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Abstract

Applied analysis aimed at assessing which value of the NIIP is appropriate for a given country is relatively scarce, and the few existing papers on the topic estimate one-size-fits-all NIIP benchmarks (e.g., Catão and Milesi-Ferretti, 2014). This paper estimates country-specific NIIP benchmarks on a sample of 65 advanced and emerging economies according to two different criteria: consistency with economic fundamentals (NIIP norms, obtained as cumulated current account norms) and prudence against the risk of external crises (NIIP prudential thresholds, obtained as the threshold of the NIIP variable interacted with relative income per capita that maximises signal power in predicting external crises). The median for the country-specific NIIP norms is around -17% of GDP, while the median for prudential threshold is about -44%. The two benchmarks are negatively correlated across countries, highlighting a tension between factors underpinning the scope for external borrowing and debt tolerance. Gaps between actual and NIIP benchmarks are highly persistent, but help predicting subsequent medium-term NIIP changes better than the NIIP level, thus confirming the usefulness of country-specific reference values. The adjustment of the NIIP in response to NIIP gaps is asymmetric, with a significant adjustment limited to negative gaps, with the exception of countries with a positive net position in foreign currency.

JEL Classification: F32, F41.

Keywords: Net International Investment Position, Balance of Payments, current account balance, external equilibrium.

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CONTENTS

1. INTRODUCTION

Major current account imbalances have largely corrected in most countries in the aftermath of the 2008 financial crisis, but stock imbalances persist (Lane and Milesi-Ferretti, 2014). Many net-debtor countries have indeed weathered their post-crisis sudden stops, and largely stabilised their net international investment positions (NIIPs). The question remains, however, whether current NIIP levels are prudent from the viewpoint of external stability risks. Moreover, as NIIPs may have evolved out of sync with their main drivers over the past, a related question is whether current NIIP levels are justified in terms of economic fundamentals, including for countries that have accumulated large and positive stocks of NIIPs.

In a nutshell, the assessment of NIIPs requires benchmarks underpinned by an adequate conceptual framework. However, while the estimation of benchmarks for current account balances is customary and well developed, the corresponding analysis for NIIPs has received far less attention. Based on panel data, a rich literature estimates current account benchmarks that help to assess whether current account balances are in line with economic fundamentals (see e.g. Debelle and Faruqee, 1996; Chinn and Prasad, 2003; Lee et al., 2008; Ca' Zorzi et al., 2009; Phillips et al., 2013, Coutinho et al., 2018,…). The aim of this literature is to estimate reduced-form current account equations capturing the main drivers of the savings-investment balance and using them to predict current "norms" on the basis of a subset of explanatory variables that only capture fundamental, structural drivers. The main alternative approach, regularly used by policy institutions, is to assess current account positions in terms of their implications for the evolution of the NIIP. To this purpose, current account benchmarks are derived from the requirement for the NIIP stock to stabilise or to reach a given target by a given date (e.g., Lee et al, 2008). ([1])

The estimation of NIIP benchmarks has not received comparable attention. Notable exceptions are the few papers that aim at deriving NIIP thresholds that imply a high probability of currency crises or sudden stops. In Catão and Milesi-Ferretti (2014) the probability of external crisis is estimated from a panel probit model, with NIIP being among the significant explanatory variables for crises. The model estimates suggest a threshold for the NIIP in the proximity of -50%. ([2])

To our knowledge, the only NIIP benchmarks estimated in the existing literature are derived from a large sample of countries and provide a common point of reference for the NIIP of very diverse countries. This contrasts with the undisputed fact that the riskiness of a given NIIP stock depends on a number of country characteristics that are not accounted for by one-size fits-all benchmarks. Country-specific benchmarks seem therefore needed for a proper assessment. The availability of country-specific NIIP benchmarks would also help the analysis of current account sustainability, as they would permit to obtain NIIP targets based on well-defined criteria for the computation of NIIP-stabilising current accounts.

([1]) Computing current account benchmarks is an integral part of the estimation of "equilibrium exchange rates" according to approaches that became known in the literature as Fundamental Equilibrium Exchange Rate (FEER, see e.g.,Williamson, 1994) or the Natural Equilibrium Exchange Rates (NATREX, see, e.g. Stein, 1994). Broadly speaking, the FEER method requires both internal (output in line with potential) and external balance, while in the NATREX approach the additional requirement is that the current account is consistent with an NIIP stable at its steady-state level (e.g., Siregar and Rajan, 2006; Isard, 2007).

([2]) Zorell (2017) performs an analogous approach and obtains similar results.

This paper aims at filling this gap by estimating two sets of NIIP benchmarks, one benchmark aimed at incorporating information on the extent NIIPs are justified by fundamentals, the other capturing NIIP riskiness.

NIIP norms are estimated as the stock equivalent of current account norms. As NIIP series are hardly stationary in the panel, the estimation of an empirical model for the NIIP would require panel co-integration analysis (e.g., Lane and Milesi-Ferretti, 2002). To overcome the short-sample limitations of panel co-integration tests and to obtain NIIP norms that can safely be interpreted as values determined only on the basis of fundamental drivers that can be considered as broadly exogenous, a different route is chosen, namely that of exploiting the fact that annual changes of NIIPs roughly correspond to the current account balances. This paper demonstrates that the estimation of current account norms akin to Coutinho et al. (2018) provides a good approximation for the benchmark NIIP in differences, given some opportune adaptations regarding which variables are defined as fundamentals. The NIIP norm would therefore amount to the cumulation of these current account norms.

Prudential NIIP thresholds aim at estimating the NIIP level beyond which there is higher risk of a balance-of-payments crisis. The threshold is selected to maximise its signal power, i.e. to minimise the risk of missing crises ("type 1 errors") or triggering false alerts ("type 2 errors"). The thresholds build on external crisis indicators on the basis of the criteria defined by Catão and Milesi-Ferretti (2014). The interaction of NIIP values with structural variables affecting the riskiness of a given NIIP stock permits to derive thresholds that are country-specific. The interaction with relative income per capita yields the threshold with the highest signal power compared with alternative interaction terms summarising structural country characteristics, as this variable summarises a number of structural economic and institutional factors that are associated with foreign debt tolerance. We carry out a number of robustness checks with respect to the external stock indicators used as the basis for the threshold (e.g. whether net external debt provides stronger signal power than the NIIP,…), the volatility of the threshold to sample perturbations, the criterion used for the selection of the threshold, the indicator used for identifying crisis periods.

We estimate NIIP benchmarks for 65 advanced and emerging economies for the 1995-2016 period. The median for country-specific NIIP norms is about -17% of GDP, while the median prudential threshold is about -44%. The two benchmarks are found to be negatively correlated across countries, as the same factors that underpin scope for external borrowing, notably relatively low per-capita income, are also correlated with lower tolerance for high foreign debt (e.g., Lane and Milesi-Ferretti, 2002). Since NIIPs vary more widely across countries than NIIP benchmarks, NIIP gaps with respect to benchmark are positively correlated across countries. NIIP gaps are a better predictor of subsequent adjustment in the NIIP than the NIIP level itself, but the adjustment to gaps is asymmetric, with significant medium-term correction limited to cases where the NIIPs are below benchmark except for countries with positive net positions in foreign currency and flexible exchange rates, as in this case currency appreciation helps reducing NIIP positions.

The remainder of the paper is structured as follows. Section 2 illustrates the estimation strategy for the NIIP norms. Section 3 discusses the methodology for estimating NIIP prudential thresholds. Section 4 analyses main patterns, evolution and characteristics of the estimated NIIP benchmarks. Section 5 concludes. Details on the methodologies for the NIIP benchmarks and detailed benchmark results are reported in Annex 2 and 3.

2. NIIP NORMS

The concept of NIIP norm adopted in this paper is that of a *reference point* for *NIIPs explained by fundamental characteristics*, such as demographics, resources, etc., that are country-specific, slow-moving, and that can be considered as broadly exogenous. NIIP norms would therefore correspond to NIIP values that are likely to be the observed on average over the medium-to-long term once temporary factors and adjustment dynamics are taken into account. Large deviations from the benchmark signal cases that are difficult to explain on the basis of standard relations with fundamental drivers. The straightforward approach to compute NIIP norms would be to estimate first an NIIP model by regressing NIIP data on a number of explanatory factors, and then to obtain the NIIP norm as the prediction from such a model. As NIIP time series are short for a number of countries of interest, the estimation of NIIP benchmarks should build on an NIIP model estimated on a multi-country panel dataset.

A difficulty with the direct estimation of NIIP equations is that NIIP time series in most available samples are likely to be unit root or near-unit root processes. Although over sufficiently long time series, the NIIP is expected to be stationary and satisfy intertemporal budget constraints, just like any other measure of net financial assets, panel unit-root tests applied to available NIIP series generally point to NIIPs exhibiting unit roots. For the NIIP sample for the countries analysed in this paper, Fisher panel unit root tests, that can be applied to data that are not strongly balanced (which is the case for the sample in this paper), cannot generally reject the null hypothesis that all panels contain a unit root.([3])

In the presence of non-stationary variables in the panel, an approach to address the risk of spurious regressions is to test for a co-integrating relation in the levels (e.g., Masson et al., 1994; Lane and Milesi-Ferretti, 2002). The problems with this strategy lie not only with the well-known limitations of panel co-integration tests in short samples (interpretation, mixed signals, balanced panel requirements, implications of cross-section dependence, e.g., Baltagi, 2013) but also with the interpretation of the co-integration relationship, as economic theory may be of little help in providing priors on what variables are expected to exhibit a co-integrating relationship with the NIIP, whether such relationship can be read as a model of determination of the NIIP or generic codetermination, and which co-integration vector should be chosen to identify a determination model for the NIIP when more than one can be identified.([4])

With a view to estimate an NIIP norm that can be safely interpreted as representing an NIIP value in line with fundamental drivers only, we follow a different route. We address the issue of non-stationary of NIIP series by using time differences: since the annual change in

([3]) The Fisher test conducts augmented Dickey Fuller (ADF) unit-root tests for each panel individually, and then combines the p-values from these tests to produce an overall test. The test is performed on all NIIP/GDP observations available for a variable constructed from various sources according to criterion illustrated in table A.2.1 for the same sample of 65 advanced and emerging economies for which NIIP benchmarks are estimated (the same countries as displayed in Table 7, except Serbia). The time period is 1970-2016 where available. The test is implemented admitting or not a linear trend, and demeaning or not the data (all combinations). Under the standard assumption of 1 lag in the ADF regression, the test rejects the null hypothesis of a unit root in all panels only in the case in which a trend is excluded and data are demeaned and only when p-values are combined using the inverse chi-squared transformation (as opposed to the inverse-normal or the inverse-logit transformations). In case where a higher number of lags are assumed for the ADF process the null hypothesis is rejected in all cases.

([4]) Including for these reasons, papers analysing NIIP determinants also resort to cross section variation in the data to shed light on the interpretation of results (e.g., Lane and Milesi-Ferretti, 2002; Furceri et al., 2011).

the NIIP roughly corresponds to the current account, the estimation of current account norms provides a benchmark for the NIIP in differences. As current account norms are the current accounts explained only on the basis of fundamentals, an NIIP norm would be obtained by simply cumulating current account norms over time, starting from an initial NIIP level.

Obtaining the NIIP benchmark by cumulating current account norms reflects the notion that current account balances account for the bulk of annual NIIP changes. More precisely, NIIP changes – as a share of starting year GDP - can be expressed as follows:

$$\Delta NIIP_t = NIIP_t - \frac{1}{1+g_t} NIIP_{t-1} = CA_t + KA_t + VE_t + NEO_t \quad (1)$$

where $\Delta NIIP_t$ is the change in the NIIP *as a share of GDP in year t*, CA_t, is the current account, KA_t is the capital account, VE_t are valuation effects, and NEO_t is net errors and omissions - all expressed as share of year *t* GDP - while g_t is the growth rate of nominal GDP between year *t*-1 and *t*. Empirically, current account balances are quantitatively the most important contributor to changes in the NIIP. In some instances, valuation effects can play a non-negligible role, but over sufficiently long time series their average is not far from zero for most countries. As a countercheck, in addition to a baseline current account regressions used as a basis to estimate current account norms, estimates have also been performed using the net lending of the economy (i.e., $CA_t + KA_t$), the change in NIIP, and valuation effects (all as a share of current GDP), as alternative dependent variables.

The specification used is the one of Coutinho et al. (2018), which in turn is akin to Phillips et al. (2013). Following most of the literature, country fixed effects are deliberately not included, as their inclusion would hamper the possibility of identifying which time-invariant or slow-moving country-specific factors are significant current account drivers. The omission of fixed effects requires the inclusion of sufficiently many explanatory variables to reduce the risk of omitted variable bias.([5])

Regressors, whenever meaningful, are expressed as differences with respect to world GDP-weighted averages, so that current accounts are allowed to react not only to economic developments in the domestic economy but also in partner countries. This transformation induces stationarity of explanatory variables. It also provides a straightforward interpretation for the policy variables so transformed, which can be seen a deviations from a common norm corresponding to world averages.([6])

([5]) In line with analogous papers (e.g., Phillips et al. (2013), time effects are also not included as this would raise an issue with their interpretation regarding whether or not should be considered among the fundamental current account drivers. Their inclusion would however not alter results significantly.

([6]) This is a point of departure from Phillips et al. (2013), where policy norms are country-specific and derived from policy-specific priors.

