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Common Fluctuations in OECD Budget Balances

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Common Fluctuations in OECD Budget Balances

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Abstract

We use a *dynamic latent factor model* to analyze comovements in OECD budget surpluses. The world factor underlying common fluctuations in budget surpluses across countries explains an average of 28 to 44 percent of the variation in individual country surpluses. The world factor, which can be interpreted as a global budget surplus index, declines substantially in the 1980s, rises throughout much of the 1990s to a peak in 2000, before declining again after the financial crisis of 2008. We then estimate similar world factors in national output gaps, dividend-price ratios, and military spending that significantly explain variation in the world budget surplus factors. Idiosyncratic components of national budget surpluses correlate with well known "unusual" country circumstances, such as the Swedish banking crisis of the early 1990s.

JEL classifications: C32, E62, F42, H62

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1. Introduction

The huge size of recent U.S. budget deficits—12.8 and 12.3 percent of Gross Domestic Product (GDP) in 2009 and 2010, respectively—returned fiscal issues to the front burner (Calmes, 2009). Analysts typically credit or blame the government for a country's fiscal situation. Leonhardt (2009), for example, apportions blame for prospective U.S. deficits to current and past presidents. Although Leonhardt (2009) more-or-less ignores the legislative branch, such assignments are appropriate in some sense: Governments decide how much to tax and spend and therefore are ultimately responsible for fiscal outcomes.

When analyzing fiscal balances, however, it is important to consider economic circumstances, because such circumstances determine the welfare implications and sustainability of fiscal policy. We analyze the effects of international circumstances on fiscal balances in the present paper. Two observations motivate our focus on international aspects of fiscal balances. First, the growth in economic and financial interdependence over the postwar era increases the potential for international circumstances to influence national fiscal policies. Second, Neely's (2003) casual examination of international comovements in fiscal balances illustrates the relevance of international influences in such matters.

We begin our analysis by estimating a dynamic factor model to identify the latent world factor underlying fiscal surpluses in 18 industrialized countries for 1980-2013. A latent factor model is a method to summarize common movements in related variables. Economists often model the movement of interest rates on bonds of different maturities with latent factor models, for example.[1] The determinants or factors are called latent (hidden) because economists can't

[1] Factor analysis has been used to model covariation in many types of related variables. For example, individuals who are good at certain mental or physical tasks are very often good at other types of mental or physical tasks that are not

directly observe them. But one can infer the behavior of these unobserved factors from the common movement in variables. Factor analysis estimates these hidden factors to explain as much of the variance of the dependent variables as possible. This effectively condenses the information from many related variables into one or a few underlying influences. When the factors are allowed to be autocorrelated over time, then they are called "dynamic" factors. In the case of interest rates, the first three factors can be readily interpreted as the level, slope, and curvature of the yield curve.

This paper uses factor analysis to summarize and analyze the comovement of national fiscal balances and investigate the determinants of those balances. Why do we study such comovements? We start by observing that net lending is strongly positively correlated across countries. One might think that some international factor or factors drive this comovement, but their identity and quantitative importance are not clear. Potentially, international budget measures might be related for many reasons. For example, net lending will tend to be correlated internationally because trade and capital flows link business conditions between countries. Asset market conditions, such as equity valuations and interest rates, are also linked internationally and can affect fiscal measures through capital gains tax revenues and interest payments on debt. Non-economic factors, such as common trends in age demographics—e.g., the baby boom— or military expenditures—the "peace dividend" in the 1990s— can also affect fiscal balances.

A factor method captures covariation among many variables in a unified framework and has major advantages over alternative procedures for measuring comovements in national budget surpluses. For example, the performance of a few large countries will dominate a GDP-weighted average of national surpluses. Similarly, pair-wise correlations or related statistics are unwieldy,

directly related. That is, students who get an A in economics are likely to have above-average grades in other courses. Charles Spearman, a psychologist, developed factor analysis to describe the tendency of children's performance on cognitive tasks to be positively correlated.

difficult to summarize, and fail to provide a unified framework.[2]

The estimated world budget surplus factor explains a substantial portion of the variability in individual OECD country budget surpluses. Furthermore, the world factor, which can be interpreted as a global budget surplus index, varies markedly over our sample: declining during the early 1980s and early 1990s, rising sharply for much of the 1990s to a peak in 2000, before declining again after the financial crisis of 2008. Reassuringly, although our procedure does not weight countries by output, it still explains a substantial part of the variability in the U.S. surplus over the sample. This suggests that international factors are relevant even for a very large and relatively closed economy.

We then examine the relationships between the world budget surplus factor and estimated world factors in national output gaps, equity valuation ratios, unexpected inflation, and military spending. These variables are potentially important determinants of national budget surpluses and can be viewed as nearly predetermined with respect to fiscal balances. Estimated world factors in national output gaps, price-dividend ratios, and military spending significantly explain fluctuations in the world budget surplus factor. Surprisingly, the world output gap factor even significantly explains the world factor in cyclically adjusted surplus measures. This indicates that OECD cyclical adjustments do not remove all business cycle variation in such measures. The fact that the world dividend-price ratio factor explains movements in the world budget surplus factor highlights the importance of swings in international equity markets in determining common trends in national budget balances. Finally, the significant relationship between world military spending and world budget surplus factors points to the relevance of geopolitical events, such as

[2] Researchers have recently employed dynamic latent factor models to measure global fluctuations in national real output growth and inflation rates; see, for example, Kose, Otrok, and Whiteman (2003, 2008) with respect to real output growth and Ciccarelli and Mojon (2010), Monacelli and Sala (2009), and Neely and Rapach (2011) with respect to inflation.

the end of the Cold War.

In addition to discerning international trends in fiscal situations, the dynamic factor model decomposes national budget surpluses into common and idiosyncratic components. We interpret the common component as the impact of international conditions on a country's budget surplus. This allows one to evaluate whether the government's fiscal position is unusual, compared to its historical record of budget comovement with similar countries. The common component thus provides a useful benchmark against which to gauge government policies and to highlight the importance of particular national circumstances—for example, a war, tax changes, a domestic financial crisis, or atypical terms of trade—versus common reactions to international economic conditions in determining fiscal balances and their sustainability. Substantial fluctuations in the idiosyncratic components of the national budget surpluses often readily relate to well known "unusual" country circumstances. For example, a sharp decline in the idiosyncratic component of Sweden's budget surplus in the early 1990s clearly corresponds to the Swedish banking crisis.

While there is a vast fiscal literature on topics such as fiscal sustainability and the relation between deficits and growth, there is little work that characterizes international determinants of deficits in industrialized countries.[3] Neely (2003) casually studies recent correlations among national budget deficits and speculates that common shocks to technology, demographics, commodity prices, and political uncertainty drive this covariance. Aside from Neely's (2003) very short study, two literatures study the causes of deficits and therefore are tangentially related to the present issue of international influences on budget deficits. First, Roubini and Sachs's (1989) seminal empirical work, related to the theoretical study of Alesina and Tabellini (1990), presents evidence that OECD countries with short-tenure governments and coalition governments

[3] For example, Corsetti and Roubini (1991), Chalk and Hemming (2000), and Heller (2005) consider tests of fiscal sustainability, while Dornbusch and Reynoso (1989), Kneller, Bleaney, and Gemmell (1999), Adam and Bevan (2005), and Heller (2005) analyze the relation between deficits and growth.

are more likely to experience deficits, although Edin and Ohlsson (1991) and de Haan and Sturm (1997) challenge the Roubini-Sachs findings. Second, Lane (2003) finds that OECD countries with volatile output and dispersed political power are more likely to exhibit procyclical fiscal policies, while Strawczynski and Zeira (2009) determine that expenditures and deficits react countercyclically to transitory shocks while government investment reacts procyclically to permanent shocks.

The remainder of the paper is organized as follows. Section 2 outlines the dynamic factor model and its estimation. Section 3 describes the data and reports dynamic factor model estimation results for national budget surpluses, output gaps, equity valuation ratios, unexpected inflation, and military spending. Section 4 analyzes the relationships between world factors in national budget surpluses and the other variables, while Section 5 examines idiosyncratic components in national budget surpluses. Section 6 concludes.

2. Econometric methodology

The dynamic latent factor model is given by

(1) $$y_{i,t} = \beta_i f_t + \varepsilon_{i,t} ,$$

where $y_{i,t}$ is the demeaned budget surplus as a share of GDP for country i ($i = 1,\ldots,N$) in year t ($t = 1,\ldots,T$).[4] The world factor, f_t, is common across all of the N = 18 OECD countries we consider and captures the global comovements in national budget surpluses. β_i is a loading measuring the response of an individual country's budget surplus to fluctuations in the world

[4] In the dynamic latent factor models discussed in Section 3, $y_{i,t}$ can also represent the demeaned national output gap, dividend-price ratio, unexpected inflation rate, or military spending as a share of GDP.

factor.[5] The final term in (1), $\varepsilon_{i,t}$, is an idiosyncratic component or country-specific factor.

