Global and country-specific business cycle risk in time-varying excess returns on asset markets

Thomas Nitschka

SCHWEIZERISCHE NATIONALBANK
BANQUE NATIONALE SUISSE
BANCA NAZIONALE SVIZZERA
BANCA NAZIUNALA SVIZRA
SWISS NATIONAL BANK

2012-10

Swiss National Bank Working Papers

ISSN 1660-7716 (printed version)
ISSN 1660-7724 (online version)

Global and country-specific business cycle risk in time-varying excess returns on asset markets

Thomas Nitschka[1]

Swiss National Bank

Abstract

Deviations of national industrial production indexes from trend explain time variation in excess returns on the G7 countries' stock markets. This paper highlights that this finding is driven by a global, common component in the national production gaps. The global component is not a mirror image of the U.S. business cycle. Quite to the contrary, a "rest-of-the-world" production gap explains time variation in U.S. stock market excess returns while the U.S.-specific production gap does not. However, both U.S.-specific and global gap components explain time-varying excess returns on U.S. bonds. The relative importance of the U.S.-specific risk gap increases with the maturity of bonds.

JEL: E32, F44, G15

Keywords: bond return, business cycle risk, excess returns, industrial production, predictability, stock return

[1] Mailing address: Thomas Nitschka, Monetary Policy Analysis, Swiss National Bank, Börsenstrasse 15, P.O. Box, CH-8022 Zurich;
Phone: +41-(0)44-6313628; FAX : +41 (0)44 6313175 ; E-mail: thomas.nitschka@snb.ch
The paper benefitted from comments and suggestions by Jonathan Benchimol (discussant), an anonymous referee of the SNB working paper series as well as participants in a SNB Brown Bag Seminar, the BMRC-QASS 2012 conference on Macro and Financial Economics, the 4th IFABS conference and the 29th GdRE Annual International Symposium on Money, Banking and Finance. Any errors and omissions are my own. The views expressed in this paper do not necessarily reflect the stance of the Swiss National Bank.

1 Introduction

Basic asset pricing theory suggests that time series and cross-sectional variation in asset returns should be related to macroeconomic risk factors. In line with theory and earlier evidence (see Cochrane (2005) for an excellent survey of the literature), Cooper and Priestley (2009) show that the deviation of industrial production from trend (production gap) or output from trend (output gap) predicts excess returns on the U.S. stock and bond market in- and out-of-sample. A negative production gap predicts high excess returns and vice versa. The in-sample forecasting power of national production gaps for national stock market returns pertains also to the other G7 countries.

This latter finding is particularly interesting for at least two reasons. First, in contrast to the production gap, the record of other purely macroeconomic forecast variables for stock market returns is rather mixed in international comparison.[2] For instance, short-run variation in the U.S. consumption-wealth ratio predicts U.S. stock market returns (Lettau and Ludvigson, 2001). This finding also pertains to consumption-wealth ratios of other Anglo-Saxon countries (Fernandez-Corugedo et al., 2003; Fisher and Voss, 2004; Tan and Voss, 2003; Ioannides et al., 2006) but their German or Japanese counterparts do not predict the respective German or Japanese stock market excess returns (Hamburg et al., 2008; Nagayasu, 2009). Second, the G7 countries' industrial production gaps are significantly and positively correlated with each other. Correlations of around 0.5 are common. Hence, a priori, it is not clear if the predictive power of the national production gaps is the outcome of common, global variation in production gaps or due to their country-specific dynamics.

Earlier studies highlight the importance of global financial market risk factors as explanation of national stock markets' time variation (e.g. Bekaert and Harvey, 1995; Campbell and Hamao, 1992; Chan et al., 1992; Dumas and Sonik, 1995; Ferson and Harvey, 1993; Harvey,

[2] Rangvid (2006) scales stock prices with GDP to show that this stock price to GDP ratio is a powerful predictor of stock market returns internationally. By construction, however, this is not a purely macroeconomic variable.

1991). Moreover, Guo (2006) and Nitschka (2010) provide evidence for the impact of global, business cycle related risk on national stock markets by showing that the U.S. consumption-wealth-ratio does not only predict U.S. but also foreign stock market returns. Recently, Cooper and Priestley (2012) show that swings in the world capital stock to output ratio predict national stock market returns of developed countries in- and out-of-sample.

The main empirical results of this paper support the view that global macroeconomic risk plays an important role for explanations of time-variation in expected asset returns. The evidence presented in this paper reveals that stock market return predictability by national production gaps is primarily driven by common variation in the production gaps. The main findings of this paper are robust to a range of controls, hold across subsample periods, pertain at different forecast horizons, remain qualitatively unaltered when data is measured at lower than the monthly frequency and are supported in statistical tests of out-of-sample predictability.

Assessments of the importance of global risks for time variation in stock market excess returns have typically relied on regressions of foreign stock market returns on U.S. forecast variables so far. The predictive power of the U.S. variables has been interpreted as evidence for the presence of a common component in stock market returns (e.g. Campbell and Hamao, 1992; Guo, 2006; Nitschka, 2010). This paper differs from these studies. It provides direct evidence for the presence of global macroeconomic risk driving time variation in stock market returns. This paper thus adds complementary insights to Cooper and Priestley (2012) who reveal the explanatory power of world business cycle fluctuations, measured in the world capital stock to output ratio, on national stock market returns. The world capital stock to output ratio, however, features also the U.S. capital stock to output ratio which could be a major driver of their results. The approach followed in this paper allows to address such concerns.