Table 2.1: **Current account regression results**

	(1)	(2)	(3)	(4)
Dependent variables	Current account, % of GDP, baseline	Net lending, % of GDP	Annual NIIP change % of GDP	'Valuation effects' % of GDP
Explanatory variables				
Fundamentals				
Relative income per capita in PPP (lagged)	0.034 ***	0.039 ***	0.067 ***	0.035 **
Relative income interacted with capital openness (lagged)	0.033 *	0.027	-0.009	-0.038 **
Ageing speed	-0.025	-0.019	-0.124	-0.105
Ageing speed wrt. world * income per capita (PPP) as % of G3 mean	0.164 **	0.147 **	0.272 ***	0.137
Old-age dependency ratio	-0.047 *	-0.036	0.006	0.037
Population growth HP-filtered (lagged)	-0.576 **	-0.692 **	-0.102	0.499
Share of manufacturing in value added, instrumented	0.234 ***	0.209 ***	0.079	-0.1
Oil & gas balance / GDP 5Y-mov.av., if positive	0.427 ***	0.379 ***	0.215 **	-0.141
Mining products exports as % of total exports (lagged)	0.002	-0.006	0.013	0.017
Domestic currency % use in world FX reserves	-0.041 ***	-0.042 ***	-0.042 ***	0.003
Financial centre dummy	0.016 ***	0.013 **	-0.013	-0.026 **
Non-fundamentals				
NIIP / GDP (lagged, in USD terms)	0.032 ***	0.031 ***	0.032 ***	-0.001
NIIP exceeding -60% of GDP (lagged)	-0.03 **	-0.03 **	-0.035	-0.005
VIX(capital openness) (lagged)*	0.084 ***	0.082 **	0.044	-0.022
VIX interacted w cap.open. & reserve currency status	-0.21 *	-0.207	0.292	0.46
Annual real GDP growth expected 5 years ahead	-0.31 ***	-0.362 ***	-0.282 *	0.111
Public health expenditure / GDP (lagged)	-1.739 ***	-1.722 ***	-0.854 **	0.746 **
Health exp. wrt. world av., interacted with old-age dep. ratio	4.773 ***	4.214 ***	2.017 *	-2.016
Structural fiscal balance, instrumented	0.272 ***	0.249 ***	0.195 **	-0.044
*(FX reserve change)/GDP * capital closedness, instrumented*	0.338 **	0.306 *	0.758 ***	0.424 **
REER growth (over 3 years, lagged)	-0.086 ***	-0.088 ***	-0.095 *	-0.015
Construction investment / GDP (lagged)	-0.099 ***	-0.079 ***	-0.069	-0.004
Change of private debt in pp. of GDP (over 3 years, lagged)	-0.059 ***	-0.059 ***	-0.086 ***	-0.021
Private debt stock/GDP (demeaned by country historical average)	-0.011	-0.011	0.024 *	0.024 *
Output gap / potential GDP	-0.385 ***	-0.409 ***	-0.346 **	0.055
Constant	-0.392 **	-0.154	-1.38 ***	-1.368 ***
Number of observations	1589	1589	1493	1493
R^2	0.641	0.6	0.22	0.05
Adjusted R^2	0.635	0.59	0.2	0.03
F-stat	111.7	94.1	16.2	2.8
Standard error	3.446	3.558	6.406	6.021

See Table A.1 for variable definitions and Table A2.1 in the appendix for information on the data sample, as well as Coutinho et al. (2018, section 4) for more details on current account norms. Left column reproduces coefficients estimated by Coutinho et al. (2018). Asterisks indicate significance at a * 10% , ** 5%, and ***1% level and on the basis of t test derived from Driscoll-Kraay standard errors.

Column (3) refers to nominal change of NIIP between year t-1 and t , divided by nominal GDP for year t, in local currency terms. The regression for Column (3) omits any observation for which the annual NIIP change exceeds 25 pp of GDP.

Fundamental drivers are the only ones used to predict current account norms, and are defined as follows: either (i) non-policy variables that have a non-temporary impact on current accounts; or (ii) policy variables with non-temporary impact and that are set in line with what observed for the world average. Since all policy variables are expressed as differences with respect to world average, these variables so transformed are never used to compute current account norms. The following fundamental drivers are used for predicting current account norms: relative per-capita income, ageing variables, manufacturing intensity of value added, energy and commodity balance and export intensity, reserve currency status, corporate financial centre status. The remaining explanatory variables included in the current account regressions are as follows: indicators of global risk aversion in financial markets, medium-term growth

expectations, welfare spending, fiscal balance, foreign currency reserve accumulation, past changes in the real effective exchange rate, private credit, and output gap.([7]) A number of variables are interacted, with a view to better qualify under which conditions such variables display an effect and with which sign. Variables that are most likely to be endogenous are instrumented. Table A.1.1 summarises the definition of the explanatory variables, their rationale and expected sign, and statistical sources. Coutinho et al. (2018) provide a detailed discussion of the regression specification.

Estimations are performed on annual data from an unbalanced panel of 65 advanced and emerging economies over the 1987-2016 period. Table A2.1 in Annex 2 describes the sample available for the regressions. The estimation method is OLS with Driscoll and Kraay standard errors to account for heteroskedasticity, serial correlation and cross-sectional dependence across panels (see Annex 2). The same specification for the current account is tested for alternative dependent variables. Results are displayed in Table 2.1.

Results indicate that the baseline *current account specification* (column 1 in Table 2.1**) yields regressions coefficients in line with expectations, explains more than 60 per cent of the current account variance, and exhibits overall a good degree of statistical significance as captured by the F test.** Taking into account the capital account balance for estimation (i.e., using the *net lending* of the economy as dependent variable) does not lead to any significant change in current account norm estimates**.** Since capital account balances are usually small and volatile, taking them into account for the 'norms' estimation should at most marginally alter the results (column 2 in Table 2.1). Moreover, the incorporation of *valuation effects* yields regression coefficients that are generally qualitatively similar to those estimated using the current account as dependent variable but less precisely estimated. Valuation effects are generally found to have high variance, little autocorrelation, and an unconditional expected value of zero for most countries. Consistently, replacing the current account balances by the NIIP change (which includes both the capital account and valuation effects) yields only negligible changes to the estimated coefficients (Table 3.1, column 3) while adding noise and thereby inducing a considerable loss in efficiency resulting in imprecisely estimated coefficients, a feature that is exhibited also by the regression using valuation effects only as dependent variable (column 4).

Despite the generally unsystematic patterns of valuation effects, a relevant exception is found for countries with a *corporate financial centre status*. Being a financial centre has a significant positive relation with current accounts and for this reason it is considered as a fundamental driver for current accounts in existing analyses (e.g., Phillips et al., 2013). However, financial centres also appear to experience at the same time persistently negative valuation losses, which could be linked to the effect of retained earnings by corporations located in financial centres on the value of shares held by non-residents as portfolio investment.([8]) The

([7]) Another point of departure from the Phillips et al. (2013) specification is that the NIIP/GDP ratio is not considered as a fundamental current account driver. It is disputable whether the NIIP/GDP ratio is to be considered as a fundamental factor as it reflects past records of current account balances that may have departed from fundamentals. Moreover, its short-term fluctuations may be non-negligible and linked to transitory factors such as volatility in nominal GDP and valuation effects. From the perspective of the present analysis, not including the NIIP among the fundamental drivers of the current account implies that NIIP norms estimated as cumulated current account norms do not depend on actual NIIP observations.

([8]) The countries in question are the seat of multinational corporations that issue shares largely held by non-residents as portfolio investment. If the profits of these firms are retained, they do not result into an income payment towards non-residents (thus creating a surplus over incoming income payments) while at the same time increasing

financial centre effect on the current account balance and that on valuation effects tend to offset each other, so that, when regressions are estimated using the change in the NIIP as dependent variable, the coefficient of the financial centre dummy turns out being insignificant.([9])

In light of the above results, the regression framework used to compute NIIP benchmarks uses the *current account/GDP ratio as a dependent variable rather than the change in the NIIP*, as this choice of dependent variable allows for more precise parameter estimates. In addition, *the financial centre status is included among the regressors* (as it is highly significant and its omission would generate a bias in the other estimated coefficients*) but it is not used as a fundamental in deriving current account norms*, because the aim is not to predict the current account driven by fundamentals, but rather the change in the NIIP, and the evidence shows that the latter variable is not significantly affected by the financial centre status of countries.

The NIIP benchmarks are computed as the cumulation of current account norms, starting from an initial value for the NIIP stock. As the current account norms are estimated a share of GDP, the computation of the NIIP norm as a share of GDP follows the following formula, where $NIIP_t$, CA_t, and Y_t stand, respectively, for the NIIP stock as a share of GDP, the current account as a share of GDP, and GDP; subscripts denote time, and the "$\bar{}$" overline denotes estimated norms:

$$\overline{NIIP_t} = NIIP_0 \frac{Y_0}{Y_t} + \sum_{i=1}^{t} \overline{CA_i} \frac{Y_i}{Y_t}, \qquad (2)$$

Current account norm estimates are available at the earliest starting from 1987 for some countries, and data available for all countries only start from 1997. Regarding the choice of the starting NIIP level for the computation of norms $NIIP_0$, the first question concerns which criterion should be adopted used for such choice. One possible criterion would be to use the earliest year for which current account norms are available. However, as current account norms and NIIP data are available starting from different years, such a choice could lead to NIIP norms that are imperfectly comparable across countries.

A common starting point for cumulating norms should ideally coincide with a period where NIIPs were close to their fundamental values for as many countries as possible. As a rule, current account norms tend to exhibit smaller absolute values compared with actual current account balances. For the same reason, NIIPs closer to zero in absolute value are more likely to be in line with fundamentals than largely negative or positive NIIPs. We follow therefore the rule-of-thumb criterion to select a common starting period for the cumulation consisting of a period where absolute NIIP values tend to be relatively low. Following this criterion, as shown in the Annex 2, the best period for the selection of $NIIP_0$ is during the mid-1990s, as it was in those years that, over the sample period for which current account norms are available, the

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the share price of firms and thus the value of their shares held abroad. This implies a tendency for financial centres to exhibit surpluses coupled with negative valuation effects. See Eggelte et al. 2014, for the Dutch case.

([9]) Following Phillips et al. (2013), the financial centre variable is a time-invariant dummy. The effect of this dummy on current accounts and NIIP depends on what countries are considered and the assumption is made that such effects remain stable over time.

median and average absolute value of the available NIIP data across the countries was at its minimum.([10])

With a view to obtain a balanced dataset of NIIP norms, *the cumulation of current account norms starts from 1995 for all countries*. Since for some countries data for the NIIP are not available in 1994 and since the earliest year for which current account norms are available for all countries is 1997, *the initial NIIP value* is the one corresponding to the year *where the NIIP exhibits the lowest absolute value* for each country *within the 1993-96 period*.([11])

A key question is whether the choice of the starting NIIP level has a strong impact on the estimated NIIP benchmarks. Robustness checks indicate that alternative choices for the starting date have relatively limited impact on estimated NIIP benchmarks for 2016 as the component of the NIIP benchmark associated with the cumulation of current account norms largely prevails over that linked to the initial NIIP stock. (see Graph A2.3 and Table A3.1 in the Annex).

([10]) For EU countries, this may reflect the stronger upward current account adjustments in countries with relatively low NIIPs after the break-up of the Exchange Rate Mechanism in 1992, which could have contributed to reduce the distance from the actual NIIP stock to the one in line with fundamentals. The largely negative NIIPs of a number of EU former transition countries recorded during the mid-2000s were at much more moderate levels than during the mid-nineties. In a number of other large advanced economies like the US and Japan, NIIPs were relatively stable during the 1990s, with moderate absolute values compared to subsequent years.

([11]) As there is no initial NIIP available for Serbia during the 1993-96 period, estimates of the NIIP norm are not obtained.

3. PRUDENTIAL NIIP THRESHOLDS

The purpose of this approach is to identify an *NIIP level that signals an increased probability of external crises*. The benchmark consists of a threshold level for the NIIP below which an external crisis is more likely to occur. Following standard practice (e.g., Kaminsky, Lizondo and Reinhart, 1998; Bussière and Fratzscher, 2006; Beck, Demirgüç-Kunt and Levine, 2006; Alessi and Detken, 2011; Baldacci et al., 2011; Berti, Salto and Lequien, 2012; …), the threshold is chosen to maximise the "signal power" of the threshold, which is equivalent to minimising the sum of the probability of missed crises and the probability of false alerts.

Data on external crisis episodes are identified on the basis of the criteria proposed in Catão and Milesi-Ferretti (2014), which include: (i) episodes of official financial assistance programmes and (ii) episodes of debt default. The variable also follows Catão and Milesi-Ferretti (2014) for the criteria to measure the duration of crisis periods. The periods during crises are excluded from the sample, so that the variable consists of a dummy taking value 1 if a crisis start and 0 if there are "tranquil times" (i.e., no crisis), while observations where crises persist after having started are omitted from the sample used for the estimation of the threshold. The sample has been extended in time beyond that used in Catão and Milesi-Ferretti (2014). The sample of crisis episodes covers 64 of the same advanced and emerging economies covered in the sample for the current account regressions, and spans the 1980-2015 period. ([12]) The available sample of crisis episodes and NIIP data used for the estimation of the thresholds is described in Table A.2.1 in the Annex 2.

The estimation applies a "brute-force" algorithm that guarantees the identification of a global maximum for the signal power despite a possible multiplicity of local maxima. Results regarding the estimation of prudential thresholds are presented in Table 3.1. The method identifies a common threshold for the NIIP at -25% of GDP. This threshold has a signal power of about 1/3, and constitutes a broadly balanced compromise between type 1 and type 2 errors, which have a probability, of 22 and 45%, respectively.

One-size-fits-all NIIP thresholds do not permit to take into account the fact that the tolerance to large stocks of net financial liabilities is likely to differ considerably across countries. To address this limitation we also estimate thresholds for the NIIP variable interacted with relevant structural country-specific characteristic that proxy borrowing constraints and debt tolerance. *We focus on interactions with structural, slow-moving variables*, in order to condition for factors that characterise countries ex-ante. Moreover, we restrict the attention to single interaction, although checks are performed with respect to double interactions.

([12]) The criteria defined by Catão and Milesi-Ferretti (2014) are based on the use of IMF quotas, which does not allow to infer data for Hong Kong, which is not an IMF member. Similar to Catão and Milesi-Ferretti (2014), Luxembourg is excluded from the sample as well in light of very volatile NIIP.

Table 3.1: **NIIP prudential threshold estimates and relevant indicators**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Threshold	Signal power of (1)	Missed crises (%)	False alerts (%)	# Crisis starts	# Obs. with no crisis	Std. dev of (1) wrt. sample perturbations	Threshold equalising (3) and (4)	Signal power associated to (8)	AUROC	Median of country-specific thresholds
NIIP	-25	0.34	0.22	0.45	46	1798	8	-34	0.31	0.72	
Cumulated net lending excl. net errors/omissions	-14	0.35	0.08	0.57	25	1388	4	-29	0.28	0.69	
NENDI	-16	0.39	0.2	0.41	46	1798	4	-22	0.31	0.73	
NIIP - FDI	12	0.11	0.28	0.61	46	1798	7	7	0.02	0.49	
Net Debt	-29	0.31	0.33	0.36	46	1798	5	-29	0.27	0.69	
Net short-term debt	204	0.01	0	0.99	8	441	74	27	-0.7	0.11	
Total liabilities	604	0.04	0.93	0.02	44	1785	413	61	-0.04	0.47	
Gross debt liabilities	25	0.1	0.04	0.86	46	1797	11	50	-0.04	0.52	
Short-term debt liabilities	12	0.23	0.15	0.61	13	668	40	23	-0.01	0.58	
Total non-FDI liabilities	93	0.14	0.36	0.5	44	1789	95	98	0.05	0.54	
Reserves	6	0.23	0.39	0.38	46	1804	2	6	0.22	0.63	
External gov't debt liabilities	34	0.27	0.59	0.14	22	1072	10	18	0.18	0.64	
External bank debt liabilities	2	0.14	0	0.86	18	965	45	13	0	0.54	
NIIP / relative per capita income	-83	0.48	0.18	0.35	45	1757	9	-103	0.44	0.77	-44
NENDI/ relative per capita income	-78	0.55	0.29	0.16	45	1757	4	-55	0.51	0.79	-41
NIIP * Non-FDI liabilities / total liab.	-65	0.38	0.38	0.24	42	1776	10	-52	0.33	0.74	-46
NIIP / imports	-131	0.41	0.33	0.26	46	1798	26	-117	0.39	0.77	-40
NIIP / Fraser economic freedom index	-7	0.45	0.33	0.22	45	1766	1	-6	0.35	0.77	-46
NIIP * (1-FXAGG)/2 (Bénétrix et al., 2017)	-21	0.35	0.36	0.29	25	1190	3	-17	0.29	0.71	-43