To make (1) a dynamic latent factor model, we permit f_t and $\varepsilon_{i,t}$ to follow autoregressive (AR) processes. Each idiosyncratic component follows an AR(p) process, while the world factor obeys an AR(q) process:

(2) $$\varepsilon_{i,t} = \rho_{i,1}\varepsilon_{i,t-1} + \ldots + \rho_{i,p}\varepsilon_{i,t-p} + u_{i,t},$$

(3) $$f_t = \rho_{f,1}f_{t-1} + \ldots + \rho_{f,q}f_{t-q} + u_{f,t},$$

where $u_{i,t} \sim N(0,\sigma_i^2), u_{f,t} \sim N(0,\sigma_f^2)$, and $E(u_{i,t}u_{i,t-s}) = E(u_{f,t}u_{f,t-s}) = 0$ for $s \neq 0$. We set $p = q = 1$ when estimating the dynamic factor model in Section 3; the results are not sensitive to other non-zero values for p or q. We make the standard assumption that the shocks in (2) and (3) , $u_{i,t}$ and $u_{f,t}$, respectively, are uncorrelated contemporaneously and at all leads and lags, implying that the world and country-specific factors are orthogonal.

Note that neither the signs nor scales of the factor and factor loadings are separately identified in (1). For example, multiplying the world factor by −2 and the loadings by −1/2 produces exactly the same model. To normalize the signs of the factor and loadings, we restrict the loading on the world factor for Australia—the first country (alphabetically) in our sample—to be positive. To normalize the scales, we assume that $\sigma_f^2 = 1$ (e.g., Sargent and Sims, 1977; Stock and Watson, 1989, 1993). The sign and scale normalizations lack economic content and do not affect any economic inference. Nevertheless, the factor loadings in Section 3 are typically positive, meaning

[5] The comovement in net-lending-to-GDP ratios is driven almost entirely by comovement in net lending rather than by comovement in GDP. International net lending correlations are, on average, very similar if one uses the predicted value of GDP from a log linear trend as the denominator in the net lending ratio rather than GDP itself. Iceland and Japan show the most evidence of correlation through GDP rather than net lending.

that national budget surpluses are nearly all positively related to the world factor.

The dynamic factor model attributes comovements in national budget surpluses solely to the world factor, f_t, via the factor loadings, β_i. That is, f_t tracks common fluctuations in national budget surpluses. To provide further intuition, consider two extremes. First, if $\sigma_i^2 = 0$ and $\beta_i \neq 0$ for all i, then $y_{i,t} = \beta_i f_t$ for all i, so that national budget surpluses are perfectly correlated. At the other extreme, if $\beta_i = 0$ and $\sigma_i^2 \neq 0$ for all i, then $y_{i,t} = \varepsilon_{i,t}$ for all i, so that the national budget surpluses are completely uncorrelated. Of course, the patterns in the data are likely to fall between these extremes.

More formally, we can decompose the variation in a country's budget surplus into the share attributable to the world factor, f_t, and the country-specific factor, $\varepsilon_{i,t}$. Given that the factors are orthogonal, this variance decomposition is straightforward to compute for country i:

(4) $$\theta_i^{world} = \beta_i^2 \operatorname{var}(f_t) \big/ \operatorname{var}(y_{i,t}),$$

(5) $$\theta_i^{country} = \operatorname{var}(\varepsilon_{i,t}) / \operatorname{var}(y_{i,t})$$

where

(6) $$\operatorname{var}(y_{i,t}) = \beta_i^2 \operatorname{var}(f_t) + \operatorname{var}(\varepsilon_{i,t}).$$

θ_i^{world} ($\theta_i^{country}$) is the proportion of the total variability in country i's budget surplus attributable to the world (country-specific) factor. As discussed above, the world factor will explain a larger proportion of the variation in countries with high β_i and low $\operatorname{var}(\varepsilon_{i,t})$ values. That is, these countries will have a higher θ_i^{world} (and lower $\theta_i^{country}$) and thus be more closely tied to global fluctuations in national budget surpluses.

Because the world factor is unobservable (latent), we cannot simply estimate it with conventional regression methods. Therefore we follow Otrok and Whiteman (1998) and Kose, Otrok, and Whiteman (2003, 2008) in estimating the model with a Bayesian approach based on a Markov Chain Monte Carlo (MCMC) algorithm to simulate draws from the relevant posterior distributions. We compute posterior distribution properties for the world factor and model parameters based on 10,000 MCMC replications after 2,000 burn-in replications. Otrok and Whiteman (1998) detail the estimation procedure. Because θ_i^{world} and $\theta_i^{country}$ are functions of the model parameters and data, we can generate these statistics for each MCMC replication, thereby building up their posterior distributions.[6]

To implement Bayesian analysis, we use the following diffuse conjugate priors, which are similar to those used in Otrok and Whiteman (1998) and Kose, Otrok, and Whiteman (2003, 2008):

(7) $$\beta_i \sim N(0,1) \quad (i = 1,\ldots,N),$$

(8) $$(\rho_{i,1},\ldots,\rho_{i,p})' \sim N[0, \mathrm{diag}(1, 0.5,\ldots,0.5^{p-1})] \quad (i = 1,\ldots,N),$$

(9) $$(\rho_{f,1},\ldots,\rho_{f,q})' \sim N[0, \mathrm{diag}(1, 0.5,\ldots,0.5^{q-1})],$$

(10) $$\sigma_i^2 \sim IG(6, 0.001) \quad (i = 1,\ldots,N),$$

where IG denotes the inverse-gamma distribution. Equations (8) and (9) imply that the prior distributions for the AR parameters become more tightly centered on zero as the lag length increases. The prior for the idiosyncratic shock variances given by (10) is very diffuse; Otrok and

[6] The latent world factor could also be estimated using principal components (Stock and Watson, 2002; Bai, 2003), with inferences based on the asymptotic distribution theory in Bai (2003). Principal component estimates of the world factors are similar to the Bayesian estimates. The Bayesian approach, however, is likely to provide more accurate finite-sample results as the asymptotic theory in Bai (2003) is based on $N \to \infty$ and $T \to \infty$.

Whiteman (1998) point out that only the first two moments exist for this proper prior. The results reported in this paper are not sensitive to reasonable perturbations of these priors.

We also assume that the AR processes in (2) and (3) are stationary, which implies that national budget surpluses are also stationary.[7] This sensible assumption is consistent with the fact that an intertemporal government budget constraint implies a mean reverting budget deficit.

3. Dynamic Latent Factor Model Estimation Results

3.1. Data

We consider four OECD measures of a country's fiscal position: (i) net lending as a share of GDP; (ii) primary balance as a share of GDP; (iii) cyclically adjusted net lending as a share of potential GDP; (iv) cyclically adjusted primary balance as a share of potential GDP. Net lending is the most common measure of a country's fiscal situation—it is the general government budget surplus.[8] The primary balance excludes interest payments from net lending. Cyclically adjusted net lending and primary balances are attempts by the OECD to measure the fiscal balance if the output gap were zero.[9] We use annual data from all 18 OECD countries that have full-data samples for each of the four measures for the period 1980 to 2013.

We wish to explain the common variation in our budget surplus measures with other variables that can reasonably be viewed as predetermined with respect to the budget surplus. The output gap is an obvious candidate to explain cyclically unadjusted surpluses. Another candidate is the

[7] We enforce the stationarity restrictions by discarding draws of the AR parameters that do not satisfy the restrictions. We do the same to enforce the sign restriction on the factor loading for Australia. Inadmissible AR parameters and Australian loadings are rarely drawn, especially after the burn-in replications.

[8] The OECD defines "general government accounts" as follows: "General government accounts are consolidated central, state and local government accounts, social security funds and non-market non-profit institutions controlled and mainly financed by government units." http://stats.oecd.org/glossary/detail.asp?ID=1095

[9] The OECD denotes the four measures as "central government net lending—as a percentage of GDP," "government primary balance—as a percentage of GDP," "cyclically adjusted government net lending—as a percentage of potential GDP," and "cyclically adjusted government primary balance—as a percentage of potential GDP." The OECD describes their cyclical adjustment method at http://www.oecd.org/dataoecd/0/61/36336878.pdf.

dividend-price ratio, a proxy for transitory but potentially persistent fluctuations in equity prices that provide temporary revenues through capital gains taxes. For example, the U.S. dividend yield and U.S. capital gains taxes as a share of GDP have a correlation of –0.62 from 1970 to 2008. Unexpected inflation has potential effects on debt financing. Finally, we consider whether trends in military spending might explain budget balances. Governments might treat defense spending variation as they typically treat wars, i.e. as a temporary change in expenditures to be mostly accommodated by deficit financing rather than by suboptimally large discrete changes in taxation.

We use output gap and Consumer Price Index price level data from the OECD and dividend-price ratio data from Global Financial Data.[10] We measure unexpected inflation as the first difference in the Consumer Price Index inflation rate (Atkeson and Ohanian, 2001).We obtain data on military spending from various issues of World Military Expenditures and Arms Transfers (WMEAT), which is compiled by the U.S. Department of State, Bureau of Verification and Compliance and obtained from the Inter-University Consortium for Political and Social Research (ICPSR).[11] Military spending is measured as a percentage of GDP.

3.2. Summary Statistics

Table 1 displays summary statistics for the fiscal surplus measures from 1980 to 2013. The average fiscal surplus (net lending) was –2.9 percent of GDP and the average standard deviation was 3.6 percentage points. Extreme deficits or surpluses were fairly common: 11 of the 18 countries exhibited deficits exceeding 10 percent of GDP, while 5 experienced surpluses of at least

[10] The OECD denotes these variables as "Output gap of the total economy" and "Consumer Price Index." Full- sample dividend-price ratio data are unavailable for Iceland, Ireland, and Spain, and we exclude these countries when estimating the dividend-price ratio world factor in Section 3.4.

