaggers (2000). "POLITY IV PROJECT - Political Regime Characteristics and Transitions, 1800-1999: Dataset Users' Manual". Mimeo, University of Maryland.
Pierce, David A. (1982). "Comment: Measurement of Linear Dependence and Feedback Between Multiple Time Series." *Journal of the American Statistical Association*, 77(378), 315-316.
Portes, R. and H. Rey (2003), "The Determinants of Cross Border Equity Flows," manuscript, Princeton University.
Prasad, Eswar, Kenneth Rogoff, Shang-Jin Wei and M. Ayhan Kose (2003). "Effects of Financial Globalization on Developing Countries: Some Empirical Evidence." Mimeo, IMF, March.
Rajan, G. R. and L. Zingales (2003). **"**The Great Reversals: The Politics of Financial Development in the 20th Century," forthcoming, *Journal of Financial Economics*.
Rodrik, D. (1999): "Who Needs Capital-Account Convertibility?" in Peter Kenen (ed), *Should the IMF Pursue Capital Account Convertibility? Essays in International Finance* no. 207, Princeton: Princeton University Press (May).
Sims, Christopher A. (1972). "Money, Income, and Causality." *The American Economic* Review, 62(4), 540-552.
Stiglitz, J., (2002). *Globalization and Its Discontents* (New York: W.W. Norton & Company, June).
Talvi, Ernesto, and Carlos A. Vegh (2000). "Tax Base Variability and Procyclical Fiscal Policy." NBER Working Paper No. W7499, January.
Tornell, A. and A. Velasco, (1992). "Tragedy of the Commons and Economic Growth: Why Does Capital Flow from Poor to Rich Countries?," *Journal of Political Economy*, 100 (6):1208-31.
_____ and P. Lane, (1999). "Are Windfalls a Curse? A Non-Representative Agent Model of the Current Account and Fiscal Policy," *Journal of International Economics*, vol. 44, pp. 83-112, 1998.
Wei, Shang-Jin (2000). "How Taxing is Corruption on International Investors?" *The Review of Economics and Statistics*, 82(1):1-11, February.
Wei, Shang-Jin and Yi Wu (2002). "The Life-And-Death Implications of Globalization." Mimeo, IMF.
Wei, William W. S. (1982). "The Effects of Systemic Sampling and Temporal Aggregation on Causality – a Cautionary Note." *Journal of the American Statistical Association*, 77(378), 316-319.
Zellner, Arnold (1982). "Comment: Measurement of Linear Dependence and Feedback Between Multiple Time Series." *Journal of the American Statistical Association*, 77(378), 313-314.

Appendix – Data Sources and Samples

Code	Source	Description
KTOTAL	*IMF-BOP statistics* [a]: Wei (2002)	Sum of capital inflows and outflows (% of GDP)
GDPPCPP	*WDI* [b]: NY.GDP.PCAP.PP.CD	GDP per capita, PPP (current international $)
TRADG	*WDI*: TG.VAL.TOTL.GG.ZS	Sum of exports and imports (% of goods GDP)
TRADGAV	*WDI*: TG.VAL.TOTL.GG.ZS	Average for TRADG for t-1,…,t-4
DLCPI	*WDI*: FP.CPI.TOTL.ZG	Inflation, consumer prices (annual %)
BDGTG	*WDI*: GB.BAL.OVRL.GD.ZS	Overall budget deficit, including grants (% of GDP)
USTBILL	*IMF-IFS*[c]	Interest rate on U.S. Treasury bill
CORRUPT	*PRS*: International Country Risk Guide	Level of Corruption [d]
POLITY2	*POLITY IV* project	Political regime type [e]
POLCOMP	*POLITY IV* project	Degree of political competition [f]
HERFGOV	*World Bank*'s political dataset	Herfindehl index for ruling coalition [g]
KKCCAR	IMF- *EAER* [h]	Binary measure for current account and/or capital account restrictions
	Samples (1982-1998) [i]	
ALL	All countries in the 2001 edition of the *WDI* (83 countries)	
OECD	OECD countries (21 countries)	
DEV	Developing countries – defined as all countries excluding OECD countries and island states (60 countries)	