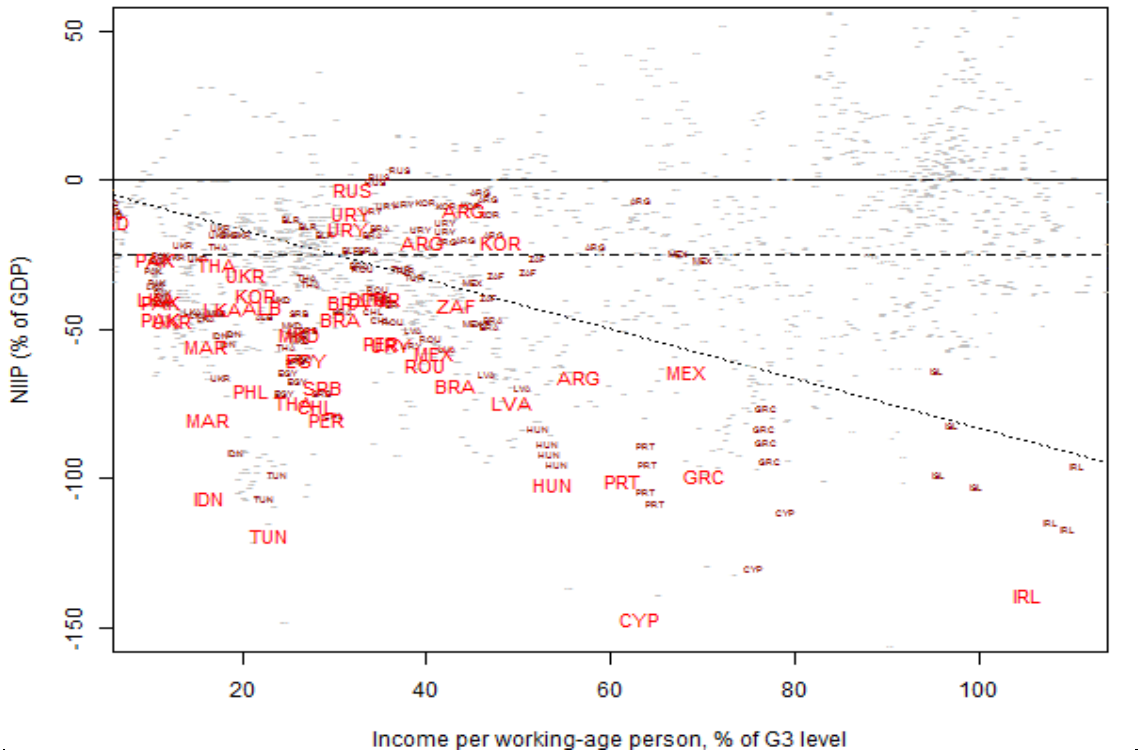
Crisis episodes are defined as in Catão and Milesi-Ferretti (2014). Base terms are defined as % of GDP if not specified otherwise, and lagged by one period. For a description of variables, see Table A.1.2. For the available sample see Table A2.1.1 in Annex 2. 'Threshold' denotes the threshold that maximises the signal power, which is defined as 1-prob(false alerts)-prob(missed crises). The percentage of missed crises and false alerts reported in (3) and (4) are those associated to the threshold in (1). The threshold standard deviation in (7) is based on 500 random draws with each case omitting 20% of the countries in the sample. The alternative threshold equalising in (8) denotes the threshold that equalises the frequency missed crisis and false alerts. 'AUROC' denotes the area under the ROC curve for the respective indicator and represents the signalling power of each indicator, irrespective of threshold choice. Column (11) reports the median across the sample for the NIIP or the NENDI country-specific thresholds, that is obtained by transforming the threshold in (1) for the interacted variable into a threshold for the NIIP specific to each country and year by using the interaction variable.

Income per capita appears to be a straightforward choice for such an interaction term. The tolerance to large stocks of net external liabilities is expected to be higher in countries with higher per-capita income, as it relates to stronger export capacity, higher financial development and better regulation, less dependence on foreign currency borrowing, more room for raising taxes and for government support to the private sector, etc. In a nutshell, per-capita income embeds information not only on economic development but also on institutions and other structural characteristics that are normally associated with higher default probability on a given amount of foreign debt. Consistently, available evidence from probit regressions (e.g., Catão and Milesi-Ferretti, 2014) indicates that the probability of external crisis is significantly higher in countries with lower per-capita income.([13]) Correcting the NIIP stock for relative per-capita income (i.e., dividing the NIIP/GDP ratio by relative income per capita in PPPs, see Table A.2.1 for details on the construction of the variable) permits defining a threshold for the NIIP/relative income indicator, which is subsequently translated into a country-specific NIIP threshold by multiplying the NIIP/relative income threshold by the relative per-capita income of each country.

([13]) Income per-capita has also been used as a proxy capturing institutional development also in analyses of the determinants of banking crises (e.g., Demirgüç-Kunt and Detragiache, 1997),

Table 3.1 shows that the signal power of the threshold for the NIIP interacted with per-capita income considerably exceeds that of the non-interacted NIIP variable, due especially to a lower probability of missed crises, but also a lower risk of false alerts. Graph 3.1 helps the intuition about why interacting the NIIP variable permits such an improved signal power. The vertical axis reports NIIP/GDP ratios, while the horizontal axis reports relative income per capita, and observations are reported distinguishing crisis starts and "tranquil" periods. The dashed horizontal line is the common NIIP threshold (-25%). The threshold for the interacted NIIP corresponds to the dotted sloped line. It stands out that crisis starts are more frequent for countries with a combination of low NIIP and relatively low income per capita. By taking into account both dimensions, the interacted threshold does a better job in separating crisis from non-crisis episodes than the simple one-size-fits-all -25% threshold.

Graph 3.1: **NIIP vs relative income and external crises**



Notes: the Graph displays NIIP as % of GDP, 1980-2015, vs relative income, defined as GDP in PPP per working-age person as % of the mean over Germany, Japan and the US. Grey labels denote observations without crisis, large red labels denote an external crisis start (as defined in Catão and Milesi-Ferretti (2014), and small red labels denote the four years leading up to that crisis start. The horizontal dashed line represent the 'NIIP' thresholds from Table 2, column (1), first line (-25%). The sloped dotted lines represent combinations of NIIP and relative income consistent with the threshold for the NIIP/relative income variable of -83% (see Table 2). Note the Icelandic crisis (with an NIIP beyond -300% of GDP) is not depicted. Note moreover that within-crisis observations are not shown in the graph.

How does the NIIP fare with respect to alternative indicators of external assets and liabilities? Are there other interaction terms that permit an even higher signal power? Are the estimated thresholds robust to sample perturbations, crisis definition, criterion for threshold determination? To address these questions, a number of robustness checks are carried out as follows:

***Alternative indicators of external stock imbalances*.** The NIIP is the statistics on net financial stocks most commonly monitored in macro-financial surveillance, including because it finds is flow counterpart in the current account balance. Nonetheless, it is disputable whether the NIIP is the best stock indicator for early identification of external crisis risk. Among alternative indicators, the following have been considered: (i) the cumulated net lending net of errors and omissions, which permits to purge the NIIP from valuation effects and the net errors and omission component; (ii) alternative definitions of net stock variables, purged from less volatile items or non-defaultable financial instruments. In addition to NIIP net of the FDI component, net external debt, net external short-term debt, we test a variable named "Net Marketable External Debt" (NENDI) that differs from the NIIP as it excludes not only FDI but also portfolio equity shares; (iii) alternative foreign liability definitions, including total liabilities, gross debt liabilities, short-term debt liabilities, reserves; (iv) debt liabilities for particular sectors of the economy: government and the banking sector.

It turns out that the threshold associated with the cumulated net lending has roughly the same signal power as that of the NIIP.([14]) No alternative indicator of net or gross liabilities perform comparably with NIIP in terms of signal power, with the exception of NENDI, which actually slightly outperforms the NIIP as it includes only items on default is possible. In this respect, it appears that the NENDI is a useful complement to NIIP in assessing the riskiness of net external financial positions. The NIIP and NENDI are also among the most robust with respect to sample perturbations, as indicated by the standard deviation of the thresholds with respect to 500 random perturbations (see Annex 2 for details). The threshold for the income-adjusted NENDI is very close to that for the income-adjusted NIIP. This means that also the country-specific thresholds for NENDI are very close to the ones for the NIIP.

Interactions with variables other than income per-capita have been tested. Table 3.1 displays results for interactions with alternative structural country characteristics: (i) trade openness, as measured by the import share (the expectation being that trade openness is associated with higher export capacity and therefore a better capacity to repay foreign debt), (ii) an indicator of external liability composition (i.e., non-FDI liabilities on total liabilities, the expectation is that negative NIIP positions mostly linked to FDI liabilities are less risky); (iii) an indicator summarising the extent to which governance and regulations are non-detrimental to business (i.e., the Fraser economic freedom index, reporting higher values when institutions are more market-friendly; the expectation is that stronger institutions reduce the riskiness of a give stock of net foreign liabilities); (iv) an indicator capturing the net position in foreign currency (obtained as a transformation of the "FXAGG" indicator developed in Bénétrix et al., 2015, and increasing with the extent to which the country is a net creditor rather than net debtor in foreign currency; the expectation is that net positions in foreign currency reduce the riskiness of net foreign liabilities as currency depreciation would reduce rather than increase the size of net liabilities).([15])

These interactions permit to achieve a somehow higher signal power as compared with that of the non-interacted NIIP, but do not outperform the interaction with relative per-capita income.

([14]) As shown in Annex 2, also the cumulated current account yield a similar signal power, indicating that the noise associated to the net error and omissions component has only a marginal impact on the capacity of NIIP to signal crisis risk.

([15]) The interaction is with (1-FXAGG)/2 which ranges between 0 and 1, as the FXAGG=(share of foreign assets in foreign currency)*(share of foreign assets in the sum of foreign assets and liabilities)- (share of foreign liabilities in foreign currency)*(share of foreign liabilities in the sum of foreign assets and liabilities) ranges between -1 and +1.

The relatively strong performance for the Fraser indicator is linked to the high correlation of this index with relative per capita income (0.58 across the available sample), which corroborates the interpretation that per-capita income also captures institutional factors that help overcoming borrowing constraints. A similar question arises for the indicator of foreign currency exposure, as the ability to be net creditor in foreign currency sufficiently is also linked to per capita income. Does foreign borrowing capacity play a relevant role on top of that of per capita income? In order to address this question a double interaction of NIIP is performed, both with relative per capita income and the FXAGG indicator. Results, shown in Annex 2 (Table A.2.1), indicate that such double interaction does not help improving the signal power as compared with the simple interaction with per capita income.([16])

Alternative threshold definitions. The identified thresholds might in some cases imply few false alerts, but fail to detect many external crises, or vice versa. To assess the robustness of results with respect to an alternative criterion of the identification of the threshold, Table 2 also reports the value of the thresholds that ensures the equality of the probability of the type 1 and type 2 errors, and the associated signal power. The results show that these alternative thresholds for the NIIP and the income-adjusted NIIP would not change much from those identified by maximising signal power. More systematically, robustness checks with respect to alternative criteria for determining the threshold can be obtained by means of the Area under the Receiver Operating Characteristic Curve (AUROC), which permits to infer the signalling power of an indicator, irrespective of how the threshold is defined. The NIIP performs well compared to alternative indicators also with respect to the AUROC metric.([17])

Robustness to alternative crisis definitions. The same analysis as reported in Table 3.1 was carried out on the basis of alternative indicators of external crises, namely currency crisis episodes as proposed by Laeven and Valencia (2012). The NIIP threshold has a similar signal power for this alternative crisis definition, and still performs fairly well in comparison with alternative indicators in terms of signal power and robustness to sample perturbations. The NIIP interaction with income per capita displays slightly less signal power than selected alternative interaction terms, while the NENDI interacted with income per capita still outperforms most alternatives.

([16]) Checks have been performed for interactions of the NIIP with more volatile variables likely to affect the probability of external crises. The most straightforward of such variables is the current account balance. Table A.2.1. in Annex 2 shows that the simple interaction NIIP times the current account balance permits to achieve a signal power almost as high as that of the NIIP interacted with per capita income, with the consequence however if increasing the volatility of the common threshold estimated with respect to sample perturbations and the standard deviation of the country specific thresholds for the NIIP. The double interaction of NIIP with both the current account and per capita income yields signal power slightly below that achieved by the simple interaction with per capita income, and at the expense of a major increase in the volatility of the threshold with respect to sample perturbations and of the dispersion of country-specific NIIP thresholds.

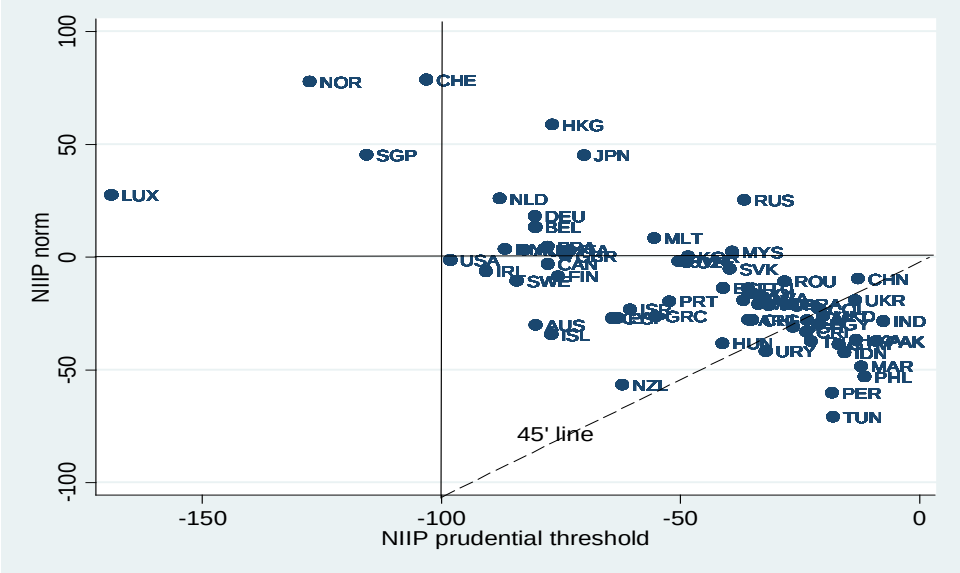
([17]) The AUROC denotes the area under the Receiving Operating Characteristic (ROC) curve which reports the share of correct signals against the share of false alarms for each value of the indicator. A higher AUROC indicates a higher signal power irrespective of the specific threshold chosen for a given indicator (see Annex 2 & 3).

