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Does Demographic Change Affect the Current Account? A Reconsideration [#]

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This paper re-examines the impact of demographic factors on the current account balance. To this end, we develop an analytical framework that is more general than the one commonly used in the literature in three aspects. First, it accounts for the facts that the world current account balance must be equal to zero. Second, a bigger economy will have greater impacts on others, but be influenced less by them. Third, a more open economy will have greater impacts on others and at the same time be more readily influenced by them. We then confront two alternative empirical specifications based on both the new and the conventional framework with a panel of data. In contrast to the findings based on the conventional framework, our results with the new framework indicate that population ageing does not appear to have discernible impacts on the current account balance.

Key words: Demography, ageing, openness, current account, general equilibrium

JEL Classification: F30, J10

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Abstract

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1. INTRODUCTION

Motivated by the observation that advanced economies are ageing rapidly and emerging economies are following soon, there has been increasing interest in the macroeconomic effects of ageing.[1] One recurrent topic of interest in the literature is the impacts of ageing, and demography in general, on the current account balance.[2] According to the life cycle hypothesis of consumption, young households borrow against their future income, middle-age households save for relinquishing debts and retirement, and old-aged households dissave. Accordingly, countries with a relative young or old population are more likely to run current account deficits (more on this later).

The focus of this paper is on how to model demographic impacts on the current account balance in a world of heterogeneous economic openness and sizes. The hitherto standard practice of accounting for these heterogeneities is to include measures of openness in the regressions and to normalise the current account balance with Gross Domestic Product (GDP), respectively. We show in this paper, first, that in a general equilibrium setting this practice is insufficient and second, that the problem can be addressed by using a new framework.

Where cross-country (including panel) data are used – as is typically the case in the related literature – three factors need to be considered in modelling the demographic impacts on the current account balance. The first factor is the general equilibrium condition. Since the current account balances must sum to zero for the world as a whole, demographic changes that affect the home country's balance must affect the rest of the world's (ROW's) balance in the opposite direction; conversely, demographic changes in the ROW must also affect the home country. This implies that it is not the home country's own pace of demographic changes that matters, but its pace relative to the ROW (Chinn and Prasad 2003). The second factor is country size. Other things being equal, the larger the home country is, the more influence it should have on others, while at the same time it should be less susceptible to external disturbances. The last factor is openness. For a given size, a more open economy should have a more pronounced impact on others and simultaneously be more readily influenced by the ROW.

Without due consideration of these three factors taken together, any empirical estimation of the effects of demography on the current account balance is likely to be biased in various ways, de-

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[1] Some important earlier works include Higgins and Williamson (1997) and Higgins (1998). Also see Edwards (1996) and Li, Zhang and Zhang (2007).
[2] Recent examples include Chinn and Prasad (2003), Chinn and Ito (2007), Gruber and Kamin (2007) and Legg, Prasad and Robinson (2007).

pending on the distributions of demographic measures, openness and sizes in the sample. To the best of our knowledge, this is the first study that pertains to this structural issue in the related empirical literature.

To illustrate our argument, we estimate the impacts of demographic change on the current account balance using both the conventional and our proposed new framework, which allows us to compare and contrast the results.

Our panel dataset comprises 84 countries and 47 years from 1960 to 2006. Based on our data and methods, we find that the effect of population ageing on the current account balance is much more subdued than what has been recorded in previous studies based on the conventional framework.

The rest of the paper is organised as follows. Section 2 reviews the related literature. Section 3 derives the new modelling framework. Section 4 describes the data used for our empirical analyses. Section 5 presents and discusses the results, and the final section concludes.

2. LITERATURE REVIEW

National account identities dictate that the current account balance is equal to the excess of national savings $(T - G + S)$ over domestic investment (I) or the excess of output (Y) over domestic absorption $(C + I + G)$:

$$CA = (T - G) + S - I = Y - (C + I + G) \quad (1)$$

where CA, T, G, S and C represent, respectively, the current account balance, tax revenue, government expenditure, private saving and private consumption.

It is on the basis of this identity that demography is hypothesised to influence the current account balance. According to Modigliani's (1970) life cycle hypothesis, households at working age are the prime net savers of societies, while young households are likely to be borrowers and old-age ones are likely to be dissavers. Therefore, countries with a relative young or old population are more likely to consume more than what they produce, resulting in a current account deficit. While the majority of the literature adopts this hypothesis and thus expects youth and old-age dependency[3] to have negative impacts on the current account balance, this is not the full story.

Often missing in the discussion is the investment aspect. Since the current account balance is equal to excess saving over investment, demography can only influence the current account balance to the extent that its respective effects on saving and investment do not net out each other. In

[3] Here, youth and old-age dependency are defined as population aged 0-14 and 65+ to population aged 15-64.

this aspect, youth and old-age dependency could have opposite effects on the current account balance. This is because countries with a young population will see their labour force growing in the future, making long-term capital investment more attractive there than in countries with an aging population (Cooper 2008).

Another missing piece is longevity. Population ageing is characterised not only by rising old-age dependency but also by rising longevity,[4] yet the theoretical impacts of the two on saving are different. As people expect to live longer, they are induced to save more, counterbalancing the impacts of higher old-age dependency (Li, Zhang and Zhang 2007).

National account identities also necessitate a country's current account balance to be equal to its receipts from the ROW for goods, services, investment income, and unilateral transfers minus its payment to the ROW. Thus, a current account surplus (deficit) represents a net outflow (inflow) of capital. As such, the effects of demography on the current account balance must be casted in the light of open economies.