Moreover, this paper reveals that foreign macroeconomic risk is important in order to explain time variation in excess returns on the U.S. stock market. To the best of my knowledge, there has been little evidence of the impact of foreign macroeconomic risk on U.S. stock market risk premia so far. I exploit this latter finding to assess the relative importance of global and country-specific risk for the explanatory power of the U.S. production gap for U.S. bond excess returns too. This paper finds that both global and U.S.-specific parts of the U.S. production gap explain time variation in U.S. bond excess returns. This observation echoes recent evidence by Dahlquist and Hasseltoft (2011) who show that both global and local versions of the Cochrane and Piazzesi (2005) bond risk factor simultaneously predict bond excess returns in the US, UK, Germany and Switzerland. Despite evidence for the importance of global risk for national bond excess returns (Borri and Verdelhan, 2011; Cooper and Priestley, 2012; Ilmanen, 1995), country-specific macroeconomic dynamics hence also play an important role in explaining bond excess returns.

Taken together, the main findings of this paper reinforce the point that truly global business cycle risk, not necessarily coinciding with U.S. macroeconomic risk, is an important explanation of time-varying excess returns on national asset markets. This is particularly true for stock markets but the empirical analysis of this paper also shows that global risk is important to understand dynamics of bond excess returns. However, the impact of country-specific macroeconomic risk is not negligible in that context. This paper thus contributes to recent studies that deal with the question if common (macroeconomic) risk factors drive different asset markets (e.g. Asness et al., 2011; Bansal and Shaliastovich, 2010; Bekaert et al., 2009; Hasseltoft, 2010; Koijen et al., 2010; Verdelhan, 2011).

It is important to bear in mind that this paper assesses the importance of global vs. country-specific risk embedded in one single macroeconomic forecast variable. This paper does not assess the general question how strongly global or country-specific macroeconomic risk affect time series variation in asset returns. There is evidence that global macroeconomic risk plays an important role in this respect and this paper supports this view. But this is not tantamount to saying that country-specific risks play no role. A number of studies provide evidence for the importance of local risk factors in asset returns, especially in emerging markets. Examples include Bekaert (1995) and Harvey (1995) who show that local factors are important when assessing the predictability of emerging stock market's risk premia or Bekaert et al. (2007) who highlight the importance of country-specific liquidity risk in emerging countries' stock market returns.

The remainder of the paper is structured as follows. Section 2 provides information about the data employed in this study as well as the calculation of the production gap. Section 3 presents the econometric framework and the main empirical results for the predictability of stock market returns. Section 4 assesses the impact of global and country-specific business cycle risk on U.S. bond excess returns. Section 5 concludes. The appendix addresses a more general point and shows that it is appropriate to neglect the potential feedback of stock returns on the real economy in the present context.

2 Data, definition of production gap and excess returns

Country coverage and baseline sample period

The countries under study are Canada, France, Germany, Italy, Japan, the UK and the US. The baseline sample period runs from January 1970 to February 2011. Due to limited data availability, the sample period for the U.S. bond predictability assessment spans only the period from January 1970 to December 2003.

Definition of production gap

To calculate the production gaps, I follow Cooper and Priestley (2009) and regress the natural logarithm of each of the G7 countries' monthly and seasonally adjusted industrial production indexes from the IMF's Financial Statistics on a linear and quadratic time trend, i.e.

$$ip_t^i = \alpha + \beta trend + \gamma trend^2 + \varepsilon_t^i \qquad (1)$$

in which ip_t^i represents the log industrial production index of country *i* at time *t, trend* denotes a time trend and the residual of this regression, ε_t^i, constitutes the production gap as defined in Cooper and Priestley (2009)[3]. The production gap for country *i*, ε_t^i, is henceforth denoted gap_t^i.

Stock market excess returns

I use monthly returns on the G7 countries' MSCI gross stock indexes, i.e. indexes that assume dividends are reinvested, denominated in local currency and monthly short-term interest rates from the IMF's Financial Statistics to calculate stock market excess returns. The logarithmic excess return is defined as the log stock market return at the end of the month minus the short-term interest rate at the end of the previous month, $r_{t+1}^i - r_t^f$. The short-term interest rates are treasury bill rates for Canada, the UK and the U.S. and money market rates for France, Germany, Italy and Japan. They are obtained from the IMF's International Financial Statistics. The stock market index data are freely available on www.msci.com.

All of the results presented in the subsequence remain unaffected if I use price indexes, i.e. indexes which assume that dividend payments are not reinvested, or stock indexes denominated in U.S. dollar instead of local currencies. Neither dividend growth nor exchange rate changes are predictable by the production gap varieties considered in this paper. In addition, all of the results remain qualitatively unaffected if I consider real stock market returns instead of excess returns in the forecast regressions. These results are not presented but available upon request.

U.S. bond excess returns

Annual U.S. bond excess returns at the monthly frequency are obtained from borrowing at the one-year yield on a one-year maturity bond in a given month, buying a longer-term (two to

[3] Cooper and Priestley (2009) consider four different definitions of an output gap for the U.S., but for reasons of data availability focus on the one obtained from equation (1) in their assessment of the G7 countries.

five years) bond and selling that longer-term bond after one year, i.e. the bond excess return obeys

$$brx_{t+1}^{N} = p_{t+1}^{N-1} - p_{t}^{N} - y_{t}^{1} \qquad (2)$$

where p stands for log bond prices, N denotes the maturity of bonds in years and y is the log yield on a bond obeying $y_t^N = -\frac{p_t^N}{N}$. This paper uses the Fama and Bliss bond data from the CRSP database as in Cochrane and Piazzesi (2005).[4]

Term spreads

I use term spreads, the difference between long-term government bond yields and short-term rates (3-month t-bills or call money market rates), as control variable in multivariate forecast regressions. The source is again the IMF's International Financial Statistics.

Dividend-price ratios

As additional control variable, this paper uses the country-specific dividend-price ratios. I follow Fama and French (1988) and e.g. Goyal and Welch (2008) and construct for each country the dividend-price ratio by summing up monthly dividends on the respective MSCI stock index from the 12 months preceding month *t*. The log of dividends minus the log of the stock price index at time t is the dividend-price ratio. The monthly dividends are obtained from the total return and stock price indexes of the countries under study. In each month the dividend for a given country is calculated as difference in the return on the total return and the return on the respective country's price index times the price index at the end of the previous month.