4. BENCHMARKING NIIPS

4.1. PATTERNS OF NIIP BENCHMARKS

Estimates for NIIP benchmarks are computed for 65 advanced and emerging economies for all the years over the 1995-2016 period.([18]) Graph 4.1.1 reports average country-specific variables over the 1995-2016 period. In general, the countries characterised by lower NIIP norms are also those for which prudential NIIP thresholds are more stringent, so that the scatterplot reporting time averages of NIIP norms and prudential threshold across countries appears negative sloped. This result, which may appear counter-intuitive at first sight, reflects the basic fact that those countries that are more likely to be net borrowers due to a relatively early development stage, are also those that are at higher risk of crises for a given stock of net foreign liabilities. The graph confirms that NIIP norms are generally well above NIIP prudential thresholds, which is expected, as the latter is an asymmetric threshold aimed at signalling whether the NIIP falls below a critical level. Graph 4.1.1 also reveals that the countries that behave as outliers, distancing themselves from the negatively-sloped scatterplot, are mainly countries exhibiting very large and positive NIIP norms. Most of these countries are either relatively small countries that are identified in our regression framework as having a corporate financial centre status or countries with a large net energy balance.([19])

Graph 4.1.1: **NIIP norms vs. NIIP prudential thresholds. 65 advanced and emerging economies, country-specific averages over available time periods**

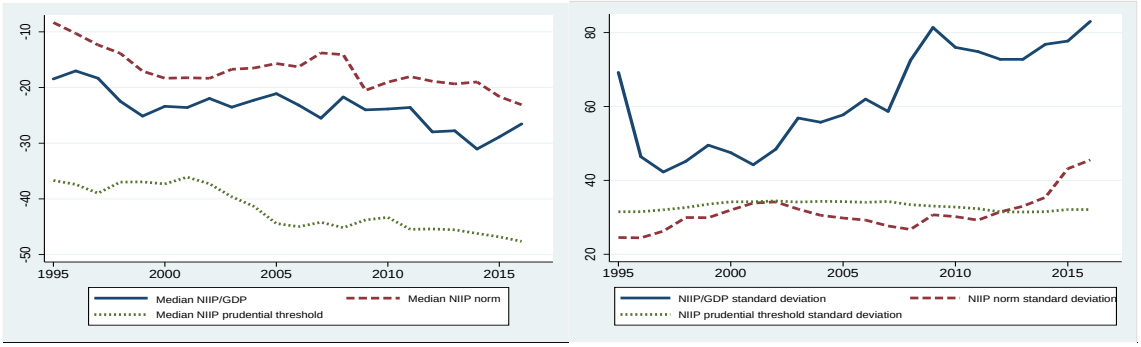


The cross-country median of NIIP norm values is not too dissimilar from that for actual NIIP/GDP ratios (Graph 4.1.2), and the two medians appear to co-move in time. The cross-country median NIIP norm varies between -10 and -25, while the median prudential threshold is between -40 and -50 percentage points of GDP. The values for these latter variables are

([18]) Table A3.1 in the Web Annex reports results for all countries for 2016.

([19]) Note that the corporate financial centre dummy is not used as a fundamental to determine NIIP norms; should this variable be included among the fundamentals the positive NIIP norm of some countries with corporate financial centre status would even be larger.

Graph 4.1.2: **NIIP, NIIP norm, NIIP prudential thresholds: evolution of median value (graph on the left) and standard deviation (graph on the right) across 65 advanced and emerging economies**



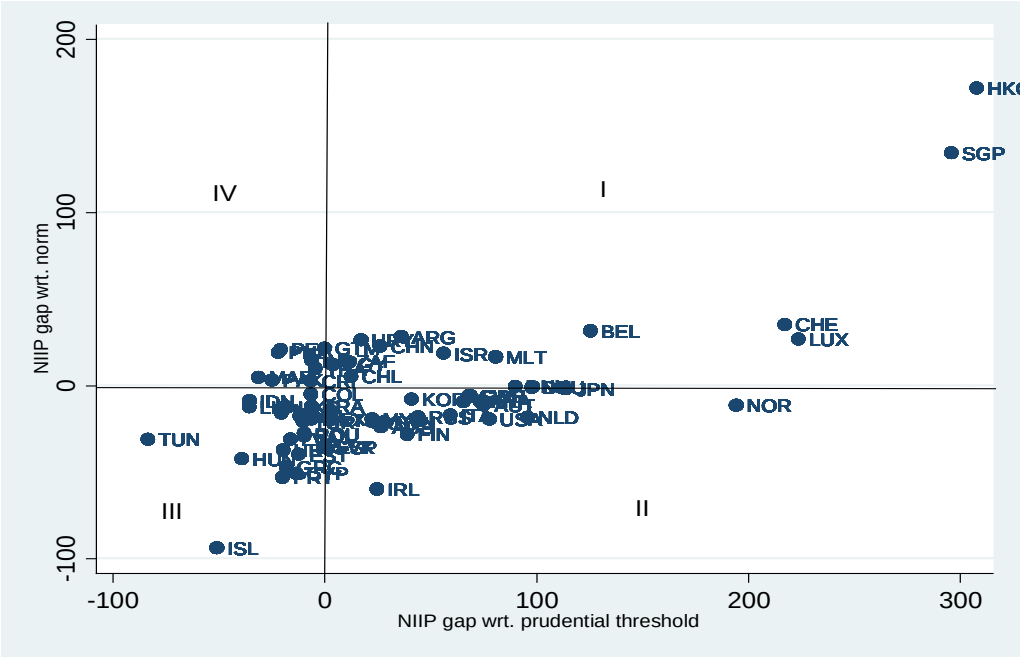
therefore broadly in line with common prudential thresholds for the NIIP reported in existing papers (Berti et al., 2010; Catão and Milesi-Ferretti, 2014). Over the sample period, the median NIIP/GDP and the median NIIP norm show a mild downward trend that reflects the growing number of countries recording negative NIIP positions, a tendency that appears to be partly underpinned by fundamental drivers. Over the crisis period, the median NIIP/GDP displays a more pronounced deterioration compared with norm, and a subsequent recovery. The median NIIP prudential threshold is much below the median NIIP/GDP, and also exhibits a mild downward trend, linked to the process of income convergence that concerns a number of countries in the sample that have seen their relative per-capita income growing over time, implying a reduction of risks associated to a given stock of NIIP.

The divergence of NIIP positions starting from the 1990s is well documented (Lane and Milesi-Ferretti, 2007), with marked NIIP deteriorations in the US and a number of EU countries, accompanied by NIIP improvements in a number of other industrial and emerging economies Consistently, Graph 4.1.2 shows that the cross-country standard deviation of NIIP ratios displays a marked upward trend over the past two decades, and that this trend, is not matched by a comparable upward trend in the dispersion in NIIP norms. This evidence is consistent with the fact that the NIIP evolution in a growing number of countries from the early 2000s was linked to current account balances deviating from fundamentals in a context of fast credit growth and financial integration. After the rebalancing process that took place after the crisis and that implied a reduced NIIP dispersion, NIIPs started diverging again in more recent years, but this more recent divergence process appears this time in line with fundamentals, as NIIP norms also exhibit an increased dispersion over the same years.

4.2. PATTERNS OF NIIP GAPS

NIIP gaps can be constructed as differences between actual and benchmark NIIPs, as both are defined in terms of percentages of current GDP. Graph 4.2.1 compares NIIP gaps with respect to norms with those with respect to prudential thresholds by means of a cross-country scatterplot of time averages over the available sample. The two gaps appear positively correlated: if the NIIP falls below the NIIP norm, it is also more likely to fall below the prudential threshold. This result holds despite the fact that the two benchmarks are negatively correlated across countries, implying that the positive correlation among gaps is linked to the much larger cross-country variation in term of actual NIIP, which largely outweighs the cross-country variation in terms of NIIP benchmarks.

Graph 4.2.1: **NIIP gaps wrt. NIIP norm vs. NIIP gaps wrt. prudential thresholds. 65 advanced and emerging economies, country-specific averages over available time periods**

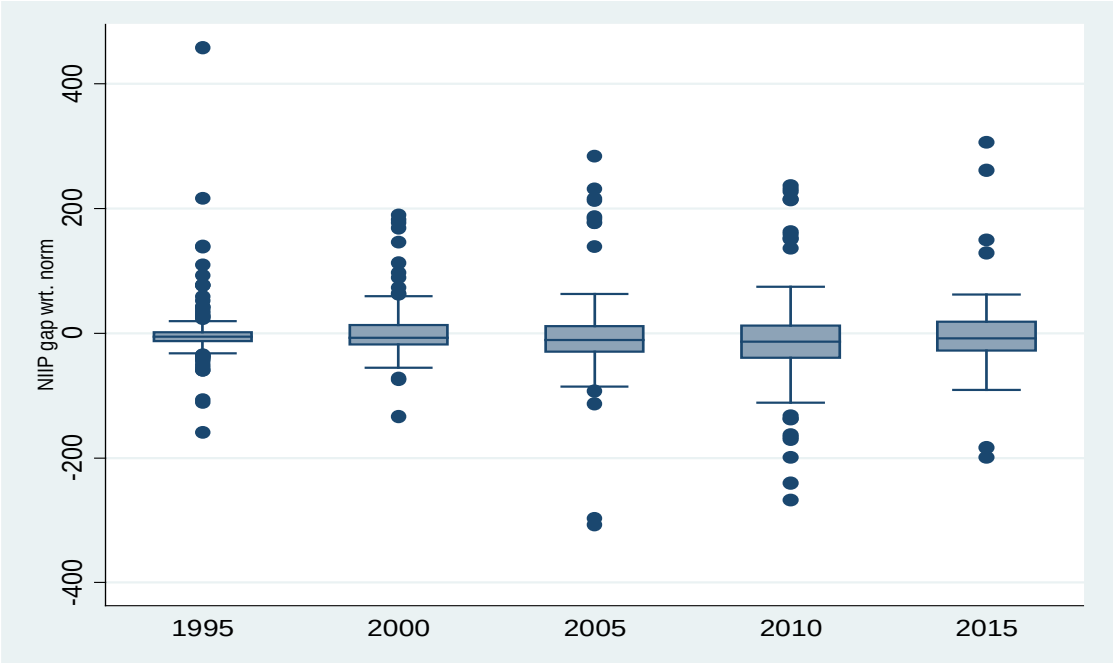


Cases where NIIP gaps are positive with respect to both benchmarks (quadrant I in Graph 4.2.1) correspond to situations where economic fundamentals would justify a lower NIIP, that anyway would remain in "safe territory". Conversely, cases where both gaps are negative (quadrant III in Graph 4.2.1) represent situations where the NIIP is exposed to crisis risk, and where fundamentals would justify less negative NIIP positions. Quadrant II in Graph 4.2.1 reports the cases where NIIP gaps are positive with respect to prudential thresholds but negative with respect to norm, representing situations where risks are limited, but where fundamentals would justify a further improvement of the net external position. Finally, quadrant IV in Graph 4.2.1 reports cases where NIIPs are below their prudential threshold but above norm, corresponding to situations where the NIIP is in "risky territory" but fundamentals would justify a further decline in the NIIP. This latter typology of situations reflects a possible tension between economic fundamentals and prudential considerations and, and appears to be the least frequent. These cases are limited to a number of emerging economies, and are associated with

the comparatively low external debt tolerance generally observed in relatively low-income countries, despite NIIP positions that could be above those justified by fundamentals.([20])

Graph 4.2.1 displays the box plot of the distribution of NIIP gaps with respect to norm observed across five-year periods. The distribution of NIIP gaps with respect to norm appears roughly symmetric, with a median not far from zero and broadly in the centre of the distribution. It is visible that values far apart from median are frequent especially in case of large negative gaps. It also turns out that the distribution of NIIP gaps is fairly stable over time, revealing a high degree of persistence, although it is visible that the dispersion of NIIP gaps has been growing over time until the crisis. The distribution of gaps with respect to prudential thresholds (Graph 4.2.3) is instead asymmetric, with a median which appears generally above zero and closer to the left tail of the distribution, implying that gaps above median may take much higher absolute values than those below median. This feature is inherent to the concept of prudential threshold, namely that of a floor below which risks associated with the NIIP become particularly high. Graph 4.2.3 also shows that the distribution of gaps with respect to prudential thresholds exhibits a high degree of stability over time, despite a lengthening of the left tail in correspondence of the crisis, as large negative gaps became more frequent in that period.

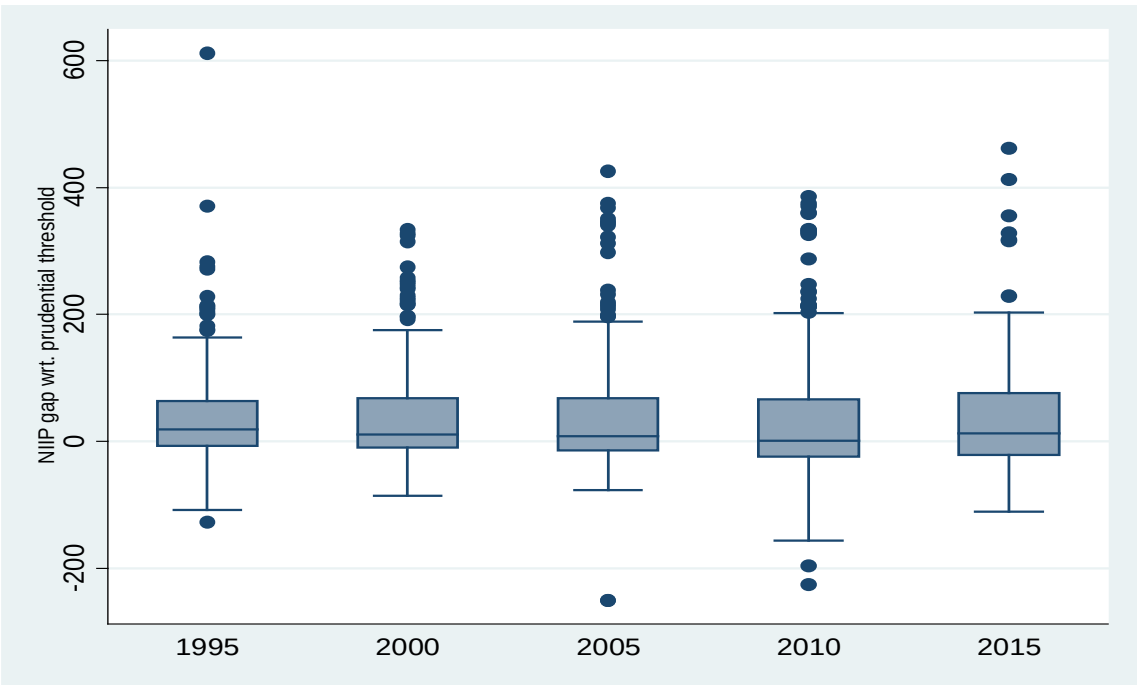
Graph 4.2.2: **Distribution of NIIP gaps wrt. NIIP norm, by 5-year periods. 65 advanced and emerging economies 1995-2016**



Years reported correspond to the first of non-overlapping 5-year periods. The period starting in 2015 only contains values for 2015 and 2016. The upper and lower limits of boxes are, respectively, the 75th and 25th percentiles; the horizontal lines cutting the boxes is the median. The vertical whiskers display 'adjacent' values that are 1.5 times the interquartile range above the 75th or below the 25th percentile; dots represent 'outsider' observations beyond those whiskers.

([20]) Cases where the NIIP gap with respect to norm is positive and that with respect to prudential threshold is negative are less than 10% of the whole sample, less than 1% of the sample of advanced economies, and about 23% of the sample of emerging economies.