[11] The current issue of the WMEAT is available at http://www.state.gov/t/vci/rls/rpt/wmeat/, while back issues were downloaded from http://www.icpsr.umich.edu/cocoon/ICPSR/SERIES/00061.xml. Military spending data are available through 2005. Data are unavailable for Iceland, and we exclude Iceland when estimating the military spending world factor in Section 3.4.

5 percent of GDP. Cyclically adjusted deficits were somewhat less variable than the unadjusted deficits, with a standard deviation of 3.0 percentage points. The average primary balances were near zero, indicating that government revenues nearly matched expenditures during this sample, when one excludes interest payments on previously accumulated debt.

Figure 1 shows the time series of annual fiscal surpluses for the 18 OECD countries during the 1980-2013 sample. The solid (dashed) blue lines indicate (cyclically adjusted) net lending, while the solid (dashed) red lines indicate the (cyclically adjusted) primary balance. There are a couple of patterns to note. First, the red lines (primary balances) are generally more positive than the corresponding blue lines, reflecting the fact that almost all countries paid interest on existing debt during the sample. Second, the cyclically adjusted balances (dashed lines) do not appear substantially different from the unadjusted balances (solid lines), suggesting that the cyclical adjustment have had little effect. Norway is an exception to both these observations. Norway is unusual in that its primary balances are visibly more negative than the full balances because the government receives significant revenues from asset holdings purchased by its sovereign wealth fund, which is funded by oil exports. And the cyclical adjustment significantly changes Norway's fiscal balances because the OECD's cyclically adjusted net lending and GDP variables pertain to "mainland" net lending and GDP, which excludes oil production and shipping, rather than to total GDP and net lending.[12]

Figure 1 suggests that fiscal balances tend to move together internationally; for example, fiscal situations improve in the late 1990s across countries and deteriorate very substantially after the 2008 financial crisis. We next formally measure the common component in national budget

[12] The Norwegian government owns all petroleum resources on the Norwegian continental shelf. Taxes and license fees from the petroleum sector go to the Government Pension Fund of Norway, which uses them both for long-term investment and directly for government expenditures. Oil profits are taxed at very high rates and revenues from those taxes reached $36 billion in 2011, or almost 8.6% of Norwegian GDP (Hsieh (2013)). See the following for the OECD's definition of mainland GDP: http://www.oecd.org/norway/47473811.pdf.

surpluses with the dynamic factor model.

3.3. Estimation results for national budget surpluses

For each budget surplus measure, Figure 2 shows the mean as well as the 0.10 and 0.90 quantiles of the posterior distribution for the country loadings on the world budget surplus factor. The estimated point loadings are always positive for all four measures and the interior 80 percent of the posterior distribution generally excludes zero for almost all countries for all measures.[13] Increases in the world factor thus imply rising budget surpluses for nearly every country. Japan's atypically low loadings are unsurprising in light of the particular macroeconomic challenges faced by Japan over much of the sample, including the "lost decade" of the 1990s. Norway has very low loadings for the cyclically adjusted balances, which indicate that non-business cycle international influences have little effect on its fiscal balances. This probably reflects its position as an oil exporter, which cushions international influences on its economy and budget.[14] Italy also tends to have low loadings for all four measures, which means that its high deficits over the sample have only very modest positive relation to the primary international factor that affects other countries' deficits.

Figure 3 displays the 0.10, 0.33, 0.50, 0.66, and 0.90 quantiles of the posterior distribution for the world factor in each of the four budget surplus measures.[15] We note that removing interest payments from the budget balances makes little difference to the patterns in the world factors; compare the world factor for net lending with that for the primary balance. Figure 3 illustrates significant fluctuations in the world factor for each of the fiscal measures: a fall in the early 1980s, a rise to a local maximum in 1989, another downturn to a trough in 1993, a subsequent rise leading

[13] We use the mean of the posterior distribution as the point estimate.
[14] The United Kingdom was also an oil exporter for most of the sample, but its oil exports were smaller in absolute value and much less important compared to the size of its economy and government budget.
[15] Observe that the world budget surplus factor is an index, so that a world surplus factor of zero in Figure 3 does not necessarily represent a balanced budget.

to a global maximum in 2000, a relative plateau from 2000-2006, and then a precipitous decline after the financial crisis of 2007-2009. The 80 percent posterior coverage regions generally exclude zero. Overall, Figure 3 points to substantial common fluctuations in national budget surpluses.

Figure 4 illustrates θ_i^{world} variance decompositions, which measure the extent to which international influences affect national fiscal balances. As in Figure 2, the blue circle corresponds to the mean of the posterior distribution, while the blue bars delineate 0.10 and 0.90 quantiles. On average across the 18 countries, the point estimates indicate that the world factor explains 44 percent of total variance for net lending, 28 percent for cyclically adjusted net lending, 44 percent for the primary balance, and 35 percent for the cyclically adjusted primary balance. The variance decompositions are precisely measured. The difference between the cyclically adjusted and unadjusted measures suggests that the world business cycle explains at least part of the global influence on deficits. The variation in the cyclically adjusted measures indicates that there are other important global (non-business cycle) influences or that the cyclical adjustment is inadequate.[16] In sum, Figures 2-4 illustrate that common fluctuations in OECD national budget surpluses represent a significant portion of the variability in these surpluses. These common movements in cyclically adjusted and primary balances indicate that global influences on fiscal balances extend beyond business cycle and interest rate effects.

3.4. Estimation Results for Predetermined Variables

To explain the variation in the four measures of fiscal balances, we first compute world factors for national output gaps, dividend-price ratios, unexpected inflation, and military spending, which we treat as nearly predetermined driving variables. These variables are not truly exogenous, of

[16] As expected, the β_i and θ_i^{world} estimates are positively correlated across countries, with correlation coefficients of 0.30, 0.53, 0.26, and 0.53 for net lending, cyclically adjusted net lending, primary surplus, and cyclically adjusted primary surplus, respectively.

course, but it seems reasonable to treat them as predetermined because we don't think that the factor in global fiscal balances strongly contemporaneously influences them. To test the sensitivity of our results to this quasi-exogeneity assumption, we estimation instrumental variable regressions with lagged regressors as instruments and compare the results to those of Ordinary Least Squares (OLS). The two sets of results are similar; this similarity supports the quasi-exogeneity assumption.

We compute the world factors in these variables in the same way that we computed the world factors for the fiscal balances. Figure 5 displays the mean and 0.10 and 0.90 quantiles for each country's loading on the world factor for each of the quasi-exogenous variables. The point estimates of the loadings indicate that each variable for each country is positively related to the world factor, with the exception of military spending for Japan.

Figure 6 portrays the estimated world factor for each of the predetermined variables. The world factor for the output gap displays a similar temporal pattern to that in net lending and the primary balance. The 1990s bull market in global equities is clearly evident in the dividend yield world factor (high equity prices and thus low dividend-price ratios), as well as the 2008 plunge in prices. The world factor in unexpected inflation visibly covaries positively with the world output gap factor—the correlation between the series is 0.61—in line with an expectations-augmented Phillips curve. World factors in output gaps, dividend-price ratios, unexpected inflation, and military spending fluctuate substantially from 1980 to 2013, and are reasonably precisely estimated, except for the military spending factor.[17] The world factor in military spending is very imprecisely estimated but there is a downward shift in mean in the early 1990s, shortly after the fall of the Berlin Wall. The next section formally explains the world fiscal surplus factors with the world

[17] The world factors typically explain a substantial portion of the variability in national output gaps, price-dividend ratios, unexpected inflation, and military spending, with averages across countries of 0.55, 0.57, 0.42, and 0.35 respectively. For brevity, we do not report the complete results for the variance decompositions, which are available upon request from the authors.

factors for the four predetermined variables.

4. Relating predetermined variables to budget surpluses

A priori, we expect that the output gap significantly explains net lending and primary balances but does not explain the cyclically adjusted versions of those measures. We also conjecture that the dividend- price ratio is negatively related to all fiscal balances through capital gains taxes because as stock prices exceed fundamental values government revenues will rise above typical levels. Examination of U.S. capital gains tax receipt data—omitted for brevity—indicates that such receipts can vary by almost 1 percent of GDP within a few years. Unexpected inflation could influence fiscal deficits in either direction. On the one hand, if higher unexpected inflation signals an adverse aggregate supply shock, then one would expect it to reduce fiscal surpluses. Similarly, higher unexpected inflation could increase the cost of financing the short-term portion of the debt. On the other hand, if monetary stimulus produces unexpected inflation, one might expect a larger fiscal surplus. Finally, we expect that defense spending would be negatively related to all fiscal balances. That is, we expect that taxes would not always be immediately adjusted for changes in defense spending.