[4] John Cochrane graciously makes this data publicly available on his website http://faculty.chicagobooth.edu/john.cochrane/

3 Econometric specifications and results of stock return predictability regressions

Production gaps of the G7 countries predict excess returns on the respective national stock markets (Cooper and Priestley, 2009). However, table 1 displays that the pairwise correlations between the G7 countries' production gaps for the time period from 1970 to 2011 are all positive, statistically significant and coefficients of 0.5 or higher are not uncommon. The predictive power of national production gaps could hence be related to a common, global component.

[about here Table 1]

To evaluate this hypothesis, I run one-month ahead, in-sample, forecast regressions of the excess returns on the G7 countries' stock markets on a "rest-of-the-world" production gap from each of the G7 countries' perspective. As a further test of this hypothesis, I distinguish between common and idiosyncratic components in national production gaps and test the predictive ability of these two components in the presence of the term spread, another powerful predictor of stock market excess returns internationally (Hjalmarsson, 2010), and the country-specific dividend-price ratios. Section 3.1 presents the corresponding results. In addition, I check whether the results are robust across subsample periods and if they hold when increasing the forecast horizon above one month. Sections 3.2 and 3.3 provide these results. Moreover, I assess if the results hold when the data is measured at lower than the monthly frequency and the common component in national production gaps is directly obtained from a principal component analysis. Sections 3.4 and 3.5 present these results. Finally, section 3.6. assesses if the information on the different production gap components could have helped investors in real time investment decisions, i.e. out-of-sample predictability.

3.1 In-sample forecast regressions: Common or idiosyncratic risk in national production gaps?

This section provides an assessment of the hypothesis that the predictive power of production gaps for excess returns on the G7 stock markets in Cooper and Priestley (2009) is driven by common, business cycle related risk. This assessment consists of two parts.

3.1.1 Evidence from univariate regressions

The first part of the assessment proceeds in three steps. First, I present results from a rerun of the Cooper and Priestley (2009) one-month ahead forecast regressions of the G7 countries' stock market excess returns on national production gaps, i.e.

$$r_t^{e,i} = \alpha + \beta^i gap_{t-2}^i + v_t^i \tag{3}$$

with $r_t^{e,i}$ the monthly excess return on one of the G7 stock markets and gap_{t-2}^i the respective countries' production gap obtained from equation (1). The forecast regression follows Cooper and Priestley (2009) in using the second lag of *gap* because industrial production index data is typically published with a lag, i.e. the industrial production index data for month t-1 is published in the middle of the period t-1 to t (see also Chen et al., 1986).

Since the sample in this study covers five additional years of data compared to Cooper and Priestley (2009) and includes the recent financial crisis and the great recession, this rerun serves as a robustness check if the predictive power of national production gaps for national stock market returns still holds.

In a second step, I construct a "rest-of-the-world" production gap, defined as

$$gap_t^{G7-i} = \frac{1}{K-i}\sum_{k=1}^{K-i} gap_t^k \tag{4}$$

where *K*= 7 and *k* denotes the G7 countries other than country *i* and assess if this "rest-of-the-world" production gap predicts excess returns on the stock market of country *i*, i.e.

$$r_t^{e,i} = \alpha + \beta^i gap_{t-2}^{G7-i} + v_t^i \tag{5}$$

In words, if, for example, *i* represents Canada, then the "rest-of-the-world" production gap is the arithmetic average of the other six G7 countries' production gaps. I then assess if this average production gap of the other countries predicts the excess return on the Canadian stock market. If *i* represents France, then the "rest-of-the-world" production gap is the average production gap of the G7 countries excluding France, etc.

In the third step, I assess if the "rest-of-the-world" production gap could be replaced by the U.S. production gap. This assessment is motivated by findings of Campbell and Hamao (1992) who show that predictive variables of U.S. stock market returns also predict Japanese stock market returns and Guo (2006) as well as Nitschka (2010) who provide evidence for the forecast power of short-run variations in the U.S. consumption-wealth ratio for foreign stock market returns. The forecast equation then takes the following form:

$$r_t^{e,i} = \alpha + \beta^i gap_{t-2}^{US} + v_t^i \tag{6}$$

Table 2 summarizes the results of this first assessment. Column (I) presents the estimates from equation (4), column (II) gives the estimates from equation (5) and column (III) displays the estimates from equation (6). Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Since the gaps are generated regressors and the sample size of almost 500 monthly observations does not guarantee that asymptotic distribution theory applies, I follow Hoffmann (2011) and additionally assess the statistical significance of the estimates by regarding Valkanov (2003) corrected t-statistics. Valkanov suggests to divide the standard t-statistic by the square root of the sample size. This corrected t-statistic allows to address concerns about the persistence of regressor and small sample bias. This is particularly helpful for inference from long-horizon regressions when the impact of persistent regressors more of a concern than in the current regression setup. Critical values for this statistic are obtained by generating normally distributed time series in the sample size and regressing this artificially generated, theoretically sound, i.e. unpredictable, series on the gap varieties. Even though only Newey-West (1987) corrected t-statistics are reported, asterisk in the tables indicates that the estimate is significant at 95% confidence level for both Newey-West (1987) and Valkanov (2003) corrected t-statistics. The sample period runs from January 1970 to February 2011.

The results presented under column (I) of table 2 confirm that the pattern observed by Cooper and Priestley (2009) also holds in this longer sample period. In fact, the results are even stronger in terms of statistical significance. A negative national production gap today predicts positive excess returns on the respective national stock market one month ahead. The estimates are statistically significant at the 95% confidence level for all of the G7 countries except Canada. The national production gaps explain between 1% and 2% of the time variation in stock market excess returns one-month ahead.