Clearly, these considerations reflect the three factors discussed in the introduction, namely general equilibrium, size, and openness, and we shall considers these factors simultaneously in our modelling of the current account balances within the world economy.

The paper is related to a strand of the literature on the macroeconomic impacts of population ageing. Within this literature, Higgins and Williamson (1997) and Higgins (1998) find that countries with relatively young populations are capital importers, whereas those with relatively old populations are capital exporters. Amongst these two studies, only Higgins (1998) controls for openness. He finds that demography does not affect the balance of trade in economies classified as closed based on the Sachs and Warner (1995) binary measure of openness. Our study differs from these two studies in that we take into consideration relative rather than absolute demography shifts across countries, as well as the heterogeneity of countries in terms of openness and relative economic size.

In recent years, some studies examining the macroeconomic effects of demography also incorporate the condition that external balances must sum up to zero for the world economy as a whole. These include Feroli (2003), Domeij and Flodén (2006), and Attanasio, Kitao, and Violante (2006). However, these studies use numerical simulations as their main investigation tool, in contrast to the empirical parameter estimation by regression analyses in the current paper.

Another strand of related studies seeks to explain current account imbalances; e.g. Chinn and Prasad (2003), Chinn and Ito (2007), Gruber and Kamin (2007), and Legg, Prasad and Robin-

[4] Another aspect of population ageing is a falling fertility rate. However, in the short to medium term, a falling fertility rate means a lower youth dependency rate, but not a rising old-age dependency.

son (2007). The last two mentioned above emphasise the effect of the Asian financial crisis as a catalyst of the Asian economies' compulsion to build up large foreign reserves, known as the global saving glut hypothesis. Kim and Lee (2007), running a VAR, find that for ten East Asian countries from 1981-2003, the dependency ratio has a significantly negative effect on the current account balance, thus providing evidence that the effects of the present demographic transition are no longer restricted to the wealthiest economies.

While these studies differ vastly in terms of sample coverage and econometric approaches, in general, it is fair to summarise that they find that demography matters and that a higher dependency ratio tends to result in a smaller current account balance. In what follows, we shall challenge this finding.

Importantly, the existing body of literature indicates that cross-country or panel data are more instrumental than individual country time series data in identifying demographic effects on saving, because the variation of demographic variables is typically more pronounced across countries than across time (Masson, Bayoumi and Samiei 1998). For this reason, our analyses draw on a large panel data set rather than on a cross section of countries or on longitudinal data for particular countries.

Another difference between the current paper and the previous literature is that we estimate both static and dynamics models. Higgins (1998) and Gruber and Kamin (2007), for instance, do not account for the strong persistence of the dependent variables in their econometric models and their results are thus subject to severe omitted variable bias.[5] Higgins and Williamson (1997) and Legg, Prasad and Robinson (2007) do take into account the dynamic nature of the data, but use different estimation techniques. In particular, Higgins and Williamson use a two-stage-least-square estimator, while Legg, Prasad and Robinson use a variant of dynamic panel data estimation from Anderson-Hsiao (1981). For the dynamic modelling, our empirical methods also include the generalised methods of moments (GMM) estimators proposed by Arellano and Bover (1995) and Blundell and Bond (1998).

3. THE NEW MODELING FRAMEWORK

Consider the following general expression of the current account balance:

$$CA_i = l(\mathbf{X}_i, q_i), \qquad (2)$$

[5] Although Higgins (1998) uses 5-year averages to try to smooth out short run volatility, this does not necessary remove the autocorrelation of the data.

where CA_i is defined as the current account balance as a share of GDP in country *i*; q_i is a scalar measure of economic openness (1 for fully open, 0 for completely closed); and $\mathbf{X}_i$ is a vector of domestic factors in the home country that are expected to affect its current account balance.

In what follows, we modify this general framework to take into account of, one at a time, general equilibrium, openness and size as discussed previously.

Firstly, the general equilibrium condition implies that, if a domestic factor affects the home country's current account balance, it must affect the balance for the ROW in the opposite direction. As such, it is the change in country i relative to that in the ROW that matters in determining its current account balance. To accommodate this, we modify (2) into

$$CA_i = l\,(\mathbf{X}_i - \mathbf{RWX}_i, q_i), \qquad (3)$$

where $\mathbf{RWX}_i$ measures the value of the same variables as in $\mathbf{X}_i$, but for the rest of the world (ROW):[6]

$$\mathbf{RWX}_i \equiv average\{\mathbf{X}_j, j \neq i\}. \qquad (4)$$

Assuming $\mathbf{X}_i$ and $\mathbf{RWX}_i$ enter $l\,(.,.)$ additively is reasonable, when the arguments are expressed either in percentage terms or as log term values.

Secondly, the impact of $(\mathbf{X}_i - \mathbf{RWX}_i)$ on the home country's current account balance should be conditional on its openness. In particular, the less open its economy is, the less susceptible its current account balance to both internal and external disturbances should be; for a completely closed economy, the current account balance must be equal to zero for any values of $(\mathbf{X}_i - \mathbf{RWX}_i)$. This implies that (3) can be written as

$$CA_i = q_i\, f\,(\mathbf{X}_i - \mathbf{RWX}_i), \qquad (5)$$

where $\mathbf{RWX}_i$ is defined as in (4).