To explore determinants of budget balances, we regress the world fiscal balance factors on world factors for the output gaps, dividend-price ratios, unexpected inflation, and military spending. We estimate both bivariate and multivariate regression models to contrast results and highlight the dependencies in the explanatory variables. The bivariate regression model takes the form:

(11) $$f_t^{surplus} = a + b_j f_t^j + e_t^{surplus},$$

where $f_t^{surplus}$ is the world factor for the fiscal surplus in year t and f_t^j is the world factor for one of the four explanatory variables, indexed by j—output gaps, dividend-price ratios, unexpected

inflation, and military spending. The multivariate regression is as follows:

$$f_t^{surplus} = a + \sum_{j=1}^{4} b_j f_t^j + e_t^{surplus} \ . \tag{12}$$

We estimate (11) and (12) using OLS, accounting for autocorrelation with Newey and West (1987) standard errors.

We present the regressions results with two caveats. First, the factors on both the left- and right-hand-side of the regressions are generated variables. The error in the left-hand-side variables (i.e., the world budget surplus factors) will decrease the apparent amount of predictability in the relations, causing the estimated R^2 to understate the R^2 that is theoretically expected, in the absence of measurement error, because the estimated total sum of squares will exceed the total sum of squares without measurement error. Likewise, the error in the predetermined variables on the right-hand-side will attenuate their estimated coefficients toward zero and thus inflate their *p*-values. Therefore, the error in the factor estimation will cause our regressions to present a conservative picture of the relation between the fiscal surpluses and predetermined variables.

Second, we view the right-hand-side variables in (11) and (12) as nearly predetermined. Strictly speaking, these variables are endogenous, meaning that the coefficients will be subject to simultaneity bias. We believe that the explanatory variables are largely predetermined, however, and unlikely to exhibit strong contemporaneous reactions to fiscal balances. Therefore, we do not believe that simultaneity bias will strongly influence our results.[18]

Table 2 presents the bivariate and multiple regression results for all four fiscal surplus measures. The sample is 1980–2013, except for regressions including military spending, for which the sample is 1980-2010. Given that including military spending reduces the sample

[18] Our exercise is similar in spirit to Crucini, Kose, and Otrok (2011) in the context of explaining the G-7 business cycle. They first estimate a world factor in G-7 real output growth rates, which they then explain using world factors in G-7 measures of productivity, fiscal policy, monetary policy, oil prices, and terms of trade.

length, is imprecisely estimated, and very persistent, we estimate multiple regression models both with and without this variable.

In the bivariate regressions, the output gap factor is positive and significant at the 1 percent level for all four fiscal measures, presumably through the familiar tax and spending channels. International business cycle fluctuations have the most explanatory power for the unadjusted surpluses: net lending and the primary balance, with R^2 statistics of 73 and 59 percent, respectively. This is not surprising as it would be expected that cyclical adjustment would remove some or all international influences. The explanatory power of the output gap factor for the cyclically adjusted surpluses is surprisingly big, however, with very sizable R^2 statistics of 41 and 24 percent for the cyclically adjusted net lending and cyclically adjusted primary balance, respectively. The OECD's cyclical adjustments apparently do not completely capture international business cycle effects on budgets.

Consistent with the idea that higher equity prices increase capital gains tax revenues, the dividend-price ratio factor is significantly negatively related to cyclically adjusted net lending, the primary balance, and cyclically adjusted primary balance factors in the bivariate regressions. The R^2 statistics are sizable, 15, 18 and 28 percent for cyclically adjusted net lending, the primary balance, and cyclically adjusted primary balance, respectively. Our results indicate that global bull (bear) equity markets significantly raise (decrease) the primary balance in industrialized countries. The dividend-price ratio factor is not significantly related to the net lending factor, although the relationship is nearly significant at the 10 percent level. The dividend-price factor explains more of the variability in primary balances than in the non-primary surpluses. A systematic relationship between global equity valuations and interest rates could create this difference.

The unexpected inflation factor significantly explains net lending, cyclically adjusted net

lending, and the primary balance in the bivariate regressions. The $R^{2\prime}$s are modest, at 8 to 16 percent. As noted in Section 3.4, the unexpected inflation factor is positively correlated with the output gap factor, so that the significantly positive coefficients on the unexpected inflation factor likely capture similar business cycle effects.

The military spending factor is significant at the 1 percent level in the bivariate regression model for net lending and the primary balance but not the cyclically adjusted measures. The R^2 statistics are modest, 11 percent for each of those two measures. The estimated positive coefficients are counterintuitive; they likely reflect long term trends up in deficits as military spending as a percentage of GDP declines. Thus, they are a spurious product of a regression with very persistent variables.

In the multiple regressions, the output gap, the dividend-price ratio, and military spending factors are significant at conventional levels for all four measures. The significance of the output gap factor confirms that the cyclical adjustments do not completely capture international business cycle effects. Unexpected inflation coefficients are no longer significant in any of the multiple regressions, probably because the unexpected inflation factor is strongly correlated with the output gap factor. The military spending factor significantly explains all of the fiscal surplus factors at conventional levels. Importantly, the signs of the coefficient on the military spending factor become reliably and significantly negative, as one would expect, when the other variables are controlled for. The R^2 statistics in the sixth column of Table 2 show that world factors in the four predetermined variables collectively explain most of the variability in the global budget surplus factors, especially for net lending and the primary balance, where the R^2 statistics are 87 and 78 percent, respectively.

The imprecise estimation and strong persistence in the military spending variable are causes for concern. Therefore we also estimate the multiple regression without the military variable and

use a 1980-2010 sample. In this specification, the output gap and dividend-price ratio factors remain significant at the one percent level for each of the four surplus factors. The unexpected inflation factor remains insignificant at conventional levels in each of the four regressions. The R^2 statistics continue to be substantial in the final column of Table 2, ranging from 51 to 81 percent.

In summary, Table 2 indicates that the output gap, price-dividend ratio, and military spending world factors substantially determine fluctuations in fiscal surplus world factors. Unexpected inflation also has predictive value when considered by itself but not in conjunction with the other variables. Global expansions, bullish equity markets, and reduced military spending improve fiscal balances across industrialized countries.[19]

5. Idiosyncratic components

Our method of investigating international influences on fiscal balances permits us to isolate the effect of domestic events on fiscal balances. That is, we can examine the common and idiosyncratic components of budget surpluses to determine the effect of domestic events or policies. Figure 7 displays common and idiosyncratic components for selected countries' net lending.[20]

The top left panel of Figure 7 shows demeaned U.S. net lending and its two components, the common component—the product of the world factor and its loading—and the U.S. idiosyncratic

[19] We also estimated fixed-effects panel regression models with national fiscal surpluses serving as regressands and national output gaps, price-dividend ratios, unexpected inflation, and military spending serving as regressors. (The complete results are not reported for brevity and are available upon request from the authors.) The national output gap and military spending are significant determinants of national net lending and cyclically adjusted net lending, while the national output gap, dividend-price ratio, and military spending are significantly related to the national primary balance and cyclically adjusted primary balance. Of course, panel estimation does not explicitly identify world factors in national budget surpluses and their determinants—the focus of this paper—but it does appear to pick up aspects of the links that we document in Table 2.

[20] The complete set of common and idiosyncratic components are available upon request from the authors.

component. Demeaned net lending is the sum of the common and idiosyncratic components, of course. Note that because net lending is demeaned and the sample mean for U.S. net lending was –5.1 percent, values of demeaned net lending near zero still indicate fairly high deficits. The figure illustrates that both global and idiosyncratic components contributed to all the major movements in U.S. net lending. For example, both components contributed to the increase in deficits —i.e., fall in net lending—in the early 1980s and the movement from substantial deficits to surplus in the 1990s. The substantial deterioration in the U.S. fiscal balance in 2001 partly reflected the common component but was mostly due to the U.S. idiosyncratic component, however. That is, U.S. factors—such as the 2001 tax cuts, the September 11th attacks, and the wars in Afghanistan and Iraq—bore the lion's share of the blame for the decline in the fiscal situation during that period. The fastest changes in U.S. net lending came during the 2008 financial crisis, however, again driven by big declines in both the common and idiosyncratic components.

The upper right panel of Figure 7 portrays the idiosyncratic components for a pair of highly indebted European countries, Belgium and Greece. The idiosyncratic components were quite different in these two countries during the 1980s. Both countries, however, faced pressure in the 1990s to reduce their debt and deficits to levels required by the Maastricht Treaty for entry into the European Economic and Monetary Union on January 1, 1999. This regional influence is clearly evident during the rise in these countries' idiosyncratic components during the 1990s.

The lower left panel of Figure 7 shows the common and idiosyncratic components for Sweden and highlights the important fiscal effect of the Swedish banking crisis of 1990-1994. During the late 1980s, the idiosyncratic component contributed to a marked improvement in Sweden's fiscal surplus. With the advent of the banking crisis in 1990, however, Sweden was forced to spend relatively large sums recapitalizing its banking systems, resulting in a sharp decrease in the

idiosyncratic component of net lending during the early 1990s. The common component also decreased in the early 1990s, so that the early 1990s were characterized by a steep decline in overall Swedish net lending. As one might expect, the resolution of the banking crisis led to a sizable increase in the idiosyncratic component during the late 1990s.

Finally, the lower right panel of Figure 7 illustrates the importance of the oil market for Norway. In addition to the Norwegian idiosyncratic component, the figure shows the value of Norwegian oil exports as a share of GDP. The two variables generally move together, indicating that oil revenues are especially important for improving the fiscal situation in Norway. Observe, however, that oil revenues moved up while the idiosyncratic component moved down around 1990. This likely reflects the influence of the Scandinavian banking crisis that affected Norway and started earlier than the Swedish crisis (Vale, 2004). The increase in oil revenues during this time helped to cushion the negative budgetary impulse of the banking crisis.