Is this predictive power the reflection of common, macroeconomic risk? The estimates under column (II) of table 2 give some indicative evidence which supports this hypothesis. For all of the G7 countries, with the exception of Italy, the average production gap of the other six G7 countries predicts the country's stock market excess return that is excluded from the production gap construction. Interestingly, the "rest-of-the-world" production gap predicts the Canadian stock market excess return while the Canadian production gap does not. Conversely, the Italian production gap predicts the respective national stock market excess return while the "rest-of-the-world" production gap does not. This finding suggests that an idiosyncratic component in the Italian production gap is responsible for its forecast ability of stock market excess returns. It also noteworthy that the U.S. stock market return is predictable by the average production gap of the other six G7 countries. So far there is ample evidence for the predictive power of U.S. variables for foreign stock market returns which is typically interpreted as evidence for the presence of a common, global driving force of time variation in stock markets (e.g. Campbell and Hamao, 1992; Guo, 2006; Nitschka, 2010). Campbell and Hamao (1992) show that U.S. financial market variables that explain time variation in the U.S. stock market return significantly predict Japanese stock market returns. By contrast, Japanese predictive variables, such as the dividend-price ratio, do not rationalize time variation in U.S. stock market returns. To the best of my knowledge, there has been little direct evidence for the predictability of U.S. stock market returns by foreign macroeconomic variables as of yet. This study fills this gap.

This latter observation is related to the question if the "rest-of-the-world" production gap is in fact driven by the U.S. production gap and thus if the evidence presented so far reflects the direct impact of U.S. business cycle conditions. The estimates from equation (6) presented under column (III) of table suggest that this is not the case. The U.S. production gap alone has some explanatory power for the UK stock market excess return but not for excess returns on the other G7 countries' stock markets. The evidence of predictability by the "rest-of-the-world" production gaps is hence unlikely a direct reflection of the U.S. business cycle.

[about here Table 2]

3.1.2 Evidence from multivariate regressions distinguishing common and idiosyncratic production gap components

The first part of the assessment if the predictive power of national production gaps for national stock market excess returns reflects common business cycle risk leaves the impression that indeed global risk plays an important role in this respect. The second part of the assessment tries to distinguish explicitly between common and idiosyncratic macroeconomic risks by decomposing the national production gaps into one component that is perfectly correlated with the respective "rest-of-the-world" production gaps and the orthogonal component interpreted as country-specific part of the production gap. Therefore, I run the following regression

$$gap_t^i = \alpha + \beta^i gap_t^{G7-i} + \nu_t^i \tag{7}$$

to obtain the component in production gaps that is perfectly correlated with the "rest-of-the-world" production gaps, $\beta^i gap_t^{G7-i}$ which is henceforth denoted $gap_t^{common,i}$. The component that is orthogonal to it, ν_{t+1}^{i}, is interpreted as the idiosyncratic component and henceforth denoted $gap_{t}^{idio,i}$.

I use these components to provide further evidence on the source of the predictive power of national production gaps by running regressions on the common and idiosyncratic production gap components alone and check also whether the term spread, the difference in yields (in percentage points p.a.) on a long-term government bond and a short-term rate, alters any of the conclusions drawn so far. Hjalmarsson (2010) shows that predictive variables constructed from interest rates, especially the term spread, are more robust predictors of stock returns than price-earnings or dividend-price ratios internationally. Including the national term spreads should hence be a good and parsimonious robustness test of the production gap components' explanatory power for time variation in stock market excess returns in this international context. As an alternative control, I also consider the country-specific dividend-price ratio.

The forecast regressions obey

$$r_{t}^{e,i} = \alpha + \beta_{1}^{i} gap_{t-2}^{common,i} + \beta_{2}^{i} gap_{t-2}^{idio,i} + \nu_{t}^{i} \tag{8}$$

and including the term spread

$$r_{t}^{e,i} = \alpha + \beta_{1}^{i} gap_{t-2}^{common,i} + \beta_{2}^{i} gap_{t-2}^{idio,i} + \beta_{3}^{i} ts_{t-1}^{i} + \nu_{t}^{i} \tag{9}$$

or the dividend-price ratio

$$r_{t}^{e,i} = \alpha + \beta_{1}^{i} gap_{t-2}^{common,i} + \beta_{2}^{i} gap_{t-2}^{idio,i} + \beta_{3}^{i} dp_{t-1}^{i} + \nu_{t}^{i} \tag{10}$$

Table 3 summarizes the results. Column (I) displays the estimates from equation (8). Column (II) presents the estimates from equation (9). Column (III) gives the estimates from regression (10). Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Again, asterisk denotes significance at the 95% level judged by Newey-West and Valkanov (2003) corrected t-statistics at the same time. The sample period runs from January 1970 to February 2011.

The results reinforce the impression left by the forecast regression results presented in table 2.

Column (I) of table 3 shows that for all of the G7 countries, it is the common component in production gaps, i.e. that component that is perfectly correlated with the average production gap across the other six countries, that forecasts stock market excess returns. Again Italy is the only exception. As conjectured before, it is the idiosyncratic component in the Italian production gap that explains time variation in the Italian stock market excess return.

Column (II) of table 3 shows that the main conclusion remains unaltered when taking the respective countries' term spread as additional predictive variable into account. The inclusion of the term spread drives out the statistical significance of the common production gap's regression coefficient for Canada. All of the other countries' results do not change. The term spread itself does not explain the variation of the stock market excess returns in the presence of the two production gap components. This finding should not be too surprising since the term spread and the production gap should both track business cycle related variation in stock returns (Cooper and Priestley, 2009). In the regressions presented above it could either be driven out by the presence of the common or the idiosyncratic production gap components depending on the extent by which national term spreads are driven by country-specific or global macroeconomic dynamics.

Finally, the results under column (III) show that controlling for the log dividend-price ratio does not alter any of the conclusions drawn above. In contrast to the term spread, the dividend-price ratio leaves the statistical significance of the common component in the Canadian production gap unaffected. The dividend-price ratio itself is not significantly explaining the stock market excess returns under study. Since the term spread seems to be better suited as control in the forecast regressions, the subsequence of the paper makes no further use of the dividend-price ratio as control variable.