This specification, however, still neglects another aspect of openness. Not only has a country to be open to be influenced by others, but also that other countries have to be open to be able to exert their influence. To account for this, we replace the unweighted averaging function in (4) with an openness-weighted averaging function:

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[6] This is the specification in Chinn and Prasad (2003). However, we found that for our dataset $\mathbf{X}_i$ and $(\mathbf{X}_i - \mathbf{RWX}_i)$ as specified in (4) are correlated close to unity, meaning that just accounting for the general equilibrium condition alone would make little practical differences to not considering it at all.

$$\mathbf{RWX}_i \equiv \sum_{j \neq i} \theta_j \mathbf{X}_j \Big/ \sum_{j \neq i} \theta_j . \tag{6}$$

Assuming $f(.)$ is a linear function of its arguments, the corresponding regression model of (5) is

$$CA_i = \alpha_0 + \theta_i(\mathbf{X}_i - \mathbf{RWX}_i)'\boldsymbol{\alpha}_1 + \varepsilon_i , \tag{7}$$

where ε_i is the error term.

Thirdly, for the same degree of openness, a larger economy will have a more pronounced influence on others, but be less affected by others at the same time. To account for this size factor, we need to modify both (6) and (7) as follows:

$$CA_i = \alpha_0 + \theta_i Z_i(\mathbf{X}_i - \mathbf{RWX}_i)'\boldsymbol{\alpha}_1 + \varepsilon_i \tag{8}$$

$$\mathbf{RWX}_i \equiv \sum_{j \neq i} \theta_j GDP_j \mathbf{X}_j \Big/ \sum_{j \neq i} \theta_j GDP_j \tag{9}$$

$$Z_i \equiv \frac{\sum_j \theta_j GDP_j / \sum_j \theta_j}{GDP_i} . \tag{10}$$

The modification to the identify function for $\mathbf{RWX}_i$ is straightforward, as we merely replace the openness-weighted averaging function in (6) with an openness-GDP weighted averaging function in (9). The latter means that shocks from larger and more open foreign countries will be weighted higher than those from smaller and less open ones in imputing the external disturbances confronted by the home country.

The modification to the equation for CA_i is somewhat more complicated, as we multiply the interaction term $\theta_i(\mathbf{X}_i - \mathbf{RWX}_i)$ with a new term, Z_i. This new term Z_i is the inverse of the relative size of the domestic economy compared to the world average, and the size of each foreign country is also weighted by its openness. Z_i is a scalar, and it will be larger than one for small economies and smaller than one for large economies. The reason for this specification is clear when we consider a world consisting of only two countries, in which the home country *i* is twice the size of the foreign country *j*, and the vector of $\mathbf{X}_i$ has only one element. Then further suppose $\theta_i = \theta_j = 1$ and $\Delta(X_i - X_j) = 1$. In the counterfactual case that Z_i does *not* appear in equation (8), $\Delta CA_i = \alpha_1$. Since $\Delta(X_j - X_i) = -1$, $\Delta CA_j = -\alpha_1$ holds simultaneously. In *dollar terms*, the current account surplus in country *i* has to match the current account deficit in country *j*. However, since CA is expressed as a ratio to GDP – a standard practice in the literature – to ensure that the world current account balance is zero, the effect of $\mathrm{D}(X_i - X_j)$ on CA_i must be half as that of $\mathrm{D}(X_j - X_i)$ on CA_j. That is, *the marginal effect will be smaller for the larger economy*, and vice versa. In the absence of Z_i, the estimated marginal effect will be somewhere between the actual marginal effects on CA_i and CA_j. In a more general, multi-country setting, the error will depend on the distribution of economic sizes. The inclusion of Z_i in (8) provides a solution to this problem and should hence lead to a more accurate estimation of the effect of $(X_i - RWX_i)$ on CA_i.[7] Furthermore, the openness measure enters Z_i because, like that in $\mathbf{RWX}_i$, an economy can influence others only if it is open.

4 EXPLANATORY VARIABLES AND DATA

4.1 Explanatory variables

Our objects of interest are the demographic effects on the current account balance. This is related to – but different from – studies of the determinants of the current account balance. The main difference is that we focus on demographic factors and include a limited number of control variables. Given that the literature has elicited numerous determinants of these two macro variables, a legitimate concern is how many of those determinants have to be included as controls to avoid biased estimations for the demographic effects. In this aspect, it is useful to notice that the demographic structure of a country is shaped by its fertility and mortality rates over decades, making it deeply predetermined and most likely exogenous with respect to many other macroeconomic variables. Accordingly, the exclusion of those variables should not cause omission bias to the estimates for demography. On the other hand, it can be argued that demography and many other macroeconomic variables are all driven by even deeper determinants such as culture, and therefore models that are too parsimonious would still be subject to omitted variable bias. Our strategy, therefore, is first to estimate models with only demographic variables, and then to add a number of control variables to test if the results of the more parsimonious specifications are robust.

[7] There is a reason why we measure the size of the home economy relative to the world average, but not the average of the ROW. Consider the two-country example in the text. If we use the average size of the ROW, for the small country, its relative size will be equal to 2 and that of the bigger country will be equal to ½. As a result, the marginal effect of the home country will be a quarter of that of the foreign country, instead of just half of it.

Following common practice in the literature, we measure demographic structure using youth and old-age dependency ratios. For the control variables, since the current account is equal to excess saving over investment and is associated to international capital flows, factors pertaining to the lifecycle consumption smoothing, investment return and risk are particularly relevant. Variables pertaining to consumption smoothing include income growth, the rural population share, and labour participation rate. Our controls pertaining to investment return include human capital (measured by average years of schooling) and the business cycle (measured by the output gap, lags of the dependent variables and year dummies). Factors pertaining to risk include financial development (measured by a financial development index), institutional quality and political stability (measured by a composite risk index), and a measure of economic openness.