Graph 4.2.3: **Distribution of NIIP gaps wrt. NIIP prudential threshold, by 5-year periods. 65 advanced and emerging economies 1995-2016**



Years reported correspond to the first of non-overlapping 5-year periods. The period starting in 2015 only contains values for 2015 and 2016. The upper and lower limits of boxes are, respectively, the 75th and 25th percentiles; the horizontal lines cutting the boxes is the median. The vertical whiskers display 'adjacent' values that are 1.5 times the interquartile range above the 75th or below the 25th percentile; dots represent 'outsider' observations beyond those whiskers.

4.3. DO NIIP GAPS HELP PREDICTING NIIP DYNAMICS?

Large NIIP gaps are expected to close over time. In the case of NIIP norms, the adjustment would be linked to the operation of fundamental drivers affecting the evolution of the NIIP. A negative (positive) gap implies that for some time the NIIP has evolved at pace above (below) what would be justified by fundamentals. Such tendencies are likely to revert at some point, implying a closing of NIIP gaps. The process however may be slow and non-linear as the dynamics of stocks defined as a ratio on GDP depend also on output fluctuations and because valuation effects may imply temporary but in some case large NIIP changes that do not necessarily go in the direction of supporting external rebalancing (see also Zorell, 2017). In the case of gaps with respect to prudential thresholds, the gaps that are most likely to close are negative ones, as these represent cases in which the NIIP position has become risky, so that a correction could come either as a result of the operation of fundamental drivers, or because of policy aimed at reducing such risks, or as a consequence of market-driven sudden stops and current account reversals.

A straightforward way to assess whether medium-term NIIP changes display a systematic relation with past NIIP gaps is to regress changes in NIIP on the lagged value of NIIP gaps across the panel, controlling for country and fixed effects. With a view to account for short-term dynamics, we use a dataset of non-overlapping 5-year periods.([21]) The dependent variable is the average annual change in the NIIP/GDP ratio during each 5-year period; the explanatory variable of interest is the NIIP gap at the start of each period. Country and period fixed effects are included to control for additional factors. Both gaps with respect to NIIP norms and with respect to prudential thresholds are considered, but in separate regressions, to ease interpretation and in light of the likely high multicollinearity induced by the simultaneous use of the two variables as regressors. What is also analysed is whether positive or negative values of the gaps have a different impact. To this purpose, two variables are constructed and used as distinct regressors, one reporting the values when the gap is positive and zero otherwise for each non-missing observations, the other variable symmetrically doing the same in case of negative gaps.

Table 4.3.1 reports results, which broadly confirm expectations. Across the whole available sample, the NIIP gap displays a negative albeit not significant coefficient, irrespective whether they are defined with respect to the NIIP norm or the prudential threshold (columns 1 and 2). It also turns out, in line with expectations, that the gap with respect to the prudential threshold exhibits a significant negative relation with the change in the NIIP in cases where the gap is negative (column 4). The response of NIIP also appears to be quite asymmetric: the regression coefficient for positive NIIIP gaps is positive, although not significantly, while that for negative gaps is negative but clearly significant only for the gaps defined with respect to the NIIP prudential threshold. The estimated coefficient of -0.098 implies that in the presence of a 10% of GDP negative gap, the NIIP would adjust each year on average by about one percentage point of GDP, so that the gap would be closed on average in about 10 years. The high persistency of positive NIIP gaps is consistent with the documented relative persistency of large current account surpluses as compared with deficits (e.g., IMF, 2017). In our sample, the lack of adjustment of NIIPs largely in excess of benchmarks appears to be associated especially with the NIIP dynamics in few small financial centres.([22])

([21]) Data for Luxemburg for the period before year 2000 are excluded from the sample as these observations are characterised by a very high volatility for the NIIP/GDP ratio associated with valuations effects.

([22]) On average, across the whole sample, positive NIIP gaps with respect to norm are virtually unchanged after five years. Instead, after excluding from the sample Hong Kong, Luxembourg and Singapore, positive NIIP gaps appear to fall by about 2% of GDP over a five-year period. The sample for the computation of the average NIIP

Table 4.3.1: **NIIP gaps vs. NIIP levels and subsequent NIIP adjustment**

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: 5-year change in NIIP					
NIIP gap wrt. to norm, t-5	-0.0153					
	[-0.541]					
NIIP gap wrt. to prudential threshold, t-5		-0.0227				
		[-0.971]				
Positive NIIP gap wrt. to norm, t-5			0.0219			
			[0.407]			
Negative NIIP gap wrt. to norm, t-5			-0.0359			
			[-1.046]			
Positive NIIP gap wrt. to prudential threshold, t-5				0.0281		
				[0.570]		
Negative NIIP gap wrt. to prudential threshold, t-5				-0.0989***		
				[-3.467]		
NIIP, t-5					-0.02	
					[-0.833]	
NIIP if positive, t-5						-0.0164
						[-0.383]
NIIP if negative, t-5						-0.022
						[-0.580]
Constant	4.390***	5.311***	3.442*	1.562	4.160**	4.015
	[2.875]	[4.863]	[1.905]	[0.811]	[2.452]	[1.335]
Observations	323	323	323	323	323	323
R-squared	0.073	0.077	0.078	0.106	0.075	0.075
Number of countries	65	65	65	65	65	65

Non-overlapping 5-year periods. The period starting in 2015 only contains values for 2015 and 2016. Observations for Luxemburg before 2000 are excluded.
Estimation method: Least Squares Dummy Variables. Country and period effects included. Standard errors robust with respect to heteroscedasticity and non-independence within panels.
Robust t-statistics in brackets. Asterisks indicate significance at a * 10%, ** 5%, and *** 1% level.

gap is restricted to the 1995-2010 period to ensure that the same number of observations is available to compute averages in the subsequent 5 years.

Table 4.3.2: **NIIP gaps and subsequent NIIP adjustment, by exchange rate regime**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Fixed exchange rates	Flexible exchange rates	Flexible exchange rate, positive foreign currency exposure	Flexible exchange rate, negative foreign currency exposure	EU	Advanced non-EU	Emerging
Explanatory variables	Dependent variable: 5-year change in NIIP						
NIIP gap wrt. to norm, t-5	-0.0394	0.00142	-0.123**	-0.149**	-0.0565	0.000287	0.00615
	[-0.993]	[0.0375]	[-3.518]	[-4.824]	[-1.266]	[0.0105]	[0.293]
NIIP gap wrt. to prudential threshold, t-5	-0.0356	-0.00696	-0.107*	-0.182**	-0.0628*	-0.0172	-0.0392
	[-1.136]	[-0.222]	[-2.446]	[-11.10]	[-2.359]	[-0.721]	[-1.659]
Positive NIIP gap wrt. to norm, t-5	0.0503	-0.0324	-0.167**	0.416*	0.0778	-0.00601	0.0328
	[1.536]	[-0.280]	[-6.569]	[2.058]	[0.548]	[-0.101]	[1.088]
Negative NIIP gap wrt. to norm, t-5	-0.101*	0.0171	-0.00479	-0.177**	-0.0794	0.00584	-0.0149
	[-2.270]	[1.440]	[-0.181]	[-9.416]	[-1.463]	[0.324]	[-0.427]
Positive NIIP gap wrt. to prudential threshold, t-5	0.0289	0.0456	-0.106*	1.081**	-0.0137	0.0316	-0.0046
	[1.623]	[0.438]	[-2.304]	[2.942]	[-0.384]	[0.455]	[-0.108]
Negative NIIP gap wrt. to prudential threshold, t-5	-0.160*	-0.0718**	-0.182	-0.233**	-0.119	-0.0988**	-0.0598+
	[-2.101]	[-3.526]	[-1.253]	[-10.81]	[-1.501]	[-5.882]	[-1.904]
Observations	117	206	92	66	138	65	134
Number of countries	33	51	36	28	28	13	27

Non-overlapping 5-year periods. The period starting in 2015 only contains values for 2015 and 2016. Observations for Luxemburg before 2000 are excluded. Each column reports results for 4 different regressions where, in addition to country and period fixed effects, the initial value for NIIP gaps are included, respectively for the gap with respect to norm, that with respect to prudential threshold, positive and negative gaps with respect to norm, positive and negative gap with respect to prudential threshold.
Estimation method: Least Squares Dummy Variables. Standard errors robust with respect to heteroskedasticity and non-independence within panels.
Fixed exchange rate observations are defined according to the definition provided in Ilzetzki, Reinhart, and Rogoff (2017), i.e., exchange regimes that can be characterised as: no separate legal tender, pre announced peg or currency board arrangement, pre announced horizontal bands narrower than or equal to +/-2%, or de-facto pegs. The index of foreign currency exposure is the "FXAGG" indicator developed in Bénétrix et al. (2015). Observations with positive foreign currency exposure are those where the FXAGG indicator is positive. The exchange rate regime and the foreign currency exposure are those observed at the start of each 5-year period.
EU: current membership. Emerging: different than "high-income", World Bank definition. Advanced non-EU: "high-income", World Bank definition, not EU member.
Robust t-statistics in brackets. Asterisks indicate significance at a * 10%, ** 5%, and *** 1% level.

Is the computation of NIIP gaps helpful in predicting subsequent changes in the NIIP/GDP ratio or would the net international investment position be an equally useful statistic by itself? To answer this question columns (5) and (6) reports the same analysis but using the starting level of the NIIP/GDP ratio rather than the starting NIIP gap as explanatory variable. Results suggest a far from significant NIIP reaction to NIIP levels, also for cases where the starting NIIP is negative.

Table 4.3.2 reports results separately according to the exchange rate regime and main world regions. For observations with flexible exchange rate regimes, separate regressions are run depending on whether the net foreign currency exposure is positive or negative. To control for the exchange rate regime, we run regressions separately for countries classified as having a fixed or a flexible exchange rate regimes in the different time periods included in the sample using the classification provided in Ilzetzki, Reinhart, and Rogoff (2017), which is time-varying

and covers the full sample. The role of the exchange rate regime is not a-priori obvious. On the one hand, an exchange rate which is allowed to float would contribute to the adjustment of the current account, thus reducing the likely of large NIIP gaps in the first place, and increasing the responsiveness of the NIIP to existing gaps.([23]) On the other hand, exchange rate fluctuations could have effects on the NIIP stock via valuation effects that go against the closing of NIIP gaps, for instance when countries record a negative gap and are net debtors in foreign currency, so that currency depreciation tends to widen the negative gap. Results indicate that the responsiveness of the NIIP does not depend crucially on the exchange rate regime as such. Irrespective of the exchange rate regime, the NIIP reacts significantly to negative gaps with respect to prudential thresholds. However, in the case of fixed exchange rates, the reaction is estimated to be significant also with respect to negative gaps with respect to norms.

To shed light on the interaction between exchange rate fluctuations and foreign currency exposure in NIIP adjustment, for the case of flexible exchange rate separate regressions are run according to the net position in foreign currency recorded by the country at the start of the period, measured based on the FXAGG indicator developed in Bénétrix et al. (2015). Results indicate that foreign currency exposure appears to matter. Countries that record a positive net currency exposure tend to record significant adjustment to positive NIIP gaps.([24]) This result contrasts with the lack of adjustment recorded over the whole sample and can be explained by the tendency for countries with positive NIIP gaps to have an appreciating (or less depreciating) currency, and therefore a reduction in the NIIP via valuation effects that compound the effects of appreciation via the trade balance.([25]) For the case of negative foreign currency positions, the adjustment goes in the opposite direction compared with expectations in the case of positive gaps, while it is strong, significant, and in line with expectations for negative gaps. The lack of adjustment in case of positive gaps possibly reflects the role of valuation effects linked to appreciation pressures, which in the case of countries with negative net foreign currency exposure tend to improve NIIP positions. The strong adjustment to negative gaps is less intuitive, as valuation effects linked to depreciation would tend to play against adjustment via valuation effects. A possible explanation is that negative NIIP gaps in countries with negative foreign currency exposures tend to be accompanied by more substantial current account improvements in light of the perceived riskiness of NIIP positions and the need to build sufficient buffers, a phenomenon which was observed after the Asian crisis in a number of emerging economies (e.g., Lane and Shambaugh, 2010).

An additional sample split is operated in Table 4.3.2 based on country groups selected by development level (advanced vs. emerging) and geography (EU vs. non-EU advanced countries). Results differ only marginally. Coefficients for the NIIP gap have generally the expected sign. In the case of EU and emerging economies the responsiveness of the NIIP is significant in case of gaps computed with respect to the prudential threshold, which reflects

([23]) Consistently, a lower standard deviation of NIIP gaps is observed across countries with a flexible exchange rate regime, the standard deviation being, respectively, 38 and 59 for flexible and fixed exchange rate regime countries for the case of NIIP gaps with respect to norm, and 74 and 91 for the NIIP with respect to the prudential threshold.

([24]) Note that the available sample shrinks when performing separate regressions controlling for foreign currency exposure as the FXAGG index is available only for a subset of the observations. The significant reaction of NIIPs to initial NIIP gaps in columns (2) and (3) of Table 4.3.2 is partly linked to the shrinking of the sample.

([25]) Over the sample for which NIIP benchmarks are available, currencies in countries with flexible exchange regimes depreciate on average with respect to the US dollar by about 7.2 and 7.8% per year if the gap is negative with respect to norm and prudential threshold, respectively, and by 3.7 and 4.5% if the gaps are instead positive.

episodes of sharp current account adjustment after protracted periods of deteriorating external balance. In the case of advanced economies, the lack of significance for the gap with respect to the prudential threshold is linked to the fact that the NIIP tends to grow in the presence of a positive gap (the vast majority of the cases), but in the case of negative gaps the response is significantly negative.

5. CONCLUDING REMARKS

The crisis has contributed to foster the adjustment of large and unsustainable current account imbalances in a number of countries, but overall NIIP positions continue to diverge. What NIIP values should be expected for a given country over the medium-to-long term? What NIIP can be considered prudent? These are the questions that are addressed in this paper. While current accounts are regularly evaluated with reference to country-specific benchmarks, this is not the case in the case of the NIIP.

The paper develops methodologies for the computation of two separate country-specific benchmarks that permit to evaluate NIIP positions from different angles. NIIP norms constitute the stock equivalent to current account norms. The aim is to assess whether observed NIIP levels can be explained on the basis of country-specific medium-to-long term drivers. Prudential NIIP thresholds aim to detect NIIP levels below which there is a higher risk of balance-of-payments crises. The threshold is selected to maximise its signal power. Country-specific values for the NIIP threshold are obtained by interacting the NIIP with relative per-capita income. By proxying for a number of economic and institutional factors that affect international debt tolerance, this interaction allows for a higher signal power as compared with that of the threshold of the non-interacted NIIP and delivers a stronger signal power as compared with alternative interaction terms. A slightly stronger performance is obtained only by an alternative definition of net foreign assets including constructed in such a way to include only defaultable instruments (NENDI), still interacted by income per capita. Such variable provides therefore for a useful complement to the NIIP in assessing the riskiness of external stock positions.