[about here Table 3]

3.2 Stock excess return forecast regressions: subsample analysis

The results presented so far highlight that a common component in national production gaps rationalizes their explanatory power for stock market excess returns one month ahead. The gap, however, is measured as a deviation of an industrial production index from a linear and a quadratic time trend over the full sample period. It might be the case that the main results depend on the particularities of the sample period. A comparison of the international evidence provided in Cooper and Priestley (2009) and the rerun displayed in section 3.1 could raise concerns in this respect. The international evidence in Cooper and Priestley (2009) is less strong in terms of statistical significance than the reruns of their original regressions presented in this paper. This is certainly due to the fact that the Cooper and Priestley (2009) sample period ends in 2005 whereas this paper includes five additional years of data including the great recession and hence a material deviation of industrial production in the G7 countries from trend.

To gauge the impact of the particular sample period on the main conclusions of this paper, I split the sample period into two halves. The first subsample period runs from January 1970 to June 1990. The second subsample spans the period from July 1990 to February 2011. I then run equation (1) to obtain the production gaps for the particular subsample period and rerun the forecast regression (9) for the two subsample periods. Table 4 summarizes the results.

Panel A of table 4 provides the forecast regression results for the first, early subsample period. In terms of statistical significance of the common production gap component's predictive power the results are slightly weaker than for the full sample period. For Canadian and Italian stock market excess returns the common production gap component exhibits no statistically significant explanatory power. For France, the estimate is marginally insignificant at the 90% confidence level. Time variation in Japanese, British and American stock market excess returns, however, appears to be significantly explained by the common production gap component. The explanatory power of the respective production gap components for this subsample period is comparable with that over the full sample period. This is also true for German stock excess returns but only at the 90% confidence level according to the Valkanov (2003) corrected t-statistics. In the case of Germany, the idiosyncratic component also reveals some explanatory power for time variation in the national stock market in this early subsample period.

Panel B of table 4 displays the forecast regression results for the more recent subsample period. The statistical significance of the common production gap component's forecast ability for the German, French and Japanese stock market excess returns deteriorates to significance levels below 95%. By contrast, the Canadian stock market excess return turns out to be significantly explained by the common production gap component as do the British and American stock market excess returns. In this subsample period, both the common and the idiosyncratic production gap component significantly drive the Italian stock market.

In sum, the particular sample period for which the production gap and its common and idiosyncratic component are calculated certainly matters. However, the general conclusion that the common component in national production gaps is a significant explanatory variable of time variation in national stock market excess returns pertains to both subsample periods.

[about here Table 4]

3.3 Stock excess return forecast regressions: Long-horizon forecasts

Macroeconomically founded predictors of stock market returns typically display their greatest explanatory power at business cycle frequency forecast horizons (e.g. Cooper and Priestley, 2009; Hoffmann, 2011; Lettau and Ludvigson, 2001; Lustig and van Nieuwerburgh, 2005; Piazzesi et al., 2007; Rangvid, 2006; Santos and Veronesi, 2006). This is also suggested by theoretical models that motivate time-varying excess returns on stock markets with time-variation in risk aversion over the business cycle (e.g. Campbell and Cochrane, 1999; Constantinides, 1990; Constantinides and Duffie, 1996; Heaton and Lucas, 2000 a, b; Yogo, 2006).

Inference from long-horizon regression estimates should nonetheless be interpreted with healthy scepticism because the usual setup of these regressions includes a relatively small sample size, persistent regressors and concatenated one-period logarithmic returns to obtain long-horizon returns. Valkanov (2003) and the literature surveyed therein provide an account of the potential econometric pitfalls in such a setting. However, Hodrick (1992) shows that relatively little but significant predictive power in the short term is consistent with a large amount of predictability at long forecast horizons. Hence, the one-month ahead forecast regressions already provide the proof of the in-sample forecast ability of the common production gap components. The one-month regressions have also taken into account that the regressors are generated in a first stage. This section therefore uses long-horizon forecasts primarily to assess if the importance of the common or idiosyncratic production gap components changes with the forecast horizon.

I assess this issue through the following regression

$$r_{t,t+h}^{e,i} = \alpha + \beta_1^{i,h} gap_{t-2}^{common,i} + \beta_2^{i,h} gap_{t-2}^{idio,i} + v_{t,t+h}^{i} \qquad (11)$$

where $r_{t,t+h}^{e,i}$ is the log stock market excess return of country i over the forecast horizon h. The forecast horizon is in months. Table 5 summarizes the results for forecast horizons of 12, 24 and 36 months. Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis and the asterisk denotes significance at 95% confidence level by both Newey-West and Valkanov (2003) corrected t-statistics. The sample period runs from January 1970 to February 2011. Furthermore, since not only potential bias in the standard errors of the estimates but also in the estimates themselves makes inference from long-horizon regressions difficult, this paper also provides long-horizon estimates and R^2 statistics implied by the one-month ahead regression under the null of no predictability (Boudoukh et al., 2008). Boudoukh et al. (2008) emphasize that the pattern in point estimates and R^2 that are typically reported in long-horizon regressions are perfectly consistent with the view that there is no return predictability at all. They show that point estimates at forecast horizon k implied by actual one-period coefficients, $\hat{\beta}^1$, and the autocorrelation of a given regressor, ρ, under the null of no predictability obeys

$$E(\hat{\beta}^k \mid \hat{\beta}^1) = \left(1 + \frac{\rho(1-\rho)^{k-1}}{1-\rho}\right)\hat{\beta}^1 \tag{12}$$

and the R^2 statistic accordingly

$$E(R_k^2 \mid R_1^2) = \left(\frac{\left(1 + \frac{\rho(1-\rho)^{k-1}}{1-\rho}\right)^2}{k}\right)R_1^2 \tag{13}$$

I report these statistics in table 5 under the heading “implied estimates”.