In summary, decomposing net lending into common and idiosyncratic components allows us to more easily evaluate the effects of domestic events and policies on a country's fiscal situation.

6. Conclusion

The emergence of the prospect of unprecedented deficits in the United States has rekindled interest in the causes of such imbalances and the question of responsibility for them. Properly addressing these imbalances requires understanding their sources and influences, including international influences.

While researchers, such as Roubini and Sachs (1989), have examined how political polarization might affect deficits, and others, such as Lane (2003), have evaluated the cyclicality of deficits, there has been no significant previous work on internationally driven comovements in deficits. This paper identifies substantial international comovements in four budget surplus

measures for 18 OECD countries for 1980-2013 with a dynamic latent factor model. Depending on the measure of the fiscal surplus, the world factor explains 28 to 44 percent of surplus variability, on average, across countries. The world factor explains 47 percent of the variation in U.S. net lending, for example.

World factors in national output gaps, dividend-price ratios, and military spending usually significantly explain variation in the four world fiscal surplus factors. Surprisingly, the output gap factor significantly explains not only the net lending and primary balance factors, but the cyclically adjusted versions of those measures. This indicates that the OECD cyclical adjustments do not completely remove the contribution of the international business cycle on fiscal balances. The importance of the world dividend-price ratio factor highlights the role of global equity market conditions in affecting fiscal balances, while the significance of the military spending factor points to the effect of an international peace dividend in the 1990s.

Our results show that international business cycle, equity market, and military spending trends create common fluctuations in national budget surpluses. The discovery of a significant global factor in international budget deficits suggests avenues for future research. What global political economy incentives influence fiscal balances? Do individual governments respond optimally to these international shocks? Can individual country characteristics explain varying sensitivities of national fiscal balances to international influences? Our findings highlight the relevance of such questions.

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Table 1
Summary statistics for annual budget surpluses, 18 OECD countries, 1980-2013

	Mean	Std. dev.	Minimum	Maximum	Mean	Std. dev.	Minimum	Maximum
Net lending as a share of GDP					Cyclically adjusted net lending as a share of potential GDP			
Australia	–0.015	0.025	–0.051	0.024	–0.013	0.023	–0.050	0.023
Austria	–0.029	0.014	–0.059	–0.002	–0.028	0.011	–0.055	–0.002
Belgium	–0.052	0.045	–0.160	0.004	–0.049	0.041	–0.157	0.004
Canada	–0.033	0.037	–0.090	0.029	–0.033	0.032	–0.088	0.014
Denmark	–0.011	0.038	–0.110	0.050	–0.009	0.028	–0.090	0.040
Finland	0.012	0.041	–0.082	0.070	0.015	0.028	–0.039	0.062
France	–0.035	0.016	–0.075	–0.003	–0.035	0.014	–0.069	–0.008
Greece	–0.082	0.031	–0.156	–0.023	–0.079	0.035	–0.170	–0.023
Iceland	–0.019	0.041	–0.135	0.063	–0.018	0.039	–0.169	0.040
Ireland	–0.051	0.072	–0.306	0.049	–0.048	0.062	–0.257	0.022
Italy	–0.067	0.039	–0.123	–0.009	–0.065	0.038	–0.121	0.003
Japan	–0.041	0.035	–0.103	0.021	–0.040	0.031	–0.096	0.009
Netherlands	–0.031	0.024	–0.092	0.020	–0.029	0.022	–0.082	0.007
Norway	0.078	0.057	–0.019	0.188	–0.011	0.018	–0.057	0.022
Spain	–0.047	0.036	–0.111	0.024	–0.043	0.028	–0.108	0.007
Sweden	–0.013	0.040	–0.112	0.036	–0.011	0.029	–0.073	0.028
United Kingdom	–0.036	0.033	–0.112	0.058	–0.034	0.028	–0.100	0.055
United States	–0.051	0.030	–0.128	0.008	–0.046	0.025	–0.110	–0.003
Average	–0.029	0.036	–0.112	0.034	–0.032	0.030	–0.105	0.017
Primary balance as a share of GDP					Cyclically adjusted primary balance as a share of potential GDP			
Australia	0.000	0.022	–0.047	0.032	0.002	0.019	–0.045	0.033
Austria	–0.004	0.013	–0.025	0.025	–0.003	0.011	–0.022	0.019
Belgium	0.017	0.037	–0.088	0.064	0.020	0.035	–0.085	0.066
Canada	–0.006	0.035	–0.064	0.059	–0.005	0.031	–0.056	0.056
Denmark	0.016	0.038	–0.080	0.090	0.018	0.028	–0.057	0.078
Finland	0.009	0.040	–0.087	0.079	0.012	0.028	–0.043	0.072
France	–0.012	0.015	–0.053	0.011	–0.012	0.012	–0.047	0.006
Greece	–0.023	0.035	–0.107	0.038	–0.020	0.039	–0.120	0.043
Iceland	–0.003	0.038	–0.135	0.067	–0.003	0.039	–0.169	0.044
Ireland	–0.012	0.069	–0.280	0.067	–0.010	0.064	–0.233	0.072
Italy	0.003	0.032	–0.065	0.060	0.005	0.033	–0.071	0.060
Japan	–0.031	0.037	–0.091	0.032	–0.029	0.034	–0.084	0.026
Netherlands	0.000	0.023	–0.048	0.049	0.002	0.021	–0.045	0.037
Norway	0.059	0.057	–0.048	0.161	–0.030	0.020	–0.086	–0.007
Spain	–0.024	0.038	–0.097	0.037	–0.020	0.028	–0.095	0.021
Sweden	0.000	0.039	–0.101	0.057	0.000	0.032	–0.068	0.050
United Kingdom	–0.010	0.033	–0.097	0.081	–0.008	0.031	–0.085	0.079
United States	–0.017	0.031	–0.100	0.036	–0.014	0.027	–0.083	0.030
Average	–0.002	0.035	–0.090	0.058	–0.005	0.029	–0.083	0.044

Note: “Average” is the average across all of the countries.

Table 2
OLS estimation results, bivariate and multiple regression models, 1980-2013

	Bivariate regression			Multivariate regression			Multivariate regression, excluding military spending		
Regressor	Coefficient	*t*-statistic	R^2	Coefficient	*t*-statistic	R^2	Coefficient	*t*-statistic	R^2
A. Regressand = Net lending, world factor									
Output gap, world factor	0.99	(7.72)	0.73	1.17	(9.07)	0.87	1.01	(7.62)	0.81
Dividend-price ratio, world factor	–0.56	–(1.59)	0.09	–0.69	–(4.09)		–0.52	–(4.17)	
Unexpected inflation, world factor	2.53	(2.76)	0.16	–0.25	–(0.56)		–0.26	–(0.56)	
Military spending, world factor	0.08	(2.78)	0.11	–0.04	–(2.11)				
B. Regressand = Cyclically adjusted net lending, world factor									
Output gap, world factor	0.61	(3.99)	0.41	0.81	(5.27)	0.69	0.63	(4.08)	0.55
Dividend-price ratio, world factor	–0.57	–(2.12)	0.15	–0.86	–(4.26)		–0.55	–(2.87)	
Unexpected inflation, world factor	1.43	(1.90)	0.08	–0.06	–(0.10)		–0.30	–(0.43)	
Military spending, world factor	0.04	(1.47)	0.04	–0.08	–(2.54)				
C. Regressand = Primary balance, world factor									
Output gap, world factor	0.86	(5.80)	0.59	0.93	(4.25)	0.78	0.87	(5.08)	0.76
Dividend-price ratio, world factor	–0.74	–(2.53)	0.18	–0.93	–(6.24)		–0.70	–(5.38)	
Unexpected inflation, world factor	2.11	(2.02)	0.12	0.15	(0.19)		–0.29	–(0.37)	
Military spending, world factor	0.07	(2.21)	0.11	–0.06	–(2.89)				
D. Regressand = Cyclically adjusted primary balance, world factor									
Output gap, world factor	0.48	(2.69)	0.24	0.55	(2.18)	0.58	0.49	(2.44)	0.51
Dividend-price ratio, world factor	–0.81	–(3.71)	0.28	–1.11	–(6.34)		–0.79	–(4.45)	
Unexpected inflation, world factor	1.05	(1.10)	0.04	0.32	(0.34)		–0.30	–(0.30)	
Military spending, world factor	0.04	(1.49)	0.05	–0.08	–(2.78)				

Notes: *t*-statistics are based on Newey-West standard errors. The sample is 1980-2010 for regression models that include military spending, world factor as a regressor.