Benchmarks are estimated for a sample of 65 advanced and emerging economies for the period 1995-2016. The median value for the country-specific NIIP norms is around -17% of GDP, while that for NIIP prudential thresholds is about -44% which is line with across-the board estimates of prudential thresholds found in existing literature (Catão and Milesi-Ferretti, 2014; Zorell, 2017).

The estimated benchmarks display a number of patterns. First, NIIP norms are generally well above prudential thresholds, the latter being an asymmetric threshold that indicates a floor below which NIIPs become risky. Second, NIIP norms and NIIP prudential thresholds exhibit a negative correlation across countries, reflecting the fact that while low economic development justifies borrowing, it also reduces tolerance to external debt. Third, while the time evolution of median NIIP norms tracks quite well that of actual NIIP-GDP ratios, NIIP norms do not display a comparable increase in their cross-country dispersion as the one observed for the actual NIIP. Fourth, NIIP gaps are fairly persistent over time and are generally positively correlated across countries: the same country that has a relatively large gap with respect to norm tends to have also a large gap with respect to prudential threshold. Only in few cases, observed mainly in emerging economies, NIIPs that are above norm are at the same time below the prudential threshold. Fifth, NIIP gaps display a weak negative relation with subsequent medium-term changes in the NIIP/GDP ratio, which is however asymmetric across the whole sample. This relation has statistical significance when there is a negative gap, while positive NIIP gaps are much more persistent, a result which is partly linked to the dynamics of NIIPs in small financial centres and to the net foreign currency exposure, as countries with flexible exchange rates and positive currency exposure appear to adjust significantly positive NIIP gaps. Most importantly, NIIP gaps are a better predictor of subsequent adjustment in the NIIP than the NIIP level itself, which confirms the importance of country-specific as opposed to one-size-fits-all benchmarks.

Country-specific benchmarks for the NIIP contribute also to the assessment of current accounts. A customary way to assess current account balances is to estimate which balance would be necessary to reach a given NIIP/GDP target by certain date. Common practice is to build such estimates of "required current account balances" (RCAs) on the requirements that the NIIP is stabilised at the current level or that a certain across-the-board NIIP level considered as safe. Country-specific NIIP benchmarks permit to have meaningful notions of country-specific NIIP targets in the computation of RCAs.([26])

Overall, applied analysis of countries' external positions would benefit from better insights of what NIIP position would be expected or considered as prudent. This paper represents a first step forward in addressing this question by means of the estimation of country-specific NIIP benchmarks.

([26]) Assuming a common across-the-board target or a country-specific one may matter a lot for the estimated RCAs, see Graph A3.1 in Annex 3.

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ANNEX 1

Table A1.1: **Variables used in current account regressions, description**

Variable	Rationale and expected sign	Construction/Transformation	Data source
Relative income per capita in PPP (lagged)	Standard theory predicts capital to flow downhill (+)	GDP in current PPP, divided by number of persons aged 15 to 64	IMF WEO (for GDP in PPP) and UN (for population)
Relative income interacted with capital openness (lagged)	Restrictions to capital movements may impede downhill capital flows (Chinn and Ito, 2008; Reinhard et al., 2013). (+)	GDP in current PPP, divided by number of persons aged 15 to 64, times capital openness index, that ranges between 0 for full restriction and 1 for no restriction and represents the quantiles of the Chinn-Ito (2006) 'kaopen' index.	IMF WEO and UN; Chinn and Ito (2008) for capital controls
Old-age dependency ratio	Old-age population is expected to have a comparatively low savings rate (-)	Persons aged 65 and over divided by persons aged 30-64	UN ESA population projections
Ageing speed	Expected ageing raises saving now to finance future spending (e.g., Milesi-Ferretti (2012) (+)	For any year T, ageing speed is defined as the old-age dependency ratio (as defined above) at year T+20 minus the old-age ratio in year T	UN ESA population projections
Ageing speed * income per capita (PPP) as % of G3 mean	Savings in anticipation of future ageing are expected to be higher if per capita income is higher because of higher propensity to save (Dynan et al., 2004) and because financial markets are more developed in ricer countries. (+)	Ageing speed minus world average ageing speed, times income per capita in PPP (as defined above) divided by the arithmetic mean of income per capita in PPP of Germany, Japan, and the US.	UN ESA population projections (for demographic data), and IMF WEO (for GDP in PPP)
Population growth HP-filtered (lagged)	Higher population growth is associated with higher shares of youth that do not save. (-)	Actual annual population growth is HP filtered (with parameter λ=5). The result closely matches annual population growth as provided by the Penn World Tables (9.0)	HP filter on AMECO, IMF WEO, and Worldbank WDI
Share of manufacturing in value added, instrumented	Positive trade balances are expected in countries with a structural specialisation in manufacturing and more engaged in global value chains. (+)	Manufacturing value added as % of GDP relative to world average. The variable is instrumented with the lagged domestic and world average share of manufacturing goods in total goods and services exports.	For the instrumented variable, Worldbank WDI and UN. For manufacturing exports as % of total exports, AMECO, IMF IFS, Worldbank WDI, and IMF BoP
Oil & gas balance / GDP 5Y mov.av. (if positive)	Some of the revenues from surpluses in natural resources are saved in anticipation of future depletion. (+)	Five-year moving average of (nominal) net exports of oil and gas in USD, divided by GDP. Set to zero if negative.	UN Comtrade
Mining products exports as % of total exports (lagged)		Exports of mining products (in USD), divided by total goods and services exports	Worldbank WDI for mining exports. For total exports, AMECO, IMF IFS, Worldbank WDI, and IMF BoP
Domestic currency % use in world FX reserves	The reserve currency status facilitates external financing (Gourinchas and Rey, 2013). (+)	Share of the currency in world foreign exchange reserves, in case the domestically issued currency is covered in the IMF COFER database, and zero in all other cases	IMF COFER
Financial centre dummy	Countries that are attractive for portfolio investment relating to offshore operations or for merchanting activities (e.g., Beusch et al., 2014) tend to display surpluses. (+)	A dummy for all observations of Netherlands, Luxembourg, Switzerland, Singapore, and Hong Kong	None
NIIP / GDP (lagged, in USD terms)	A negative NIIP worsens the net income balance but requires a more positive current account balances for its sustainability. (?)	Net international investment position (NIIP) in USD, divided by GDP in USD	Eurostat, IMF BoP, Lane and Milesi-Ferretti (2007)
NIIP exceeding -60% of GDP (lagged)	For a largely negative NIIP the sustainability argument prevails and requires a positive current account balance. (-)	Max(140,Min(NIIP/GDP+60,0)	Eurostat, IMF BoP, Lane and Milesi-Ferretti (2007)
VIX(capital openness) (lagged)*	Risk aversion in global financial markets is associated with higher national savings especially in countries with open capital accounts. (+)	Chicago VXO index demeaned by the average index since 1987, times capital openness index	CBOE (for VXO) and Chinn and Ito (2008) for capital controls
VIX(capital openness) * currency use in world reserves*	For countries with reserve currency status global risk aversion has a reduced impact on current accounts. (-)	Chicago VXO index demeaned by the average index since 1987, times capital openness index, times " Domestic currency % use in world FX reserves"	CBOE (for VXO), Chinn and Ito (2008) for capital controls, IMF COFER for reserve currency use
Annual real GDP growth expected 5 years ahead	Stronger medium-term growth expectations justify borrowing. (-)	For any year T, real annual GDP growth expected for T+5 in year T	IMF WEO, EIU
Public health expenditure / GDP (lagged)	Welfare protection justifies reduced precautionary savings. (-)	Public health expenditure in USD, divided by GDP	WHO public health expenditure. Pre-1995 data imputed with OECD public health expenditure, and Phillips et al. (2013).
Health exp. wrt. world av., interacted with old-age dep. ratio	Higher age-related expenditure reduces the room for reducing savings in the presence of welfare protection. (+)	Public health expenditure in USD, divided by GDP minus corresponding world average, times the outright old-age dependency ratio as defined above	WHO, OECD, and Phillips et al. (2013) for public health expenditure, UN population projections for demographic data
Structural fiscal balance, instrumented	Higher government savings is associated with higher current account balances ("twin deficits"). (+)	General government structural fiscal balance as % of GDP, where available. Otherwise the cyclically adjusted fiscal balance.	AMECO, IMF WEO, OECD, and Phillips et al. (2013)
*(FX reserve change)/GDP * capital closedness, instrumented*	Current account balances may partly reflect targeting of official reserve by monetary authorities, notably if capital openness does not offset the effect of open market operations by central banks (Reinhardt et al., 2010).	Aannual change of foreign exchange reserves as pp. of GDP times 1-capital openness index. Instruments used are the contemporaneous world average of the variable, its lag, the US T-bill rate times capital closedness, and domestic M2 growth times capital closedness	IMF IFS and Chinn and Ito (2008) for the instrumented variable, IMF IFS for US T-bills, IMF IFS and OECD for M2 growth
REER growth (over 3 years, lagged)	Recent REER changes affect the trade balance. (-)	Three-year percentage change in CPI-based trade weighted real effective exchange rate index vs 167 countries	Darvas (2013)
Construction investment / GDP (lagged)	Construction investment draws resources from tradable activities reducing the trade balance (Gete, 2014). (-)	Residential and non-residential construction investment as % of GDP	AMECO, OECD, UN, and own calculations following Inklaar and Yang (2012)
Change of private debt in pp. of GDP (over 3 years, lagged)	Financial development reduces borrowing constraints (e.g., Gruber and Kamin, 2009). (-)	Three-year change of the private debt stock (as defined above) as pp. of GDP	IMF IFS banking claims on the private sector (in local currency)
Private debt stock/GDP (demeaned by country historical average)		Contemporaneous debt stock divided by GDP in local currency, minus the country-specific arithmetic mean over 1987-2016	IMF IFS banking claims on the private sector (in local currency)
Output gap	Output above potential implies activation of higher imports than average over the cycle. (-)	Difference between actual and potential output/potential	AMECO, IMF WEO, OECD, and Kalman filter (with lambda=100)

All variables are defined as differences with respect to world average, except for variables reported in italics. Data sources are reported in the order of precedence for imputations. For instance, for the output gap, the European Commission DG ECFIN AMECO database is used as first source, and, if data are missing, IMF WEO data are used. If also these are not available, OECD data are used. In absence of OECD data, missing values are replaced by output gap constructed using a Kalman filter to estimate potential output.
CBOE refers to the Chicago Board Options Exchange, that produces the VXO index widely referred to as VIX index in the literature. WDI refers to World Development Indicators, BoP to Balance of Payment statistics.

Table A1.2: **Definition of indicators used for assessing prudential thresholds**

Indicator	Obs.	Construction	Data source
NIIP	1844	Reported net international investment position	IMF BoP, complemented by Lane and Milesi-Ferretti (2006)
Cumulated Net Lending excluding Net Errors and Omissions	1413	Cumulated net Lending/Borrowing position in U.S. dollars excluding net errors and omissions, as % of current GDP in U.S. dollars, since start of available sample.	IMF BoP, complemented by AMECO
NENDI	1844	Net marketable external debt (net portfolio debt, net other investment and reserves) plus net in mutual funds.	IMF BoP, complemented by Worldbank QEDS and Lane and Milesi-Ferretti (2006)
NIIP – FDI	1844	NIIP minus net direct investment (according to BPM5 definition)	IMF BoP, complemented by Lane and Milesi-Ferretti (2006)
Net debt	1844	Sum of net portfolio investment debt and other investment	IMF BoP, complemented by Lane and Milesi-Ferretti (2006)
Net short-term debt	449	Net short-term portfolio and other investment debt	IMF BoP, complemented by Worldbank QEDS and Lane and Milesi-Ferretti (2006)
Total liabilities	1829	Total liabilities from direct, portfolio, and other investment	IMF BoP, complemented by Worldbank QEDS and Lane and Milesi-Ferretti (2006)
Gross debt liabilities	1843	Gross portfolio and other investment debt liabilities	IMF BoP, complemented by Worldbank QEDS and Lane and Milesi-Ferretti (2006)
Short-term debt liabilities	681	Gross short-term portfolio and other investment debt liabilities	IMF BoP, complemented by Worldbank QEDS and Lane and Milesi-Ferretti (2006)
Total non-FDI liabilities	1833	Total liabilities from portfolio, and other investment	IMF BoP, complemented by Worldbank QEDS and Lane and Milesi-Ferretti (2006)
Reserves	1850	Non-gold foreign-exchange reserves	IMF BoP
External govt. debt liabilities	1049	Portfolio and other investment liabilities of the general government sector	IMF BoP, complemented by Worldbank QEDS
External bank debt liabilities	983	Portfolio and other investment liabilities of monetary financial institutions excl. central bank	IMF BoP, complemented by Worldbank QEDS
NIIP / relative per capita income	1803	NIIP divided by: PPP income per inhabitant aged 15-64, as % of the mean over DE, JP, US (see Phiips et al., 2013)	IMF BoP, complemented by Lane and Milesi-Ferretti (2006). For PPP: IMF WEO
NENDI/ relative per capita income	1802	NMED divided by: PPP income per inhabitant aged 15-64, as % of the mean over DE, JP, US (see Phiips et al., 2013)	IMF BoP, complemented by Lane and Milesi-Ferretti (2006). For PPP: IMF WEO
NIIP * Non-FDI liabilities / total liab.	1818	NIIP times the 'total non-FDI liabilitites' divided by the 'total liabilities' indicator from above	See above
NIIP / imports	1844	NIIP divided by the 5-year moving average of goods and services imports as % of aggregate demand	AMECO and Worldbank WDI; for NIIP see above
NIIP / Fraser economic freedom index	1811	NIIP divided by the Fraser institute's economic freedom index ranging between 1 (low) and 10 (high)	Fraser institute; For NIIP, see above
NIIP * (1-FXAGG)/2 (Bénétrix et al., 2017)	1215	NIIP times (1 – FXAGG)/2. Note that the FXAGG indicator ranges between -1 (external liabilities in domestic currency, and assets in foreign currency) and 1 (reverse)	Bénétrix, Lane and Shambaugh (2017) FXAGG indicator; For NIIP, see above

All variables except relative per-capita income, the Fraser indicator of economic freedom, the VIX index and the FXAGG indicator are expressed as % of GDP.
'Obs.' denotes the overall number of indicator observations for each indicator that are available that are available for the external crises sample 1980-2015 of 64 countries detailed in Table A1.1 in the Web Appendix.
Data sources: IMF BoP denotes the IMF Balance of Payments statistics. Data in Lane and Milesi-Ferretti (2006) are updated to 2017 (update available on the paper's website). Worldbank QEDS denotes the institution's Quarterly External Debt Statistics. IMF WEO denotes the World Economic Outlook database. CBOE denotes the Chicago Boards Options Exchange, that publishes the VIX indicator (now called VXO index by the CBOE). Worldbank WDI denotes World Development Indicators.

ANNEX 2
Computing NIIP norms

A2.1. COMPUTING NIIP NORMS

Table 2.1 in the paper reports the current account regression results from Coutinho et al. (2018). In general, the sign and magnitude of the estimated coefficients correspond to those found in previous studies. The regression is able to explain more than 60 % of the variance of the dependent variable despite the omission of country fixed effects and a lagged dependent variable.