The long-horizon forecasts reveal two major insights. First, in line with theory and earlier evidence, the predictive power of the production gap components increases with the forecast horizon. At the 36-month horizon almost 30% of the time variation in the French and Japanese stock market excess returns is explained by the common production gap. For the other countries the explanatory power ranges between 12% and 17% at that horizon. Second, it is the common production gap component that drives the predictive power of production gaps at all forecast horizons. The importance of the idiosyncratic component for the Italian stock market return visible in table 3 vanishes in the long-horizon forecasts.

The standard error corrections (Valkanov, 2003) and the implied estimates under the null of no predictability (Boudoukh et al., 2008) most of the time deliver a consistent picture with regard to the significance of the long-horizon estimates. Consider e.g. France at the 24-month and at the 36-month forecast horizon. At the 24-month horizon, the conventional Newey-West corrected t-statistics leave the impression of significant predictability of the common production gap. However, the Valkanonv-corrected t-statistics suggest the opposite as do the implied estimates according to Boudoukh et al. (2008). The point estimates and the implied estimates under the null of no predictability are very similar. This picture changes, however, when we regard the French stock market excess return at the 36-month forecast horizon. At this horizon, there appears to be significant explanatory power of the respective common production gap component according to the corrected t-statistics as well as according to a comparison of the actual with the implied point estimates.

[about here Table 5]

3.4. Stock excess return forecast regression: quarterly frequency

The evidence presented so far relies on data measured at the monthly frequency. However, macroeconomic data such as the industrial production gaps examined in this paper is typically used to make inference at quarterly or lower frequencies. This section presents results from one-period ahead forecast regressions of quarterly stock excess returns on the rest-of-the-world production gaps as in equation (5). These results corroborate the monthly frequency forecast regressions.

Results from univariate regressions are presented in the left column of table 6. In addition, this section takes into account earlier evidence by Guo (2006) and Nitschka (2010) who show that short-run variations in the US consumption-wealth ratio, *cay*, do not only explain time variation in excess returns on the US stock market (Lettau and Ludvigson, 2001) but also on foreign stock markets.[5] The results from multivariate regressions of national stock market returns on the rest-of-the-world production gaps and *cay* are summarized in the right column of table 6. The sample period for these regressions runs from the first quarter of 1970 to the fourth quarter of 2010.

The univariate forecast regression results show that the rest-of-the-world production gap is a significant predictor of national stock market returns at the quarterly frequency. The evidence supports the main conclusion of this paper and is very similar to the evidence provided for

[5] Martin Lettau graciously makes the U.S. *cay* data publicly available on his website. At the time I downloaded this dataset it ended in the second quarter of 2010. I updated this data until the fourth quarter of 2010 as described in Lettau and Ludvigson (2001).

data at the monthly frequency. A common component in industrial production gaps explains time variation in stock market returns. Again Italy is the exception among the G7 countries. The explanatory power of the rest-of-the-world production gaps for quarterly stock excess returns ranges from 3% to 11% for the UK.

This general conclusion prevails when additionally controlling for *cay*. Only for U.S. stock market excess returns does *cay* exhibit predictive power in excess of the rest-of-the-world production gap. The R^2 statistic, adjusted for the number of regressors, improves slightly. The bulk of predictability seems to come from the production gap in this setting. However, the fact that both variables are statistically significantly explaining time-varying U.S. stock market returns suggests that both contain valuable information about the U.S. stock market return. In addition, the correlations between *cay* and the respective "rest-of-the-world" production gaps varies between -0.2 and -0.3 (not reported in tables but available upon request). It could be the case that the two macroeconomic variables capture similar dimensions of global, business cycle related risk such that one variable is driving out most of the statistical significance of the other in the regressions presented in table 6.

[about here Table 6]

3.5 Stock excess return forecast regression: Principal components in production gaps

This section addresses two potential concerns about the evidence presented so far. First, the results highlighting the importance of a rest-of-the-world production gap for time variation in stock market excess returns rely on the use of an arithmetic average of national production gaps. This averaging underlies the assumption that all production gaps are equally affecting common variation in production gaps. This is not necessarily true. Second, I refer to those components of national production gaps that are perfectly correlated with the average production gap of the other six G7 countries as "common" components. These components are obtained from regressions of the national output gaps on the respective rest-of-the-world production gaps. It might be useful to evaluate a more direct way to obtain a truly common component in national production gaps.

For these two reasons I apply principal component analysis to the national production gaps of the G7 countries. i.e. identify those components that drive the common variation in production gaps. Table 7 presents the loadings of the original variables, the national output gaps, on these principal components. The last row of table 7 indicates how much of the common variation in the national output gaps is explained by the respective principal component.

As can be seen from table 7, the two first principal components explain about 80% of the common variation. The first principal component looks like the best candidate of a common component in production gaps that could be responsible for the Cooper and Priestley (2009) results. Remember that all national output gaps predict stock returns with the same sign. Only the loadings on the first principal component have the same sign. In addition, the loadings are of similar size such that taking an arithmetic average, i.e. assigning equal weights, of national production gaps to obtain a common component seems justified. In fact, the arithmetic average of national production gaps is almost perfectly positively correlated with the first principal component.

[about here Table 7]

Is the first principle component also an explanatory variable for time variation in stock market excess returns? The answer that the regression estimates of table 8 provide is yes. Table 8 presents results from the following regression

$$r_t^{e,i} = \alpha + \beta_1^i PC_{t-2}^1 + \nu_t^i \qquad (14)$$

where PC^1 denotes the first principal component of the G7 national production gaps. The sample period runs from January 1970 to February 2011. Newey-West corrected t-statistics appear in parenthesis and the asterisk denotes significance at 95% confidence level by both Newey-West and Valkanov corrected t-statistics.