[a] The IMF's *Balance-of-Payments Statistics.*
[b] The World Bank's *World Development Indicators*.
[c] The IMF's *International Finance Statistics*.
[d] This index runs from -6 (low probability/risk of encountering corruption) to 0 (highly corrupt).
[e] The index runs between -10 (fully autocratic) to +10 (fully democratic).
[f] The index defines incremental steps between 1 (repressed competition –such as in totalitarian systems or military dictatorships) and 10 (institutionalized open electoral participation).
[g] The index is constructed by summing the squared seat shares of all parties in the government. Thus, the index runs between 0 and 1 (a single party in the coalition).
[h] The IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions;* see Glick and Hutchison (forthcoming).
[i] Data availability further constrained our samples. Thus, the numbers reflect countries for which data were available for the specifications described in table 3 columns 1-3 (but not necessarily for the whole 1982-1998 time period for each country).

Table 1A. Financial Openness – Descriptive Statistics

	1970s	1980s	1990s	All years
Developing countries	6.23	5.43	8.63	6.82
OECD countries	7.34	9.31	16.79	11.50
East Asia	11.20	8.47	16.53	12.38
Latin America	4.81	6.05	8.15	6.53
Other [a]	6.21	4.89	7.10	5.93
All	6.83	6.96	10.35	8.23

[a] Other includes Africa (North and Sub-Saharan), Middle East and South Asia.

Table 1B. Financial Openness - Correlations

Correlation of financial openness measure with…	Comm. openness (t)	Comm. openness (previous average)	Current account
Developing countries	0.34	0.34	0.25
OECD countries	0.39	0.37	-0.04
East Asia	0.32	0.27	-0.23
Latin America	0.25	0.18	0.20
Other [a]	0.34	0.39	0.36
All	0.39	0.38	0.23

[a] Other includes Africa (North and Sub-Saharan), Middle East and South Asia.

Table 3. Benchmark Model Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Per capita GDP	0.64**	0.14	2.28***	2.14***	2.02***	1.41***	1.45***
	(2.14)	(1.09)	(4.09)	(4.28)	(3.67)	(3.11)	(2.59)
Budget surplus	-0.26*	0.44***	-0.40**	-0.28*	-0.42**	-0.26*	-0.28
(% of GDP)	(-1.70)	(4.60)	(-2.07)	(-1.62)	(-2.16)	(-1.81)	(-1.42)
Inflation (CPI)	0.00	-0.14	0.00	0.00	0.00	0.00	0.00
	(-0.16)	(-1.46)	(-0.38)	(-0.27)	(-0.47)	(-0.28)	(-0.27)
US Treasury bill	-0.32	-0.03	-0.26	-0.31	-0.19	-0.13	-0.54
rate	(-0.88)	(-0.14)	(-0.53)	(-0.70)	(-0.38)	(-0.32)	(-1.10)
Trade openness	0.11***	0.09***	0.07***	0.08***	0.08***	0.09***	0.07***
(Average for t-1,…,t-4)	(9.08)	(7.99)	(4.52)	(5.51)	(5.15)	(7.19)	(4.48)
Democracy/autocra	-0.44***	-0.40	-0.51**	-0.26*			-0.36*
cy	(-2.71)	(-0.37)	(-2.48)	(-1.60)			(-1.71)
Corruption	-2.01**	-0.12	-2.74**		-1.86*		1.13
	(-2.23)	(-0.25)	(-2.24)		(-1.59)		(0.90)
The 1990s	4.89***	3.04***	4.65**	4.04**	3.52*	3.83**	3.41*
	(2.99)	(3.71)	(2.10)	(2.08)	(1.62)	(2.17)	(1.56)
De jure financial openness							-1.04
							(-0.68)
ρ [a]	0.88***	0.86***	0.88***	0.88***	0.88***	0.88***	0.89***
Observations	829	222	607	694	607	768	578
Sample [b]	ALL	OECD	DEV	DEV	DEV	DEV	DEV

t-statistics for all variables are given in parentheses. We denote significance levels at the 10%, 5% and 1% with *, ** and *** respectively.
The LHS variable is the sum of financial inflows and outflows (as % of GDP).
Estimation using the Prais-Winsten algorithm assuming an AR(1) process for the error terms.
For definitions of variables, see appendix B.