A number of these variables require some elaboration. First, we do not include income in levels because income is found to be non-stationary[8], and this would weaken the internal instruments used in GMM estimations; as a result, only its first-difference, i.e. the income growth rate, is used.[9] Second, the share of the rural population in the total population is included as a control variable because rural households, especially those in developing countries, may not have as good access to financial intermediation as their urban counterparts and thus have different saving behaviour. Lastly, a measure of economic openness is included, mainly to ease comparison with the conventional model, but we also include it in our alternative model as a standalone control variable to avoid the transformed variables from picking up the effect of the openness measure.

4.2 Data

The definitions, data sources and basic summary statistics of the variables referred to are summarised in Table 1. Most of the variables are measured according to standard practice in the related empirical literature that draws on cross-country panel data. Yet, a few of our variables deserve some discussion.

Since the current account balance is associated with international capital flows, we focus on financial openness in constructing the openness variable q . This variable is based on the index constructed by Chinn and Ito (2007), which is the first principle component of three binary variables on capital controls recorded in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions. Using this index instead of a trade openness measure also has the advantage that it is in-

[8] This is based on the results of Fisher and Im-Pesaran-Shin panel unit root tests.
[9] However, for non-GMM estimations such as fixed effects models, we have experimented with including income as well.

stitution-based and therefore less susceptible to endogeneity problems and variation due to business cycles. Notwithstanding, we also refer to a standard trade openness measure for robustness check.

The usual proxies for financial development or activity rely on money and credit volumes.[10] However, they suffer from a number of shortcomings that cast doubt on their usefulness in cross-country and inter-temporal comparisons.[11] We therefore refer to a new multi-indicator measurement of financial activity that captures not only the degree of monetization or financial intermediation, but – in addition – the share of resources a society devotes to run its financial system. In particular, our measurement consists of the following four indicators: the share of the labour force employed in the financial system; the number of banks and branches per capita; the share of the financial system in GDP; and the traditional measure M2/GDP. While each of these variables individually is plagued with a host of validity problems, we trust that collectively they can be transformed into a reasonably reliable measure for the intended notion of financial activity. To that end, the factor scores of the first principal component of the four variables are taken as our numerical estimates for financial development.[12] This measure stands for a resource-based concept of financial development. This notion of financial development is thus different from the common notion of financial depth, as it signifies a real rather than a monetary phenomenon.

For institutional quality and political stability (combined), we refer to the political risk index from the International Country Risk Guide. A higher value of this index implies better institutional quality and higher political stability. For simplicity, we refer to the variable as 'institutional quality'.

The coverage of the panel results from a pragmatic approach. We started with the broadest cross-section allowed for by data availability; yet to curb sampling effects due to excessive unbalancedness of the panel, we excluded those countries for which data are available for recent years

[10] Both Gruber and Kamin (2007) and Chinn and Ito (2007) use the ratio of private credit to GDP, expressed as a deviation from its GDP-weighted sample means as a proxy for financial development. Legg et al. (2007) use the annual stock market turnover as a proportion of share market capitalisation as a proxy for financial depth.

[11] The standard variable is M2/GDP (e.g. see King and Levine, 1993). However, due to definitional instability and difficulties in international comparability, the selection of a suitable monetary aggregate creates a serious problem (Siklos and Barton, 2001). Moreover, monetary aggregates may be highly misleading as they indicate monetisation rather than financial sophistication (Lynch, 1996). Another standard proxy is credit within the *private* sector/GDP, which is used by King and Levine (1993). The measure, however suffers from the fact that highly beneficial credits are lumped together with non-performing loans. In addition, this variable refers to bank-based finance rather than total intermediation, and thereby may be a misleading indicator of financial development in countries where a substantial part of investment is raised through the primary capital market.

[12] Specifically, the data of these four variables for all countries and nine points in time (1960, 1965, ..., 2000) were pooled into a panel, and the first principal component was extracted. The first component already accounts for 75% of total variance, and all communalities are 0.69 or higher, indicating a one-dimensional data space. For a comparable approach to measure financial development, see Graff (2005).

only.[13] Moreover, following common practice in cross-country studies, we disregarded very small countries,[14] as their integration into the global economy can be assumed to differ substantially from larger economies, as well as OPEC countries whose national income derives mainly from exporting crude oil. The remaining 84 countries are listed in the Appendix.

The longitudinal dimension of the panel consists of yearly data that – given the coverage in most international data sets referred to in this literature – start in 1960. We extended the data collection to 2006, resulting in a maximum of 47 yearly observations.[15]

As can be expected, there is a considerable number of missing observations for the maximum of 3948 data points. The dataset is hence an unbalanced panel. A typical sample size for our regressions comprises slightly more than 2700 observations.[16] The most severe constraint on the sample size comes from the institutional quality measure and then the labour participation rate. Including these two variables means a loss of more than 1000 observations. Therefore, we shall first estimate our models without these two variables to take advantage of the maximum size of the dataset, and then add them to the models to test for the sensitivity of our estimates.