Apart from the magnitude of the regression coefficients, the evidence provided in table 8 is very similar to forecast regression estimates on the respective "rest-of-the-world" production gaps as under column II of table 2. Again the Italian stock market excess return is not significantly explained by the first principal component of the national production gaps. The first principal component's explanatory power ranges from 1% to 3% for the other G7 countries' monthly stock market returns. In addition, it is a statistically significant explanatory variable at conventional significance levels. In sum, the results of these regressions corroborate the main findings of this paper. This subsection, in particular, also corroborates the main conclusions of Cooper and Priestley (2012) who show that the world capital stock to output ratio predicts national stock market returns. The first principal component of production gaps is conceptually close to their proposed global, macroeconomic variable as it also aggregates all the business cycle related information of the countries under study, i.e. also of that country whose stock market return one would like to predict.

[about here Table 8]

3.6 Is the information about common production gap components exploitable for investors?

So far, this paper has focused on in-sample predictability regressions. Information from the whole sample period has been used to calculate production gaps and their respective country-specific and common components. This section assesses the relative importance of common and idiosyncratic production gap components in statistical tests of out-of-sample predictability.

Out-of-sample predictability is a question of still intensive debate as e.g. Bossarts and Hillion (1999) or Goyal and Welch (2008) show that in-sample predictability does not translate into out-of-sample predictability. By contrast, Campbell and Thompson (2008) stress that many predictive variables can beat the historical mean of stock excess returns in out-of-sample predictability tests once theoretically motivated restrictions on the sign of coefficients or return forecasts are imposed. In addition, they show that small out-of-sample predictability can translate into economically sizeable utility gains for mean-variance optimizing investors.

This paper assesses the question of out-of-sample predictability by calculating the production gap as deviation of the respective countries' log industrial production index value at time t from its one-sided Hodrick-Prescott filtered trend.[6] The one-sided Hodrick-Prescott filter estimates the trend in the log industrial production index iteratively and thus only uses information available up to time t to forecast returns in t+1. However, due to the lack of vintage data, this is not really a real-time estimate since the industrial production index series employed in this paper have been subject to ex post revisions.

The forecast period runs from January 1990 to February 2011. I use the period from January 1970 to December 1989 to calculate the deviations of industrial production indexes from their Hodrick-Prescott filtered trends and the respective mean historical excess returns for forecasts beginning in January 1990. The January 1990 information is then added to forecasts for February 1990 and so forth.

I follow Campbell and Thompson (2008) and report an out-of-sample R^2 statistic that can be compared with the in-sample R^2. This statistic obeys

$$R_{oos}^2 = 1 - \frac{\sum_{t=1}^{T} (r_t^e - \hat{r}_t^e)^2}{\sum_{t=1}^{T} (r_t^e - \bar{r}_t^e)^2} \tag{15}$$

in which $\hat{r}_t^e$ denotes the forecast of excess returns up to t-1 and $\bar{r}_t^e$ represents the historical mean excess return calculated up to t-1. If this statistic is positive, then the excess return predicted by the forecast variables delivers lower mean squared errors than the historical mean return. Notice that I neither restrict coefficients in the predictive regressions to the theoretically suggested negative values nor require forecasted returns to be positive. As

[6] I used the MATLAB routine of Alexander Meyer-Gohde to calculate the one-sided Hodrick-Prescott filtered trend. This program is publicly available on his IDEAS website.

Campbell and Thompson (2008) point out, imposing such restrictions almost always improves the out-of-sample forecasting power of the predictive variables.

Panel A of table 9 summarizes this statistic for a forecast regression of national stock market excess returns on the respective common and country-specific production gap components. The first column presents R^2_{oos} when only the coefficient on the common gap component is used to calculate the forecast of excess returns. The second column then additionally takes into account the coefficient on the country-specific component.

These statistics show that for five of the G7 countries information about the common production gap delivers a better out-of-sample forecast performance than the simple historical mean of the respective excess returns. For most of these countries, the country-specific part of the national production gaps does not add important out-of-sample forecast power. Notable exceptions are Canada and the U.S. for which R^2_{oos} takes negative values. In sum, the R^2_{oos} leave the impression that the information about the common components in national production gaps helps to beat the historical return in out-of-sample forecasts. The importance of country-specific production gap components is weaker.

Additionally, I follow Campbell and Thompson (2008) as well as Ferreira and Santa Clara (2011) and assess the economic importance of the production gap information by taking the stance of a mean-variance optimising investor. Each period this investor faces the choice to invest in the risky asset (the stock market excess return) and a risk-free asset (short-term interest rate). To make her choice, the investor either uses information about the historical average excess returns on the stock market or the predicted stock market return using the decomposed production gaps. Hence, at each point in the forecast period, each country i investor calculates the optimal portfolio weight for the risky asset in country i with

$$w_t^i = \frac{(\hat{r}_t^i - r_t^{f,i})}{\gamma \hat{\sigma}_t^{i,2}} \qquad (16)$$

in which $\hat{r}_t^i$ represents the expected return on the stock market of country i up to time t. The expected return is derived either from the mean average return or from predictive regressions on the respective country's common and country-specific production gap components. The term, $\hat{\sigma}_t^{i,2}$, denotes the variance of the return, γ is the coefficient of risk aversion assumed to be 2 and $r_t^{f,i}$ represents the country i short-term interest rate.

Given these weights, the return on the investor's portfolio at each point in time obeys

$$r_{t+1}^{p,i} = w_t r_{t+1}^i + (1 - w_t) r_t^{f,i} \tag{17}$$

such that I obtain a time series of portfolio returns under the assumption that shorting stocks ($w_t \geq 0$) and more than 50% leverage ($w_t \leq 150$) is not allowed thus following Cooper and Priestley (2009, 2012).