Fundamentals behave as expected. The response of the current account to an increase in relative income depends on the degree of capital account openness, tending to be insignificant for relatively closed countries. The effect also varies with the economy's aging speed, that is, richer countries that age faster also save more in net terms than poorer countries aging at the same speed. The oil and gas balance in resource rich countries and the share of value added in manufacturing, improve the current account balance. Conversely, old-age dependency, population growth and the share of mining products in total exports impact negatively on the current account (although the latter variable has limited significance). The reserve currency status allows to soften external balance constraints and is associated with lower current account balances, as expected. At the opposite, the financial centre dummy has positive sign, indicating that countries that are particularly attractive for corporate offshoring operations tend to exhibit more positive balances for the current account. Temporary and policy-related factors have the expected sign and are statistically significant.

Current account norms are obtained as the predicted current accounts on the basis of fundamentals only. Algebraically, the norm is thus defined as the sum of contributions from fundamentals, with the required adjustment in the constant term to purge it from the influence of non-fundamental drivers. Obtaining the NIIP benchmark by cumulating flow 'norms' for the current account reflects the notion that current account balances account for the bulk of annual NIIP changes. However, more precisely NIIP changes are obtained as follows:

$$\Delta NIIP_t = NIIP_t - \frac{1}{1+g_t} NIIP_{t-1} = CA_t + KA_t + VE_t + NEO_t \qquad \text{(A2.1)}$$

where $\Delta NIIP_t$ is the change in the NIIP *as a share of GDP in year t*, CA_t, is the current account, KA_t is the capital account, and VE_t are valuation effects, NEO_t is net errors and omissions, all expressed as share of year *t* GDP. g_t is the growth rate of nominal GDP between year *t*-1 and *t*.

To assess if the other components that determine NIIP dynamics matter, alternative regressions have been estimated using the net lending of the economy (i.e., the sum of the current and the capital account), and the change in NIIP (all as a share of current GDP), as alternative dependent variables. Results are displayed in Table 2.1 in the paper and indicate that:

*Taking into account the capital account balance for estimation does not lead to any significant change in current account norm estimates***.** Since capital account balances are usually small and volatile, taking them into account for the 'norms' estimation should at most marginally alter the results. In its third column, the Table displays the coefficients obtained when net lending

(CA_t+KA_t) is used as a dependent variable. The coefficients of either model are not significantly different from each other and, consequently, neither are the estimated NIIP norms.

The incorporation of valuation effects in the dependent variable implies a loss in the precision of estimated coefficients, with regression coefficients for the fundamentals that are qualitatively similar to those estimated using the current account as dependent variable. Valuation effects are generally found to have high variance, little autocorrelation, and an unconditional expected value of zero for most countries. Consistently, replacing current account balances by NIIP changes ($\Delta NIIP_t$) yields only negligible changes to the estimated coefficients while adding noise thereby inducing a considerable loss in efficiency resulting in imprecisely estimated coefficients. It also turns out that a regression using valuation effects as the dependent variable has very little explanatory power.

*The corporate financial centre status variable behaves differently when the dependent variable in the change in NIIP***.** Using the current account as a dependent variable the corporate financial centre status has a significantly positive impact while it is insignificant when the NIIP change is used as dependent variable, this being the only coefficient that is significantly different from the baseline model at the 1% level. The explanation is that valuation effects in financial centres tend to offset the positive financial centre impact on current accounts, which is possibly linked to factors such as the statistical treatment of reinvested earnings on portfolio investment. Graph A2.1 plots the estimated norms using the current account as dependent variable on those obtained using the change in NIIP. The scatterplot shows that the choice of the dependent variable would imply qualitative differences in the estimated NIIP norms only for countries with a corporate financial centre status.

On the basis of the above findings, the current account/GDP variable is kept as the dependent variable for the estimation of the fundamentals to estimate NIIP norms, but the *corporate financial centre status*, which compares among the explanatory dummies for current accounts in light of its high explanatory power, is *not included among the fundamentals* for the estimation of NIIP norms.

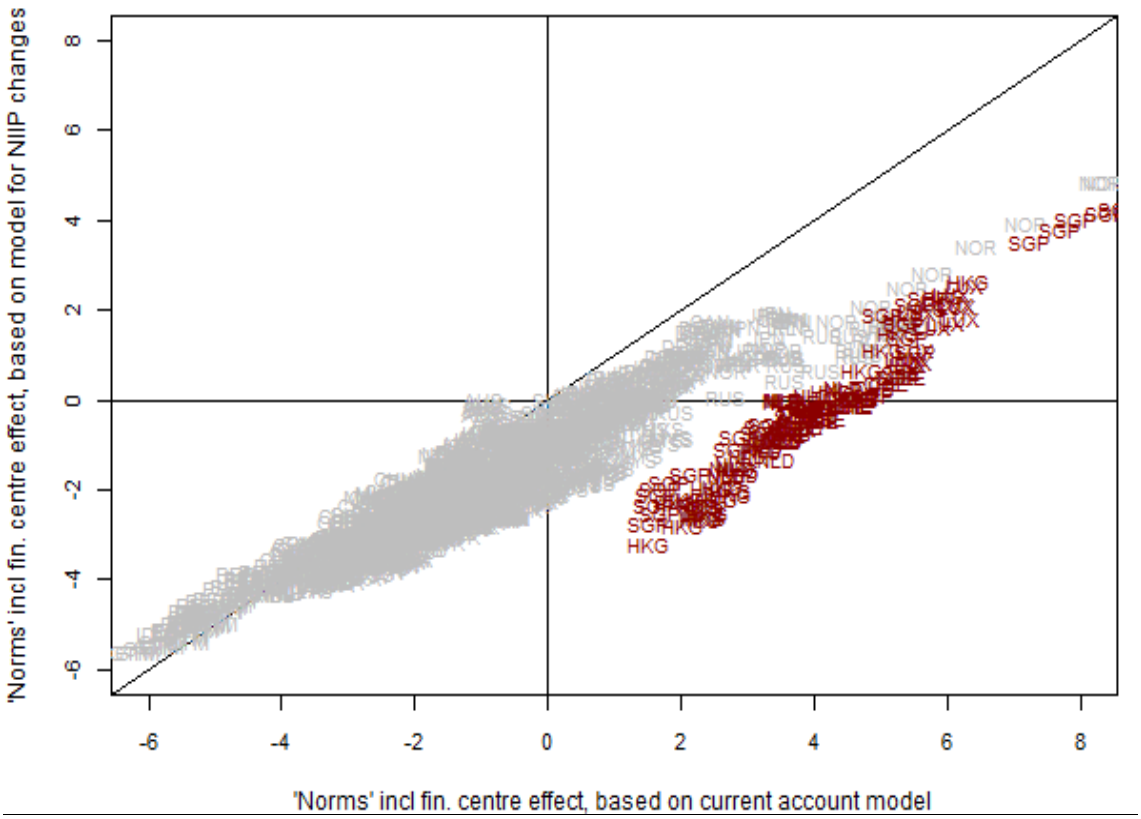
The cumulation of current account norms to obtain NIIP norms should ideally start from an NIIP level that can be considered broadly in line with fundamentals. In this respect, the first available year for NIIP series, namely 1987, may not be considered an ideal starting point. Actual NIIPs reflect the cumulation of past current account *balances* while NIIP norms reflect the cumulation of previous current account *norms*. and since current account norms tend to display on average lower absolute values as compared with actual current account balances, the identification of an appropriate starting point for the cumulation of NIIPs could be based on the minimisation of the average absolute value of NIIP/GDP ratios across the sample.

Graph A2.2 indicates that, across the sample for which current account norms are available, NIIP median and average NIIP absolute values were at their lowest level in correspondence with the mid-1990s. To improve comparability of NIIP norms, the starting point for cumulating norms should be the same for all countries, or sufficiently close. For this reason, and with a view to obtain a balanced dataset of NIIP starting from 1995 for all countries the cumulation of current account norms starts from 1995. Since for some countries data for the NIIP are not available in 1994 and since all countries have NIIP data for 1997, the starting NIIP

value is the one corresponding to the year where the NIIP exhibits the lowest absolute value for each country within the 1993-96 period.([27])

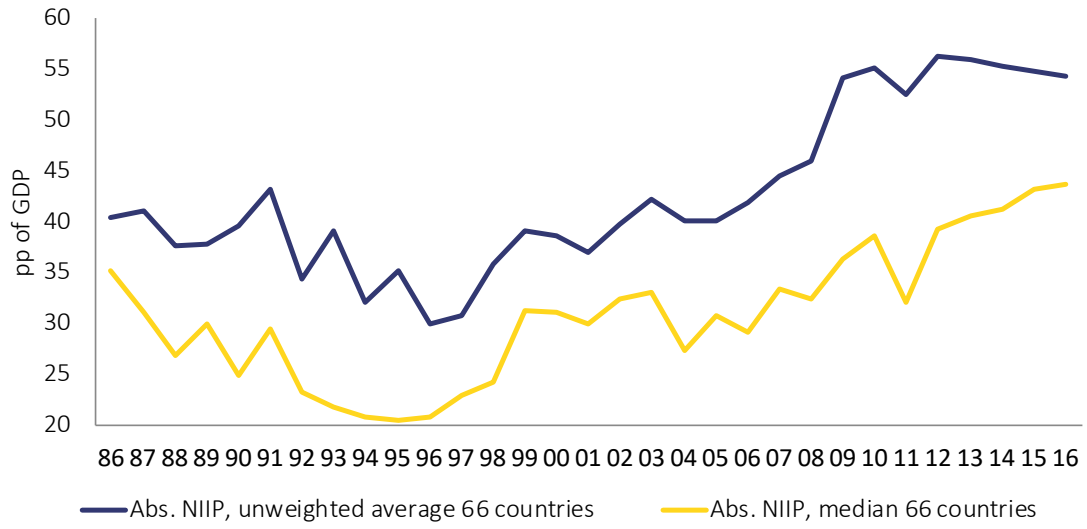
The choice of the starting NIIP is however not fundamentally affecting the value of NIIP norms, for the basic reason that the fraction of the NIIP norm explained by the cumulation of current accounts largely outweighs that associated with the initial NIIP. Graph A2.3 shows that choosing alternative initial NIIP stocks would impact the 2016 benchmark levels by less than 15 percentage points for all countries but a few financial centres.

Graph A2.1: **Current account norms vs corresponding norms estimated on NIIP changes**



(27) NIIP norms are not computed for Serbia, as initial NIIP data for the 1993-1996 period are missing.

Graph A2.2: **NIIP cross-country average values, evolution**



Graph A2.3: **Distribution of estimated NIIP norms arising from different starting values**

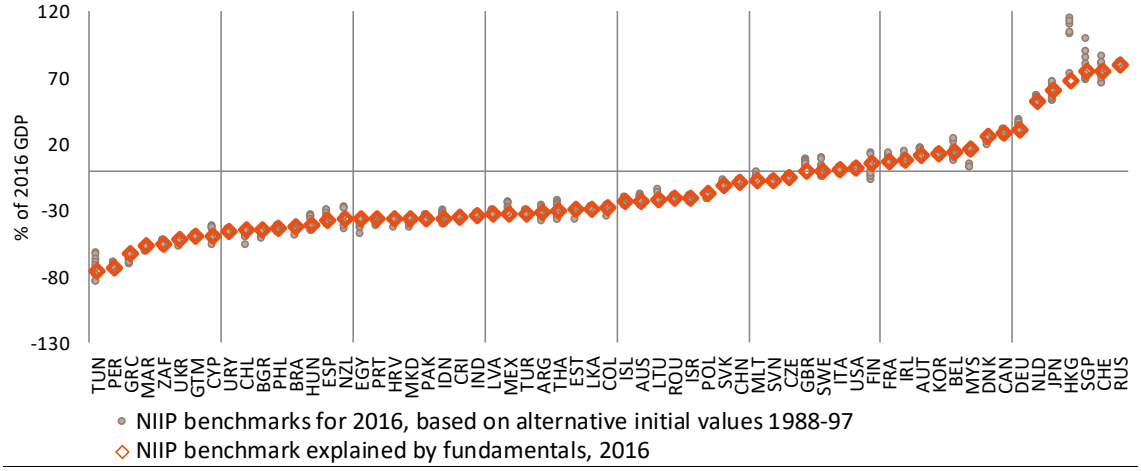


Table A2.1: **Sample coverage**

Country	Code	Current account norms sample	NIIP threshold sample	Country	Code	Current account norms sample	NIIP threshold sample
Argentina	ARG	1987-2016	1980-2015	Japan	JPN	1987-2016	1980-2015
Australia	AUS	1987-2016	1981-2015	Korea, Republic	KOR	1987-2016	1980-2015
Austria	AUT	1987-2016	1980-2015	Sri Lanka	LKA	1987-2016	1980-2015
Belgium	BEL	1990-2016	1980-2015	Lithuania	LTU	2000-2016	1994-2015
Bulgaria	BGR	2002-2016	1992-2015	Luxembourg	LUX	2000-2016	
Brazil	BRA	1991-2016	1981-2015	Latvia	LVA	2002-2016	1993-2015
Canada	CAN	1987-2016	1980-2015	Morocco	MAR	1996-2016	1980-2015
Switzerland	CHE	1987-2016	1980-2015	Mexico	MEX	1991-2016	1980-2015
Chile	CHL	1991-2016	1980-2015	Macedonia, FYR	MKD		1995-2015
China	CHN	1987-2016	1992-2015	Malta	MLT	2004-2016	1990-2015
Colombia	COL	1991-2016	1980-2015	Malaysia	MYS	1987-2016	1980-2015
Costa Rica	CRI	1991-2016	1981-2015	Netherlands	NLD	1987-2016	1980-2015
Cyprus	CYP	1998-2016	1991-2015	Norway	NOR	1987-2016	1980-2015
Czech Republic	CZE	1997-2016	1994-2015	New Zealand	NZL	1992-2016	1981-2015
Germany	DEU	1992-2016	1981-2015	Pakistan	PAK	1996-2016	1980-2015
Denmark	DNK	1990-2016	1980-2015	Peru	PER	1991-2016	1980-2015
Egypt	EGY	1987-2016	1980-2015	Philippines	PHL	1989-2016	1980-2015
Spain	ESP	1987-2016	1980-2015	Poland	POL	1995-2016	1992-2015
Estonia	EST	1997-2016	1994-2015	Portugal	PRT	1987-2016	1980-2015
Finland	FIN	1987-2016	1980-2015	Romania	ROU	2000-2016	1992-2015
France	FRA	1987-2016	1980-2015	Russia	RUS	1997-2016	1992-2015
United Kingdom	GBR	1987-2016	1980-2015	Singapore	SGP	1999-2016	1980-2015
Greece	GRC	1988-2016	1980-2015	Serbia	SRB	2006-2016	2000-2015
Guatemala	GTM	2000-2016	1980-2015	Slovakia	SVK	1997-2016	1992-2015
Hong Kong	HKG	1994-2009		Slovenia	SVN	1997-2016	1987-2015
Croatia	HRV	2004-2016	1997-2015	Sweden	SWE	1987-2016	1980-2015
Hungary	HUN	1992-2016	1992-2015	Thailand	THA	1991-2016	1980-2015
Indonesia	IDN	1996-2016	1980-2015	Tunisia	TUN	1996-2016	1980-2015
India	IND	1988-2016	1980-2015	Turkey	TUR	1987-2016	1980-2015
Ireland	IRL	1990-2016	1980-2015	Ukraine	UKR	2003-2016	1995-2015
Iceland	ISL	1993-2016	1981-2015	Uruguay	URY	1991-2016	1980-2015
Israel	ISR	1996-2016	1980-2015	United States	USA	1987-2016	1980-2015
Italy	ITA	1989-2016	1980-2015	South Africa	ZAF	1987-2016	1980-2015