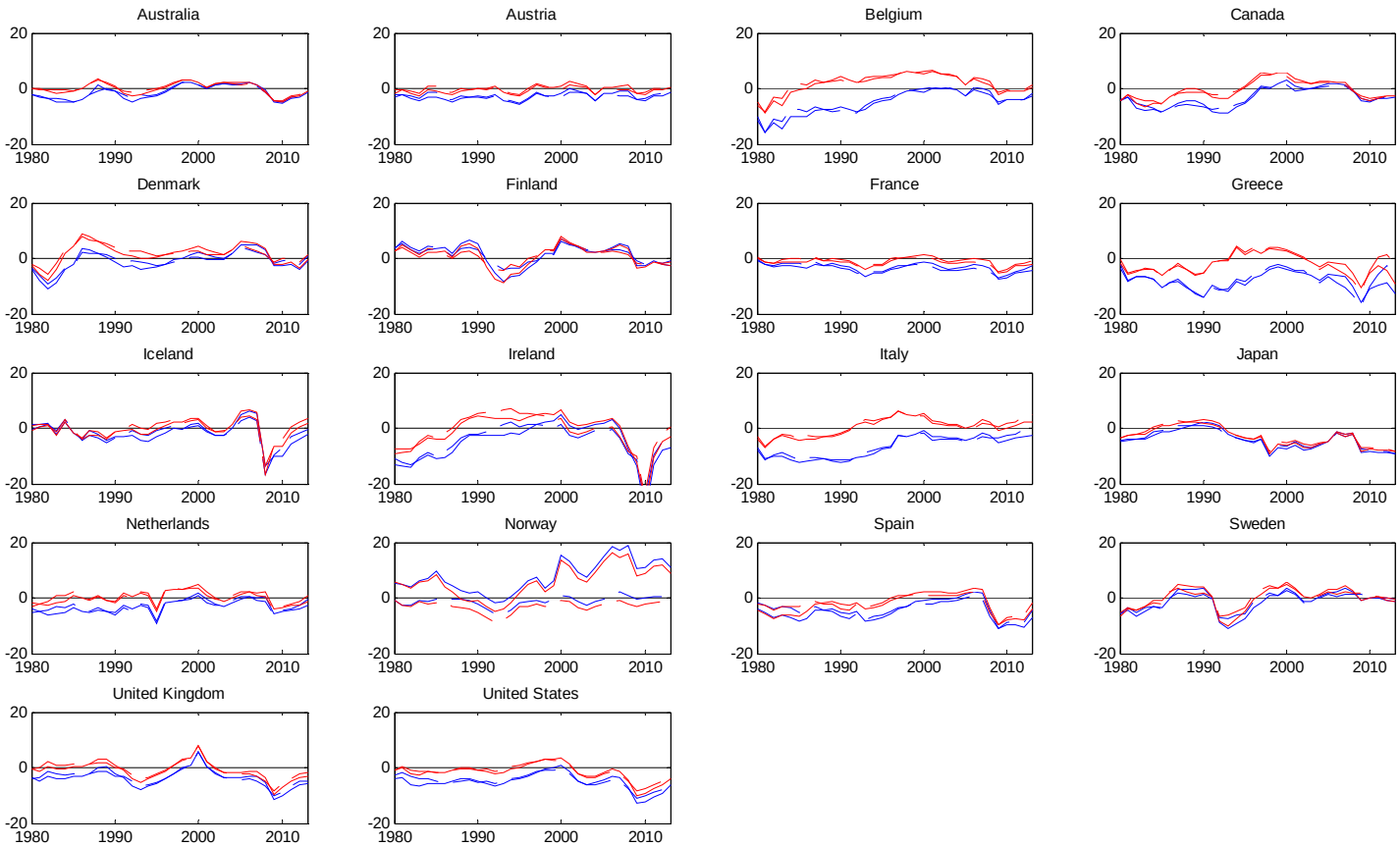

Fig. 1. Annual budget surpluses, 18 OECD countries, 1980-2013. Solid blue line is net lending as a share of GDP; dashed blue line is cyclically adjusted net lending as a share of potential GDP; solid red line is primary balance as a share of GDP; dashed red line is cyclically adjusted primary balance as a share of potential GDP.

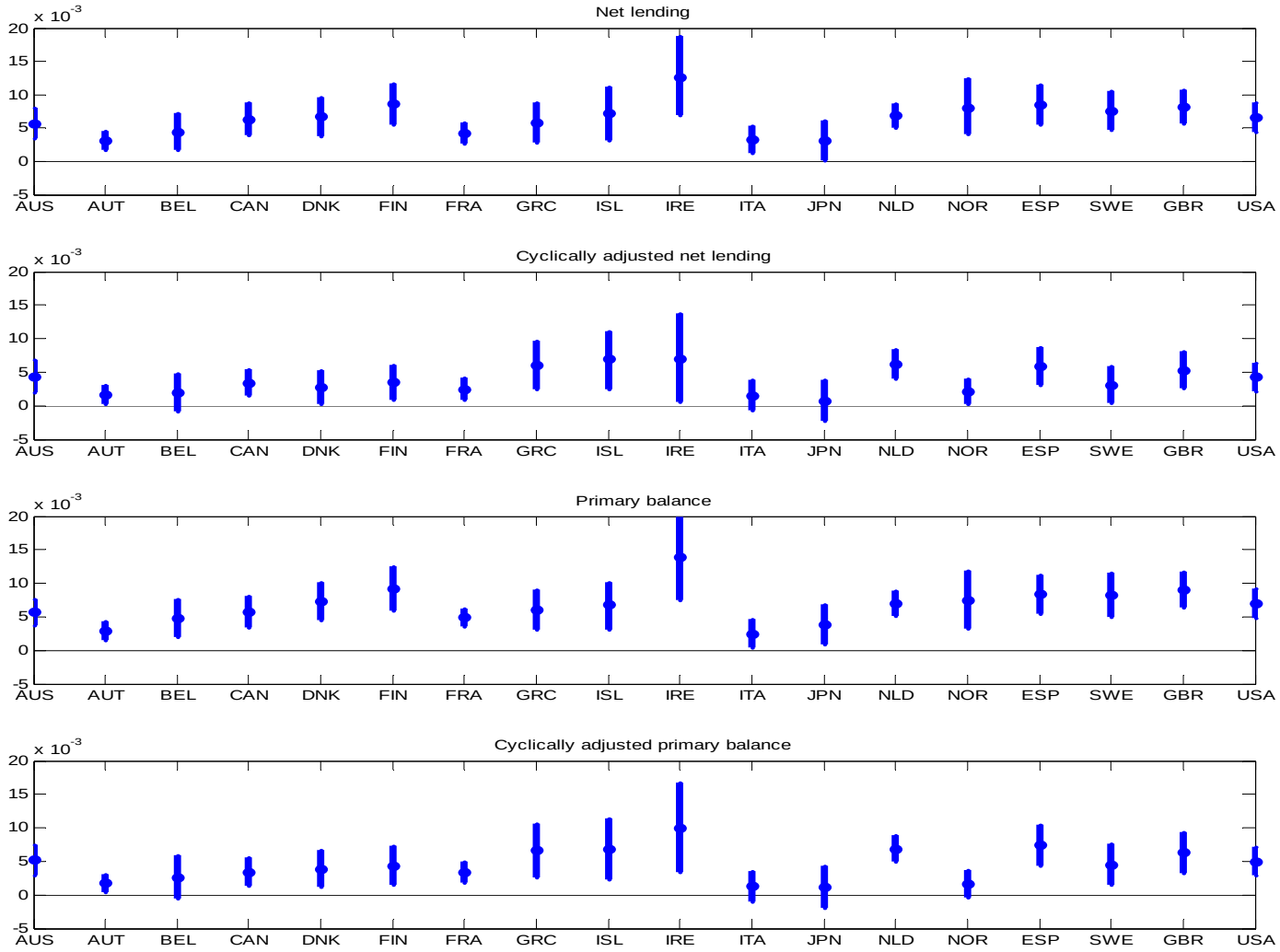

Fig. 2. Loadings on the world factor for budget surpluses, 1980-2013. Circle indicates the mean and vertical bars delineate 0.10 and 0.90 quantiles for the posterior distribution.