5. EMPIRICAL RESULTS

While our objects of interest are the demographic effects on the current account balance, a premise of the paper is that our suggested framework is theoretically sounder than the conventional one. Nonetheless, whether the new framework would lead to different findings in practice is a different matter. Thus, in what follows we focus on the comparison between the results regarding demography obtained using the new and conventional frameworks respectively. Although the new framework is more elaborated than the conventional one, their comparison is straightforward once we notice that both can be represented in similar ways:

$$CA_{i,t} = a_0 + \hat{\mathbf{X}}'_{i,t}\boldsymbol{\alpha}_1 + e_{i,t} \text{ (new)} \qquad (11)$$

$$CA_i = b_0 + \mathbf{X}'_i\boldsymbol{\beta}_1 + e_i \text{ (conventional),} \qquad (12)$$

[13] This is mainly because these countries became independent entities only recently, particularly after the collapse of the Soviet Union and Yugoslavia.

[14] Our cut-off is 1 million inhabitants during any year from 1960-2004 as recorded in the Penn World Tables, Mark 6.1.

[15] Notice that we deliberately refrain from pushing the sample period to the latest available years (2009 for most countries), as this would include the 2008/2009 recession as well as the bubble economy of 2007-2008. During these years, current accounts were first inflated and later plunged as never before since the end of World War II, and this spectacular variance was certainly not driven by the long-term determinants, in which we are interested.

[16] For a strictly balanced panel, the sample coverage drops to 75 countries and 22 years from year 1985 to 2006.

where $\hat{\mathbf{X}}_i \equiv q_i Z_i(\mathbf{X}_i - \mathbf{RWX}_i)$ can be considered as a transformed version of $\mathbf{X}_i$. Since $\hat{\mathbf{X}}_i$ and $\mathbf{X}_i$ have different means and standard deviations, to make the comparison of their coefficients meaningful, they are standardised before entering the regressions.

5.1 Fixed effects estimations within the conventional framework

We first estimate the conventional model using two-way fixed effects (i.e. country and year fixed effects). The country fixed effects are to control for time invariant country heterogeneity like geography or culture, and the year fixed effect are to control for country common but time varying factors like the global business cycle. The results are reported in Table 2. Figures in parentheses are robust standard errors.

[Table 2]

When only the two demographic variables are included in the model (2a), both coefficients point estimates are negative, but insignificant at standard levels. Recall that while most of the literature assumes an expected negative sign for the two demographic variables based on the life cycle theory, the literature review in section 2 suggests that a more comprehensive consideration will lead to no conclusive presumption regarding their signs. Accordingly, we assess statistical significance for these variables with two-sided tests.

In model (2b), a number of control variables are added to the model, including the rural population share, average years of schooling, financial development, income growth, the output gap and financial openness. Now old-age dependency becomes significant at the 10% level, retaining the negative sign. In model (2c), two more control variables are added, namely the labour participation rate and institutional quality. This cuts the sample size by more than one-third. However, the findings regarding the two demographic variables remain the same in qualitative terms, albeit that the coefficient of old-age dependency becomes somewhat larger. Thus, interpreting these results mechanically, an increase in the old-age dependency ratio by one standard deviation may reduce the current account balance by some 0.4 standard deviations. In what follows, we take this as the baseline model for the sensitivity analyses.

We also estimated the baseline model using random rather than fixed effects (2d). The results are similar to those of the fixed effects model in qualitative terms. However, the Hausman test strongly rejects the null hypothesis that the random effects estimates are consistent. Thus, we maintain the fixed effects framework.

As a robustness check, in model (2e), we add yet another demographic variable, namely life expectancy, to the baseline model. The reason of including this variable is that population ageing is characterised not only by higher old-age dependency, but also by rising life expectancy.[17] Since these two aspects are highly correlated, while having opposite expected effects on saving, omitting life expectancy may lead to biased estimation for old-age dependency. On the other hand, since the information content of the three demographic variables overlaps substantially, including all of them implies multicollinearity problems. Despite this concern, the results are almost identical to those of the baseline model (i.e. 2c), and the life expectancy variable is not significant at any conventional level.

Another robustness check is to include income in the model (2f). Although this variable is non-stationary, that is less an issue for the fixed effects estimations than for GMM. The results remain virtually the same as in the baseline case.

Overall, the findings based on the conventional framework indicate that – after controlling for a reasonable number of confounders – both youth and old-age dependency appear to have negative effects on the current account balance, but only the effect of the old-age dependency is statistically significant. This would therefore suggest that population ageing indeed has discernible negative impacts on the current account balance, while a question mark is in order regarding youth dependency. Previous studies also tended to find negative effects for both age dependency ratios,[18] even though not all record both of them as statistically significant. So, in general, our results are consistent with previous findings based on a similar framework, which is reassuring as a starting point. Let us now proceed to our new specification.

5.2 Fixed effects estimations within the new framework

Within the new framework, we start with re-estimating the baseline model (3a). The results are reported in Table 3. Both dependency ratios are now insignificant at even most moderate standard levels, i.e. referring to statistical inference, the coefficients are not distinguishable from zero. We also estimated the model using random effects (3b) but, once again, the Hausman test strongly rejects the null hypothesis that the random effects estimates are consistent. We also repeat the two ro-

[17] In Li, Zhang and Zhang (2007), the fertility rate instead of youth dependency is used as a measure of demography, along with life expectancy and old-age dependency. Yet, in low-income countries, infant and child mortality rates are often regrettably high, so the youth dependency rate is more accurate to capture the demographic structure, as it reflects both fertility and mortality.

[18] However, in some of their estimations, Chinn and Prasad (2003) record a positive effect of old-age dependency ratio on the current account balance.

bustness tests of adding life expectancy (3c) and income (3d), respectively, to the model and find the results remaining the same as in the baseline case.