Table A2.2: **Current account regression, alternative specifications and estimation methods**

		(1)	(2)	(3)
		Baseline	**Baseline, time fixed effects**	**Baseline, GLS**
Fundamentals	Constant	-0.392 **		-0.751 **
	Income per person aged 15-64 in PPP	0.034 ***	0.024 **	0.041 ***
	Income per person interacted with capital openness	0.033 *	0.038 **	0.021
	Ageing speed	-0.025	0.027	0.021
	Ageing speed wrt. world * income per capita (PPP) as % of G3 mean	0.164 **	0.109 *	0.152 *
	Old-age dependency ratio	-0.047 *	-0.034	-0.051
	Population growth HP-filtered (lagged)	-0.576 **	-0.416 *	-0.58
	Share of manufacturing in value added, instrumented	0.234 ***	0.218 **	0.211 ***
	Oil & gas balance / GDP 5Y-mov.av., if positive	0.427 ***	0.46 ***	0.363 ***
	Mining products exports as % of total exports (lagged)	0.002	-0.006	0.019
	Domestic currency % use in world FX reserves	-0.041 ***	-0.046 ***	-0.017
	Financial centre dummy	0.016 ***	0.018 ***	0.038 ***
Non-fundamentals	NIIP / GDP (lagged, in USD terms)	0.032 ***	0.031 ***	0.018 ***
	NIIP exceeding -60% of GDP (lagged)	-0.03 **	-0.027 **	-0.014
	VIX*(capital account openness) (lagged)	0.084 ***	-0.046	0.087 ***
	VIX *(capital account openness) * reserve currency status	-0.21 *	-0.118	-0.195 *
	FX reserve change / GDP interacted with capital closedness, instr.	0.338 **	0.314 *	0.146
	Annual real GDP growth expected 5 years ahead	-0.31 ***	-0.377 ***	-0.28 **
	Public health expenditure / GDP (lagged)	-1.739 ***	-1.762 ***	-1.837 ***
	Health exp. wrt. world av., interacted with old-age dep. ratio	4.773 ***	4.808 ***	5.205 ***
	Structural fiscal balance	0.272 ***	0.286 ***	0.1 **
	Change of private debt in pp. of GDP (over 3 years, lagged)	-0.059 ***	-0.056 ***	0.001
	Private debt stock/GDP (demeaned by country historical average)	-0.011	-0.018 **	-0.051 ***
	Construction investment / GDP (lagged)	-0.099 ***	-0.084 ***	-0.076
	REER growth (over 3 years, lagged)	-0.086 ***	-0.082 ***	-0.051 ***
	Output gap / potential GDP	-0.385 ***	-0.377 ***	-0.432 ***
	Time fixed effects		YES	
	R^2	0.64	0.65	0.6
	Adjusted R^2	0.64	0.65	0.6
	RMSE	3.42	3.35	3.59
	Number of observations	1589	1589	1589
	Durbin-Watson stat (headline)	0.64	0.63	0.52
	Durbin-Watson stat (AR1-adjusted)			1.62
	Coefficient volatility	0.06	0.09	0.05
	P-value joint FE significance		0.001	
	GLS autocorrelation parameter (rho)			0.677

ANNEX 3
Computed NIIP benchmarks

Table A3.1: **NIIP/GDP, NIIP benchmarks, additional relevant data, 2016**

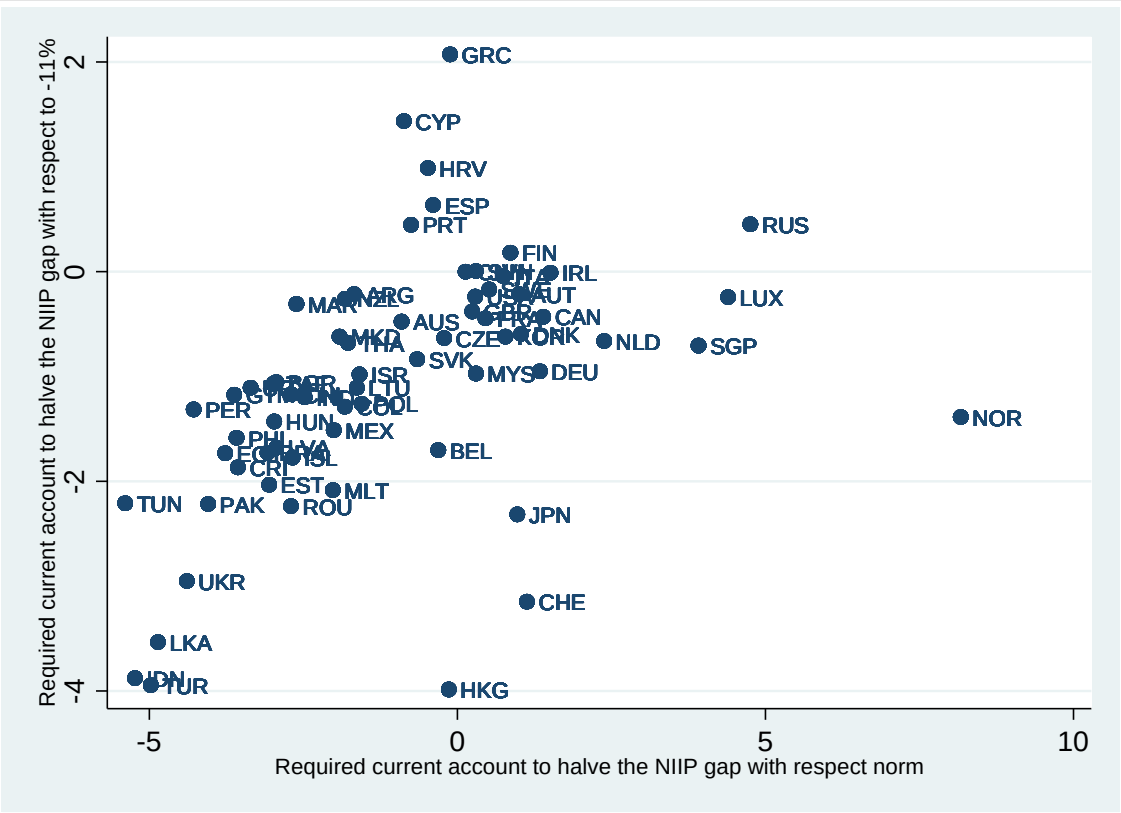
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	NIIP 2016, % of GDP	NENDI 2016, % of GDP	Relative income per capita (%)	NIIP norm	Prudential NIIP threshold	Prudential NENDI threshold	Year of initial NIIP for NIIP norm	Incidence of initial NIIP
ARG	9.5	12.5	41.3	-31.2	-34.3	-32.2	1993	-1.9
AUS	-59.5	-47	99.1	-22.7	-82.2	-77.3	1994	-14.2
AUT	5.3	-8.8	95.4	11.3	-79.2	-74.4	1993	-3.3
BEL	48.8	57.7	93.4	13.7	-77.5	-72.8	1993	6.8
BGR	-49.3	27	40.7	-44.2	-33.8	-31.8	1995	-6.1
BRA	-34.1	0.5	29.3	-42.5	-24.3	-22.9	1995	-4.8
CAN	8.4	-46.1	91.7	28.4	-76.1	-71.5	1996	-14.6
CHE	126.7	112.5	118	75.5	-98	-92.1	1995	35.5
CHL	-17.6	-0.1	46.3	-44.9	-38.5	-36.1	1996	-3.7
CHN	15.8	33.6	28.5	-8.5	-23.7	-22.2	1993	-0.3
CRI	-49.4	3.9	30.7	-34.4	-25.5	-24	1996	-3.4
COL	-49.5	-6	28.3	-27.4	-23.5	-22.1	1994	-5.4
CYP	-121.8	-137.9	64.9	-49.3	-53.9	-50.6	1993	-7.4
CZE	-25.8	27.6	66.6	-4.5	-55.3	-51.9	1995	0.9
DEU	51.8	40.3	98	30.5	-81.3	-76.4	1996	2.6
DNK	57.4	16.5	97.1	25.6	-80.6	-75.7	1996	-12.1
EGY	-30.7	0	25.5	-36.7	-21.2	-19.9	1996	-1.1
ESP	-79.9	-62.1	73.5	-36.9	-61	-57.3	1995	-9.1
EST	-35.4	19.8	60.2	-29.2	-50	-47	1993	0.2
FIN	-2.2	6.9	88.8	6.1	-73.7	-69.3	1995	-17.4
FRA	-15	-32.2	89.7	7.2	-74.4	-69.9	1994	-1
GBR	-1.2	19.2	88.2	-0.4	-73.2	-68.8	1995	-0.9
GRC	-132.8	-128.4	55	-62.4	-45.6	-42.9	1996	-3.5
GTM	-22.4	-2.6	18.9	-49.4	-15.6	-14.7	1993	-2.2
HKG	288.3	237.5	106.5	67.9	-88.4	-83.1	1996	27.1
HRV	-73.8	-25.7	45.1	-36.5	-37.4	-35.2	1996	-1.7
HUN	-67.8	-11.5	53.9	-40.4	-44.7	-42	1993	-19
IDN	-35.5	-5.9	23.3	-35.5	-19.3	-18.1	1993	-10.1
IND	-16.1	-3.1	13.3	-33.3	-11.1	-10.4	1996	-3
IRL	-167.9	-239.3	140.8	7.7	-116.9	-109.8	1994	-4.1
ISL	1.4	-39.9	97.1	-23	-80.6	-75.8	1996	-15.3
ISR	35	43.9	75.9	-20.9	-63	-59.2	1996	-6.6
ITA	-9.3	-14.7	75.4	1.4	-62.6	-58.8	1996	-1.6

Table A3.2: **Continuation of table A3.1**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	NIIP 2016, % of GDP	NENDI 2016, % of GDP	Relative income per capita (%)	NIIP norm	Prudential NIIP threshold	Prudential NENDI threshold	Year of initial NIIP for NIIP norm	Incidence of initial NIIP
JPN	63.2	45.6	85.9	60.4	-71.3	-67	1994	14.2
KOR	19.8	27.5	69.6	12.9	-57.7	-54.3	1993	-2.2
LKA	-54.7	-44.6	22.6	-28.6	-18.8	-17.7	1996	-6.2
LTU	-41.2	-15.5	57.9	-21.5	-48.1	-45.2	1993	0.1
LUX	33.1	-3535	199.2	117.2	-165.4	-155.4	1994	56.7
LVA	-56.1	-8.6	52.2	-32.6	-43.3	-40.7	1995	-0.2
MAR	-63.1	-15.8	16.7	-56.5	-13.8	-13	1996	-13.4
MEX	-43.5	-3.1	38	-32.5	-31.5	-29.6	1993	-16.6
MKD	-56	-14.6	27.4	-36.2	-22.8	-21.4	1994	-3.2
MLT	45.4	215.7	74.3	-7.9	-61.7	-58	1996	6.5
MYS	5.2	5.6	52.4	16.6	-43.5	-40.9	1994	-1.8
NLD	65.8	-16.6	104.4	52.3	-86.6	-81.4	1996	3
NOR	194.9	41.2	142.2	201.3	-118	-110.9	1994	0.3
NZL	-61.2	-45.5	75.9	-36.7	-63	-59.2	1996	-23.4
PAK	-30.7	-15.3	10.8	-36.2	-8.9	-8.4	1993	-8.5
PER	-41.7	0.7	26.4	-73	-21.9	-20.6	1995	-13.3
PHL	-9	10.7	16.3	-43.4	-13.5	-12.7	1996	-9.8
POL	-64.3	-22.9	53.5	-17.4	-44.4	-41.7	1995	-4.3
PRT	-99.8	-65.7	57.4	-36.7	-47.6	-44.8	1993	-4.2
ROU	-52.9	-8.2	43	-21	-35.7	-33.5	1995	-0.2
RUS	17.5	26.2	49.7	79.7	-41.3	-38.8	1996	0.4
SGP	214.2	238.2	158.3	74.6	-131.4	-123.5	1993	8.5
SVK	-59.5	-13.1	58.7	-10.4	-48.7	-45.8	1996	0.5
SVN	-35.2	-21	63.4	-7.6	-52.6	-49.4	1993	0.7
SWE	11.9	-6.9	106	0	-88	-82.7	1996	-15.4
THA	-8.6	37.5	31.1	-30.1	-25.8	-24.2	1995	-12.1
TUN	-119.3	-50.8	22.4	-75.5	-18.6	-17.5	1996	-39.3
TUR	-48.6	-37.9	41.7	-32	-34.6	-32.5	1993	-6
UKR	-43.7	8.3	15.7	-52.2	-13	-12.3	1996	-9.3
URY	-29.4	13.9	44.6	-46.2	-37	-34.8	1993	-5.2
USA	-44.8	-48.1	116.1	2.1	-96.4	-90.5	1994	-0.6
ZAF	8	-10	27	-55.6	-22.4	-21	1993	-7

Notes: Column (1) reports the NIIP/GDP ratio of 2016 (data as of December 2017). Column (2) shows net marketable external debt (NENDI) as % of GDP 2016, which is defined as NIIP less net direct investment and portfolio equity shares. As a memorandum item, column (3) displays relative income (in PPP) per working-age inhabitant in 2016, with respect to the arithmetic average of DE, JP, and US (see Phillips et. al., 2013). Column (4) shows the NIIP norm. Column (5) shows the NIIP prudential threshold. Column (6) displays the country-specific NENDI threshold. Column 9 displays the year from which the initial NIIP for the cumulation was selected, and Column (7) shows the contribution of this initial NIIP to the fundamental NIIP level for 2016.

Graph A3.1: **Required current account to reach NIIP norm vs. required current account to reach a common -10% NIIP target. 65 advanced and emerging economies, country-specific averages over available time periods**



The required current account is computed as the current account that needs to be sustained over 10 years to halve the distance between the current NIIP/GDP ratio and a target NIIP ratio (alternatively, the country-specific norm and the common -10% target, broadly equal to the sample mean of NIIP norms). Required current accounts represent the average % of GDP ratio over that period, and are computed based on 10-year European Commission forecasts for nominal GDP growth. For non-EU countries the nominal GDP projection is based on IMF WEO, assuming that five-year ahead growth rate to remain stable for another five years. In addition, the capital account balance (a minor item for most countries, but important for a few EU countries) is assumed to remain stable at the median over the last three available annual observations. Finally, IIP valuation effects are assumed to net out to zero. With given values for the capital account balance and nominal growth, the required current account then obtains straightforwardly from any given NIIP target value.

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