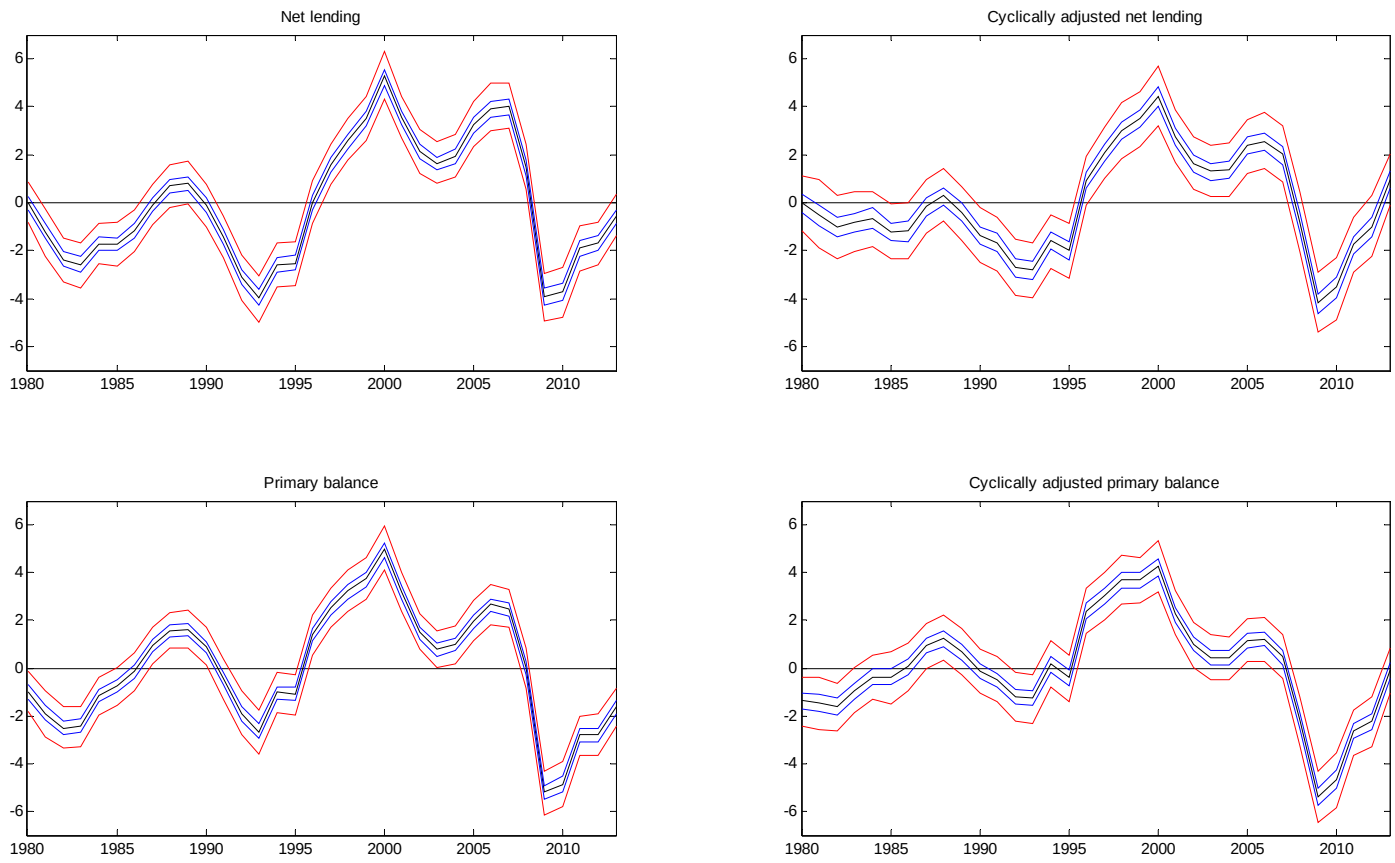

Fig. 3. World factors for budget surpluses, 1980-2013. Black line delineates the mean of the posterior distribution. Blue (red) lines delineate the 0.33 and 0.66 (0.10 and 0.90) quantiles for the posterior distribution.

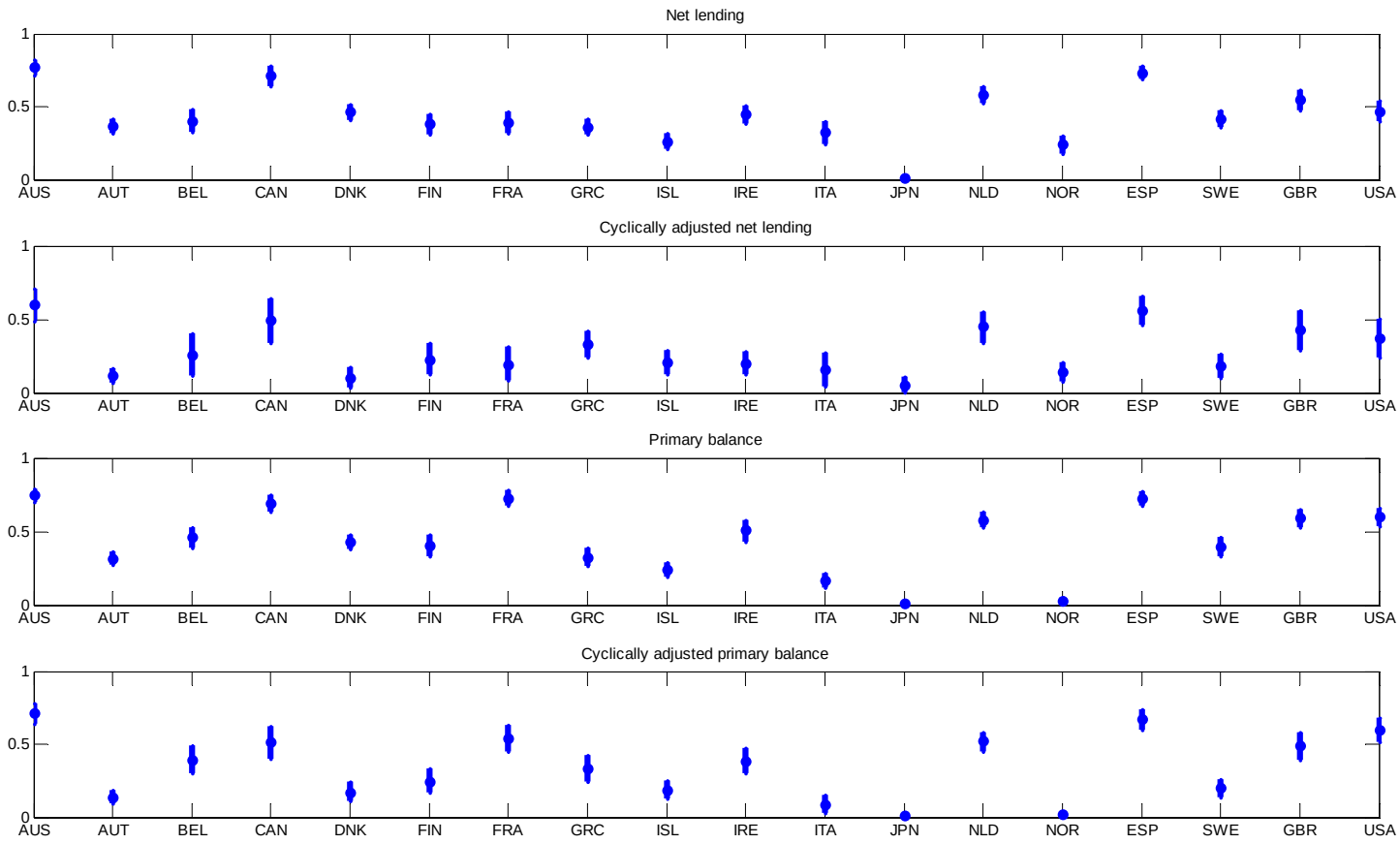

Fig. 4. θ_i^{world} variance decompositions for budget surpluses, 1980-2013. Circle indicates the mean and vertical bars delineate 0.10 and 0.90 quantiles for the posterior distribution. "Average" is the average of the posterior means across all of the countries.

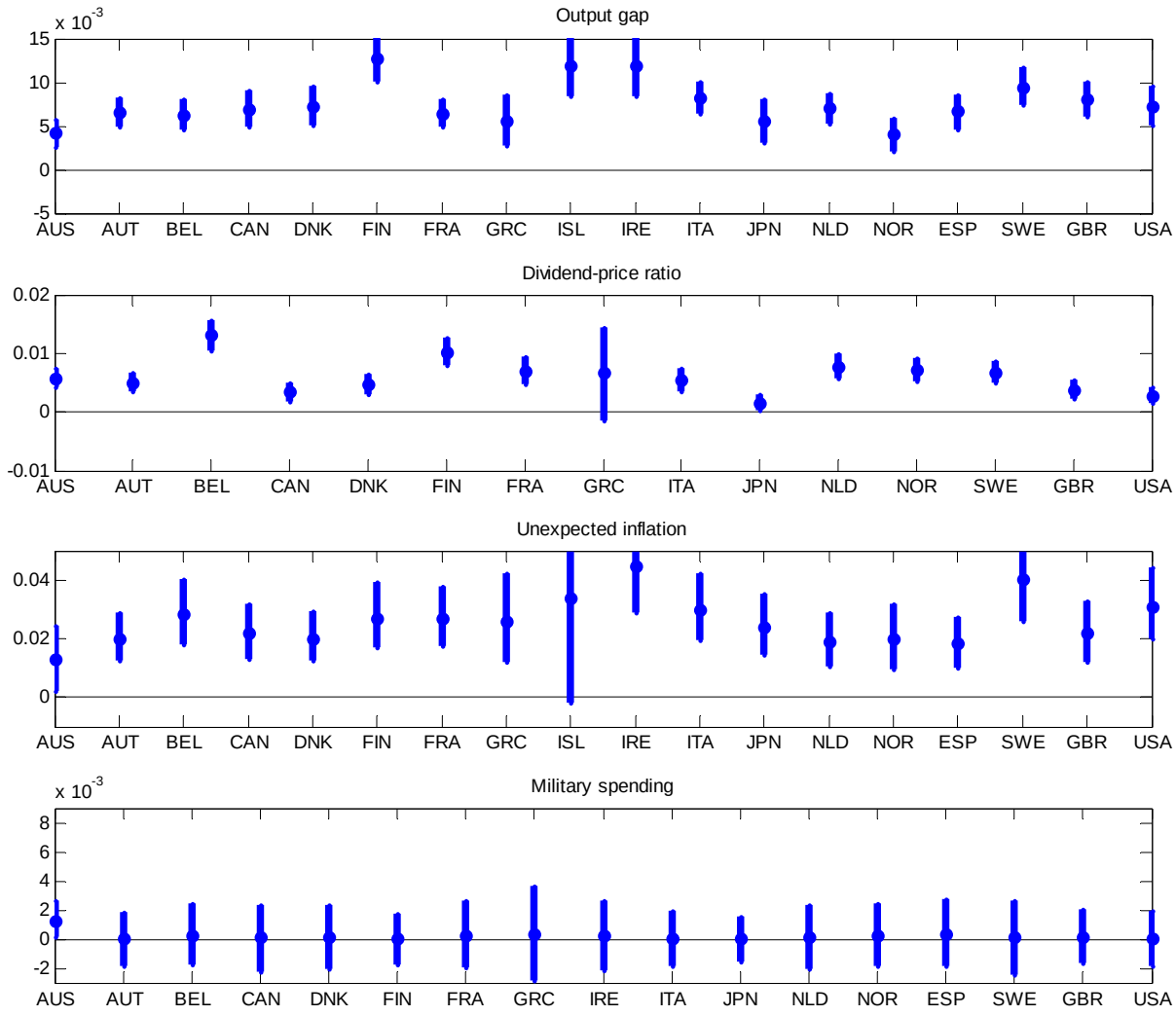

Fig. 5. Loadings on the world factor for predetermined variables, 1980-2013. Circle indicates the mean and vertical bars delineate 0.10 and 0.90 quantiles for the posterior distribution. Estimated loadings for military spending are based on data for 1980-2010.