[Table 3]

The key message we get from these results is that the new framework leads to very different conclusions regarding the effects of demographic factors on the current account balance. Specifically, compared to the results from the conventional framework, the new results do not support the hypothesis that population ageing would have unambiguous and negative impacts on the current account balance.

5.3 Dynamic panel estimations within the new framework

Given that the current account balance is characterised by strong inertia,[19] omitting its lagged values in the fixed effects models could result in inconsistent estimation of the coefficients for demography and other explanatory variables (Bond 2002). To address this issue, we include lagged values of the current account balance into the model and estimate it using GMM estimators. The Difference (DIFF) GMM estimator following Holtz-Eakin, Newey and Rosen (1988) and Arellano and Bond (1991) involves first differencing the equation to remove the cross sectional fixed effects:

$$\Delta CA_{i,t} = \Delta \hat{\mathbf{X}}'_{i,t}\boldsymbol{\alpha}_1 + \sum_{k=1} \gamma_k \Delta CA_{i,t-k} + \Delta v_t + \Delta \varepsilon_{i,t} \quad \text{(new)} \qquad (13)$$

and then using lagged level variables as instruments. The conventional framework is obtained by substituting $\mathbf{X}_{i,t}$ for $\hat{\mathbf{X}}_{i,t}$.

Arellano and Bover (1995) and Blundell and Bond (1998) improve the DIFF GMM estimators by simultaneously estimating the level equation using the lagged first-difference of a variable as an instrument. The modified version is commonly referred to as the System (SYS) GMM estimator. Post-estimation Difference-in-Hansen tests are performed to assess if the additional moment conditions with the SYS GMM estimator as compared to the DIFF GMM estimator are valid. Both estimators require the first-differenced errors to be serially uncorrelated, which can be tested post-estimation. The number of lags for the dependent variable is extended until this condition is fulfilled.

The estimations are performed using a two-step process, as this does not require homoskedasticity of the error term, and the standard errors are corrected for small sample bias following Windmeijer (2005). Since the two-step GMM estimation presupposes that the errors are not corre-

[19] For our dataset, the first order autocorrelation of the current account balance is 0.73.

lated across countries, the year fixed effects are retained in the model to remove universal time-related shocks from the errors (Roodman 2009a).

The youth dependency ratio, the old-age dependency ratio, the rural population share, average years of schooling, and financial openness are treated as exogenous, as they are slowly evolving stock or level variables. Financial development is treated as a predetermined variable, meaning that its first and deeper lags are used as instruments. The remaining variables are treated as endogenous, meaning that only their second and deeper lags are used as instruments. Using too many instruments can lead to downward bias of the standard errors. Therefore, we limit the number of lags to two in generating instruments, unless a post-estimation diagnostic test results in a demand for longer lags, as well as "collapsing" the moment conditions.[20]

The results are reported in Table 4. All estimations reported in the table pass the autocorrelation and over-identification tests described above.

For the conventional model (4a), the lagged value of the current account balance is significant and shows a sizable coefficient, vindicating its inclusion.[21] The incorporation of short run dynamics in the model sees some substantial changes to the results compared to the static model. Both dependency ratios are now significantly negative at the 5% level. This finding thus would deliver support for the lifecycle hypothesis described in the introduction.

[Table 4]

For the new model (4b), once again, the lagged value of the current account balance is significant and sizable. Moreover, there are noticeable changes to the demographic effects as compared to the static models. Youth dependency is now significantly negative. On the other hand, old-age dependency has a positive point estimate, but remains insignificant, as in the other specifications based on our suggested new framework.

We furthermore conducted a number of robustness tests for the dynamic panel model. To keep the discussion focused, we only go through the results regarding the new framework.[22]

Firstly, when life expectancy is added to the model (4c), the youth dependency ratio gets insignificant. This is probably due to multicollinearity.

Secondly, since some sizeable OECD countries tend to have comparatively low saving ratios, and at the same time attract a lot of international capital, one may also question if their current account balances respond to demographic changes differently from other countries. To examine this, we split the sample into an OECD and a non-OECD subsample. However, as in the OECD subsam-

[20] For a detailed discussion, see Roodmand (2009b).
[21] Results from diagnostic tests suggest that one lag term is sufficient.
[22] The other results can be obtained from the corresponding authors upon request.

ple, there is severe multicollinearity between regressors, including the youth dependency ratio, we can only report meaningful results for the non-OECD subsample (4d). Importantly, excluding the OECD countries does not change the main findings from the baseline case in that only the youth-age dependency ratio is significantly negative.

Thirdly, we divide the dataset into two 10-year periods, one from 1986 to 1995, and the other one from 1996 to 2005.[23] There are two considerations leading to this robustness check. Firstly, it allows us to examine whether the demographic effects on the current account balance change over time. Secondly, the SYS GMM estimator is designed for datasets of "large N, but small T". For the period of 1986-1995 (4e), both dependency ratios are insignificant, whereas for the period of 1996-2005 (4f), the key results are again the same as in the full sample in that only the youth dependency ratio is significant and negative.

Lastly, we refer to a standard measure of trade openness in place of financial openness in constructing $\tilde{\mathbf{X}}_i'$. The most commonly used measure of trade openness is total trade normalised with GDP. This measure, however, is sensitive to the business cycle. Therefore, we extract the long run trend using the Hodrick-Prescott filter and treat it as a predetermined rather than exogenous variable. The youth dependency ratio retains the negative sign, as before, but its standard error has increased somewhat such that its significance level falls out of the two side 10% range (p=0.12) (4g).