[a] ρ is the correlation coefficient for the AR(1) process: $\varepsilon_{it} = \rho\varepsilon_{it-1} + \mu_{it}$.

[b] ALL denotes the whole sample, OECD includes only OECD countries and DEV denotes the developing countries sample. For precise definitions see appendix B and text.

Table 4. Effects of Changes in Independent Variables on Financial Openness

	Effect of positive change of one standard deviation		Effect of moving from the median value of the variable in developing countries to the median value in the OECD sample
	Whole Sample[a]	Developing Countries[b]	Whole Sample[a c]
Trade openness	12.27	9.42	2.95
Democracy/autocracy	-3.13	-3.51	-2.21
Corruption	-2.89	-3.12	4.01

[a] Specification in table 3 column 1.
[b] Specification in table 3 column 3.
[c] From our data, the median developing country is less open to trade, less democratic and more corrupt.

Table 6. Reverse Causality (from FO to CO) - Benchmark Model Results

	(1)	(2)	(3)	(4)	(5)
Per capita GDP	0.00***	0.00	0.02***	0.02***	0.02***
	(5.94)	(1.07)	(12.43)	(12.08)	(12.11)
Budget surplus	1.37***	-1.05**	0.93**	0.90*	1.05**
(% of GDP)	(3.53)	(-2.06)	(1.98)	(1.88)	(2.11)
Inflation (CPI)	0.00	-0.11	0.00	0.00	0.00
	(0.29)	(-0.46)	(0.23)	(0.21)	(0.32)
US Treasury bill rate	1.72**	0.68	1.60	1.91*	2.51**
	(2.03)	(0.77)	(1.51)	(1.74)	(2.29)
Financial openness	0.67***	1.46***	0.43***		
(t-1)	(11.42)	(4.71)	(6.44)		
Financial openness				0.47***	0.43***
(average t-1….t-4)				(6.01)	(5.53)
Current and capital account restrictions (0/1)					-20.21***
					(-3.96)
Democracy/autocracy	-1.20***	-1.36	-2.06***	-2.26***	-2.73***
	(2.72)	(-0.23)	(4.06)	(-4.34)	(-5.06)
Corruption	-4.50**	-6.42***	-10.34***	-11.28***	-6.20*
	(1.99)	(2.54)	(3.54)	(3.70)	(1.95)
The 1990s	4.16	0.39	-1.75	0.47	-2.02
	(0.93)	(0.08)	(0.30)	(0.08)	(-0.34)
ρ [a]	0.91***	0.88***	0.89***	0.86***	0.89***
Observations	965	269	696	670	642
Sample [b]	ALL	OECD	DEV	DEV	DEV

t-statistics for all variables are given in parentheses. We denote significance levels at the 10%, 5% and 1% with *, ** and *** respectively. The LHS variable is the sum of exports and imports (as % of GDP). Estimation using the Prais-Winsten algorithm assuming an AR(1) process for the error terms. For definitions of variables, see appendix B.

[a] ρ is the correlation coefficient for the AR(1) process: $\varepsilon_{it} = \rho\varepsilon_{it-1} + \mu_{it}$.

[b] ALL denotes the whole sample, OECD includes only OECD countries and DEV denotes the developing countries sample. For precise definitions see appendix B and text.

Table 7. Geweke (1982) Decomposition of Causality

	Decomposition of feedback [a]	Percent of overall linear feedback [b]
Developing Countries		
From financial openness to commercial openness ($F_{FO \to CO}$)	0.27***	53
From commercial openness to financial openness ($F_{CO \to FO}$)	0.17***	34
Simultaneous causality between financial and commercial openness ($F_{FO \bullet CO}$)	0.06***	13
OECD		
From financial openness to commercial openness ($F_{FO \to CO}$)	0.09	21
From commercial openness to financial openness ($F_{CO \to FO}$)	0.20	46
Simultaneous causality between financial and commercial openness ($F_{FO \bullet CO}$)	0.14	33

** represents rejection of H_0: no causality, at the 1% significance level based on a χ^2 test as in Geweke (1982).

[a] As defined in equations (33)-(35).

[b] As percent of the total linear feedback between the two time-series as defined in equation (32).