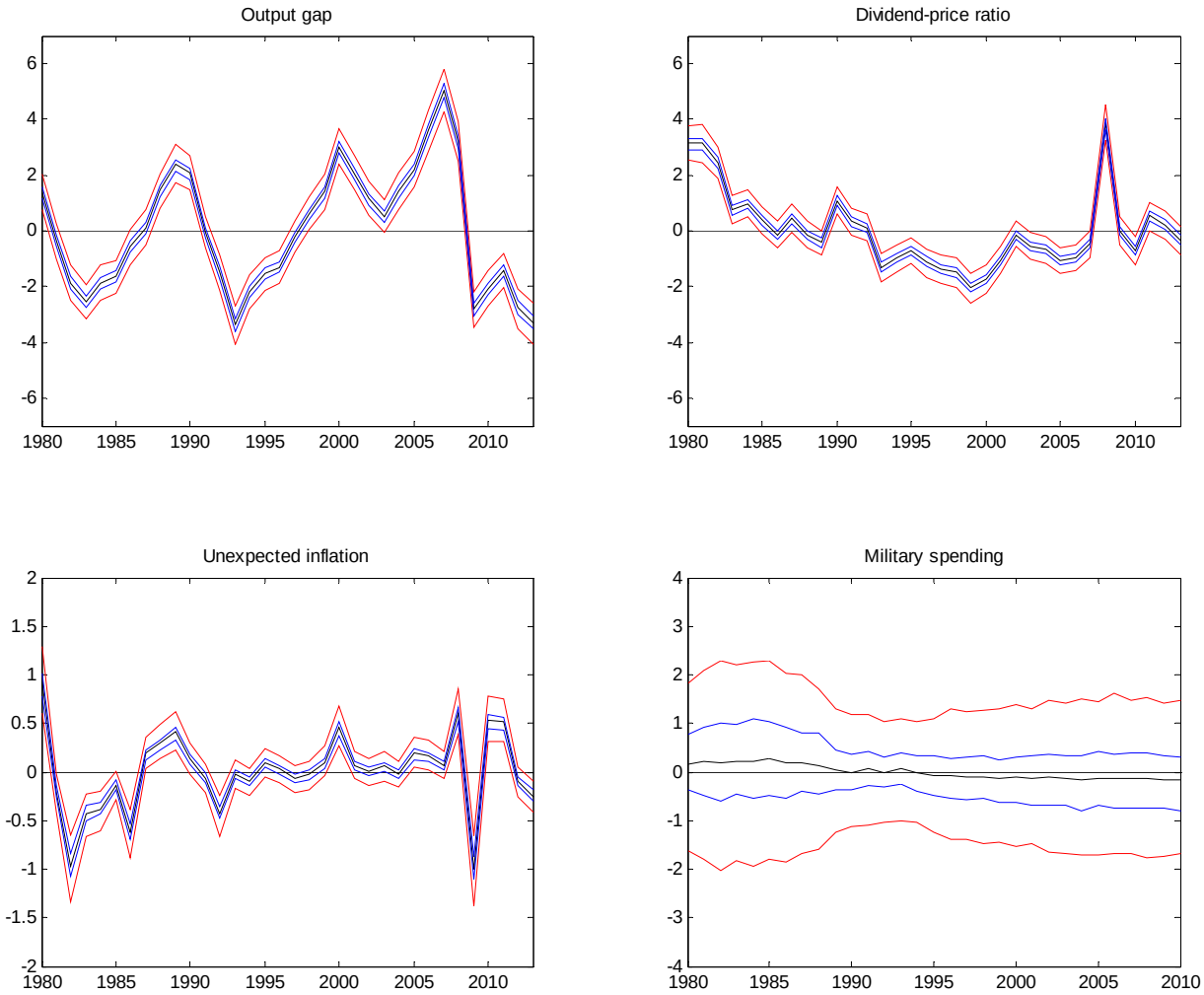

Fig. 6. World factors for predetermined variables, 1980-2013. Black line delineates the mean of the posterior distribution. Blue (red) lines delineate the 0.33 and 0.66 (0.10 and 0.90) quantiles for the posterior distribution. The world factor for military spending is estimated for 1980-2010.

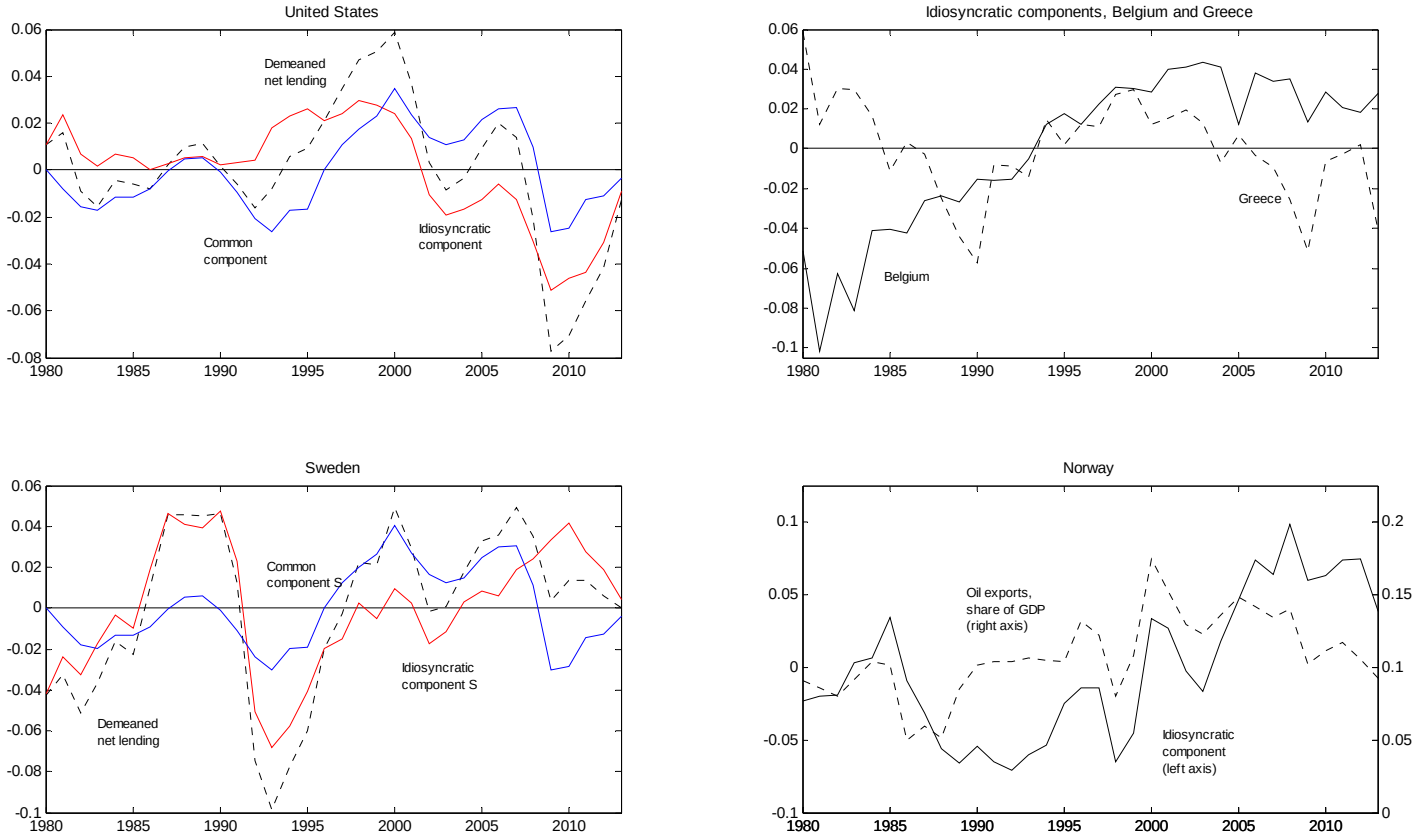

Fig. 7. Common and idiosyncratic components for demeaned net lending, 1980-2013, selected countries.