5.4 Discussion

What can we take from the reported regressions? Although the details vary from estimation to estimation, as expected, a number of general observations regarding the demographic effects on the current account balance is in order.

Firstly, accounting for the inertia of the current account balance makes substantial differences to the results within the new and conventional frameworks. Accordingly, when discussing the principal findings on the demographic effects on the current account balance, it is important to emphasise whether the results are based on static or dynamic models.

Secondly, for either the static or the dynamic models, our results based on the new framework are noticeably different from those based on the conventional approach. This suggests that at the very least, accounting for general equilibrium, relative size and openness is important in modelling the current account balance; and that at the very most, all previous estimations based on the conventional framework are biased.

[23] There are insufficient data to estimate the full model before 1985.

Thirdly, for either the static or the dynamic models, the results based on the new framework indicate that the effect of population ageing on the current account balance is much more subdue than reported in previous studies using the conventional framework. As discussed in the literature review, this is not contradictory to the theoretical arguments, because population ageing could affect both saving and investment, leaving its effect on excess saving over investment (i.e. the current account balance) ambiguous. Furthermore, people moving toward retirement may save more, and retirees may dissave more slowly due to longevity uncertainty. In this regard, it is plausible for population ageing to have either a positive or a negative impact on the current account balance, or no discernible impacts at all – as found in this study.

6. CONCLUSION

This paper re-examines the effects of demography on the current account balance. A key departure of the paper from, and hence its contribution to, the current literature is its consideration of the general equilibrium nature of the current account balance in a world of heterogeneous economic size and openness. Our modelling framework differs from the conventional one in three aspects. Firstly, it recognises that in a general equilibrium setting, it is the relative pace of demographic changes across countries rather than the absolute pace of changes in a particular country that contributes to determining its current account balance. Secondly, it acknowledges the fact that a country can influence others and likewise be influenced by others only up to the extent that it is economically open. Thirdly, it accounts for the fact that the influence of one country on another depends on their relative sizes.

This new framework is put to test referring to a large panel dataset. The empirical strategy is to estimate the new and conventional models and contrast their differences. It is demonstrated that the new framework leads to noticeable changes in some conclusions based on the conventional one. The new evidence indicates that population ageing as measured by old-age dependency does not have discernible impacts on the current account balance, and thus suggesting that different findings in the previous literature may be due to the negligence of the general equilibrium, size and openness factors.

In a nutshell, the effects of demographic factors on the current account balance may comprise more – and sometimes conflicting – driving forces than previously considered, which calls for more research along the lines suggested here. Last but not the least, although the current study focuses on demography, the key rationale behind the new framework is quite general and hence applicable to empirical studies of many other open economy issues.

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Table 1 Data definitions, sources and summary statistics

Variable	Definition	Source	No. of obs.	Mean	Std. dev.
The current account balance	The current account balance to GDP ratio (in %)	Penn World Tables 6.2 (PWT)	2530	-2.83	6.59
Youth dependency ratio	Population aged 0-14 to population aged 15-64	World Development Indicators (WDI)	2530	0.61	0.25
Old-age dependency ratio	Population aged 65+ to population aged 15-64	WDI	2530	0.11	0.07
Life expectancy	Life expectancy at birth	WDI	2530	64.55	11.62
Rural population share	Share of rural population in total population (in %)	WDI	2530	48.29	24.82
Years of schooling	Average years of schooling	Barro and Lee (2001)	2530	5.59	2.97
Financial development	The first principle components of four financial development indicators	Graff (2005)	2528	0.32	1.11
Income growth rate	Growth rate of income per capita (%)	PWT	2516	1.77	4.51
Output gap	Output gap (in % of potential GDP)	Relative deviation of annual GDP (PWT) from potential output, where the latter is derived by HP-filtering ($l = 100$) the logged empirical GDP series.	2522	0.12	4.16
Labor participation rate	Labor participation rate (in %)	WDI	2167	69.11	9.26
Institutional quality	Composite political risk index (0-100, a larger number means better institutional quality and higher political stability)	International Country Risk Guide	1688	64.63	15.98

Table 2 Fixed effect estimations within the conventional framework; dependent variable: current account balance/GDP

	2a	2b	2c	2d	2e	2f
Youth dependency	-0.122	-0.005	-0.010	-0.214	-0.002	-0.102
	(0.15)	(0.20)	(0.29)	(0.16)	(0.28)	(0.32)
Old-age dependency	-0.064	-0.296*	-0.405**	-0.203*	-0.410**	-0.425**
	(0.14)	(0.17)	(0.20)	(0.12)	(0.20)	(0.18)
Rural population share		0.101	0.790	0.147	0.784	0.647
		(0.43)	(0.52)	(0.14)	(0.52)	(0.48)
Years of schooling		0.683***	0.547**	0.357***	0.549**	0.551**
		(0.25)	(0.25)	(0.14)	(0.25)	(0.26)
Financial develop-ment		0.297	0.054	0.182	0.052	-0.037
		(0.21)	(0.18)	(0.16)	(0.18)	(0.15)
Income growth		0.009	0.034	0.046	0.035	0.037
		(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
Output gap		-0.066**	-0.074*	-0.081*	-0.074*	-0.086*
		(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Financial openness		-0.053	-0.105	-0.076	-0.104	-0.101
		(0.08)	(0.09)	(0.07)	(0.09)	(0.08)
Labor participation rate			0.143	0.034	0.139	0.127
			(0.13)	(0.08)	(0.13)	(0.14)
Institutional quality			-0.067	-0.078	-0.073	-0.051
			(0.08)	(0.07)	(0.08)	(0.08)
Life expectancy					0.061	
					(0.24)	
Income						0.349
						(0.34)
R-squared	0.071	0.103	0.084		0.084	0.088
N	2739	2551	1686	1686	1686	1686

*, **, *** denote significance at 10, 5 and 1% respectively.
Figures in parentheses are robust standard errors.

Table 3 Fixed effect estimations within the new framework; dependent variable: current account balance/GDP

	3a	3b	3c	3d
Youth dependency	0.045	-0.231	0.088	0.047
	(0.23)	(0.21)	(0.22)	(0.23)
Old-age dependency	-0.193	-0.022	-0.149	-0.209
	(0.27)	(0.21)	(0.27)	(0.33)
Rural population share	0.141	0.150	0.197	0.139
	(0.26)	(0.18)	(0.24)	(0.26)
Years of schooling	0.628*	0.325	0.551*	0.603
	(0.34)	(0.24)	(0.33)	(0.41)
Financial develop-ment	-0.151	-0.114	-0.165	-0.163
	(0.30)	(0.32)	(0.31)	(0.26)
Income growth	-0.031	-0.025	-0.033	-0.031
	(0.05)	(0.05)	(0.05)	(0.05)
Output gap	-0.056	-0.056	-0.054	-0.057
	(0.05)	(0.05)	(0.05)	(0.05)
Financial openness	-0.054	0.062	-0.062	-0.050
	(0.10)	(0.08)	(0.10)	(0.10)
Labor participation rate	-0.054	-0.005	-0.037	-0.062
	(0.09)	(0.08)	(0.10)	(0.13)
Institutional quality	-0.149	-0.164*	-0.179	-0.144
	(0.12)	(0.09)	(0.12)	(0.11)
Life expectancy			0.220	
			(0.28)	
Income				0.047
				(0.40)
R-squared	0.068		0.070	0.069
N	1619	1619	1619	1619

*, **, *** denote significance at 10, 5 and 1% respectively.
Figures in parentheses are robust standard errors.

Table 4 Dynamic panel estimations; dependent variable: current account balance/GDP

	4a	4b	4c	4d	4e	4f	4g
Youth dependency	-0.240**	-0.468**	-0.298*	-0.408**	0.217	-0.422**	-0.346
	(0.12)	(0.21)	(0.17)	(0.18)	(0.48)	(0.20)	(0.22)
Old-age dependency	-0.224**	0.178	0.182	-0.097	-0.015	0.060	0.010
	(0.11)	(0.19)	(0.24)	(0.25)	(0.43)	(0.24)	(0.15)
Rural population share	-0.063	-0.059	-0.042	-0.265	0.190	-0.003	-0.258
	(0.12)	(0.18)	(0.18)	(0.25)	(0.22)	(0.28)	(0.25)
Years of schooling	0.017	0.073	0.009	0.754	0.286	0.021	0.034
	(0.12)	(0.13)	(0.14)	(0.54)	(0.32)	(0.20)	(0.25)
Financial development	0.149	-0.506	-0.482	-1.087**	0.286	-0.337	-0.679
	(0.11)	(0.38)	(0.50)	(0.47)	(0.61)	(0.42)	(0.55)
Income growth	-0.077	0.028	0.033*	0.036	0.014	-0.136	0.047
	(0.08)	(0.02)	(0.02)	(0.02)	(0.01)	(0.18)	(0.06)
Output gap	-0.032	-0.026	-0.027	-0.036	0.059	-0.147***	-0.019
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.04)
Labor participation rate	0.276**	0.165**	0.206	0.296**	0.123	0.151	0.249
	(0.13)	(0.08)	(0.15)	(0.13)	(0.20)	(0.19)	(0.16)
Institutional quality	-0.050	-0.200*	-0.199	-0.299*	0.052	-0.082	-0.192
	(0.09)	(0.11)	(0.16)	(0.16)	(0.41)	(0.17)	(0.18)
Financial openness	-0.050	0.058	0.048	0.041	0.026	0.099	
	(0.05)	(0.04)	(0.04)	(0.07)	(0.04)	(0.06)	
Lagged current account balance	0.600***	0.574***	0.578***	0.497***	0.614***	0.488***	0.596***
	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.08)
Life expectancy			0.283				
			(0.40)				
Trade openness							-0.051
							(0.17)
R-squared							
N	1686	1619	1619	1205	697	727	1674

*, **, *** denote significance at 10, 5 and 1% respectively.
Figures in parentheses are robust standard errors.

Appendix: Country coverage

Angola
Argentina
Australia
Austria
Bangladesh
Belgium
Benin
Bolivia
Brazil
Bulgaria
Burundi
Cameroon
Canada
Chile
China
Colombia
Congo
Costa Rica
Cote d`Ivoire
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Finland
France
Germany
Ghana
Guatemala
Haiti
Honduras
Hungary
India
Indonesia
Israel
Italy
Jamaica
Japan
Jordan
Kenya
Korea
Lesotho
Madagascar
Malaysia
Mali
Mauritania
Mauritius
Mexico
Morocco
Mozambique
Nepal
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Panama
Papua New Guinea
Peru
Philippines
Poland
Portugal
Rwanda
Senegal
Sierra Leone
Singapore
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Syria
Thailand
Togo
Trinidad &Tobago
Tunisia
Turkey
Uganda
United Kingdom
United States
Uruguay