To gauge the economic importance of the production gap information, I calculate the certainty equivalents when using the common or the common and idiosyncratic production gap components to calculate the portfolio returns. I compare these certainty equivalents, i.e. the the risk-free return the investor would require in order to be indifferent between the risky strategy and a riskless investment strategy. The certainty equivalent is calculated from

$$ce = \bar{r}^{p,i} - \frac{\gamma}{2} \sigma^{p,i,2} \tag{18}$$

with risk aversion $\gamma = 2$. The annualized difference to the certainty equivalent that the investor obtains when using just the historical mean excess return to calculate portfolio returns is presented in panel B of table 9. These results are broadly consistent with the evidence in panel A of table 9. The information about the common production gap to calculate expected stock market return leads to small gains for investors in the G7 countries. The only exception is France. For France, taking additionally into account the information about the country-specific production gap leads to certainty equivalent gains. For the other countries this additional information does not add any gains.

In sum, the out-of-sample tests are consistent with the in-sample regression results. They show that information about the common production gap component leads to a better forecast performance and gains for mean-variance optimizing investor compared with historical mean excess returns as out-of-sample predictor. Information about country-specific production gaps is less important.

[about here Table 9]

4 Global and idiosyncratic business cycle risk in U.S. bond excess returns

In line with evidence on the link of bond risk premia with common factors among a set of macroeconomic variables (Ludvigson and Ng, 2009), Cooper and Priestley (2009) provide evidence for the predictive power of the U.S. production gap not only for stock excess returns but also for U.S. bond excess returns. They thus support the theoretical model of Hasseltoft (2010) who shows that stock and bond returns are driven by common macroeconomic risk factors. To complement their analysis, I assess if the distinction between common and idiosyncratic production gap components matters for explaining time-variation in bond excess returns. This assessment is motivated especially by Dahlquist and Hasseltoft (2011) who find that both local and global versions of the Cochrane and Piazzesi (2005) bond risk factor explain time variation in excess returns on bonds in Germany, Switzerland, the UK and the U.S. In addition, Ilmanen (1995) and Cooper and Priestley (2012) provide evidence of global risk driving time-varying bond excess returns.

I use prices on U.S. zero bonds to calculate annual bond excess returns of two- to five-year bonds in excess of the yield on a one-year bond. I employ two sets of regressions to evaluate the impact of the different production gap components on bond excess returns. First, following Cooper and Priestley (2009), I regress the annual bond excess returns on the 13-month lagged national production gap, i.e.

$$brx_t^N = \alpha + \beta^N gap_{t-13}^{US} + \nu_t \quad (19)$$

Second, I regress annual bond excess returns on the “rest-of-the-world” production gap from the U.S. perspective to assess if the predictive power of national production gaps is driven by global movements in production gaps. The estimate equation obeys

$$brx_t^N = \alpha + \beta^N gap_{t-13}^{G7-US} + \nu_t \quad (20)$$

Table 10 summarizes the results. Column (I) presents the results from forecast regression (19), column (II) gives the results from forecast regression (20). Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Again the asterisk signals a significant point estimate at 95% confidence level for both Newey-West and Valkanov corrected t-statistics. The sample covers the period from January 1970 to December 2003. The end of the sample period is due to the limited public availability of the CRSP Fama and Bliss data on zero bonds. The beginning of the sample period is chosen to make the results of the bond return forecast regressions broadly comparable with the stock return forecast regressions presented so far.

The estimates of the Cooper and Priestley (2009) rerun under column (I) of table 10 show that the production gap is a powerful predictor of annual US bond excess returns. The U.S. production gap explains between 23% (2-year bond) and 15% (5-year bond) of the time variation in U.S. bond excess returns. Notice that these results are not directly comparable with the results of Cooper and Priestley (2009) due to the different start of the sample period.

The estimates under column (II) of table 10 highlight that the rest-of-the-world production gap has statistically significant explanatory power for the U.S. bond excess returns. This result is in line with Ilmanen (1995) and Cooper and Priestley (2012) who provide evidence for the predictive power of global risk factors for bond excess returns. Interestingly, the rest-of-the-world production gap explains about half as much time variation as the U.S. production gap for excess returns on 2-year bonds. The relative explanatory power of the rest-of-the-world production gap declines with the maturity of the bonds. For the 5-year bond excess returns, the rest-of-the-world production gap reveals only about a quarter of the predictive power of the U.S. production gap. It seems to be the case that country-specific components of the U.S. production gap matter for explaining time-varying bond excess returns and their relative importance seems to increase with the maturity of bonds.

Finally, to illustrate that both the idiosyncratic and the common component in the U.S. production gap explain U.S. bond excess returns, I perform the forecast regression (8) for the bond excess returns. Column (III) of table 10 displays the respective results which corroborate that the country-specific part of the U.S. production gap as well as its common, global component significantly explain. time-variation in bond excess returns. By construction they deliver the same fit as the U.S. production gap that is not decomposed.

Taken together the observations presented in table 10 lead to two conclusions. Global macroeconomic risk certainly matters for explanations of time-varying bond risk premia. However, its importance decreases with the maturity of the bonds under consideration. This latter finding is related to the second main conclusion. Country-specific risks, such as e.g. the base of tax payers that back government bonds, cannot be neglected in this respect.

5 Conclusions

This paper complements Cooper and Priestely (2009) who present evidence for the explanatory power of national production gaps for time-variation in national stock market returns. The simple decomposition of industrial production deviations from trend into "global" and "country-specific" components introduced in this paper highlights that the explanatory power of production gaps for national stock markets is largely due to global, business cycle related risk. Out-of-sample tests support this view. These findings confirm stress that the G7 stock markets are well integrated.

In contrast to some earlier studies of the impact of common business cycle risk on stock markets, the evidence presented in this paper is based on variables that can be readily interpreted as mirror image of global risk without the short-cut of employing U.S. variables to explain foreign stock market returns. This approach additionally affirms the interpretation of the evidence provided in this paper as evidence of global business cycle risk driving the major stock markets. It is not a mirror image of the U.S. business cycle.

Furthermore, this paper shows that foreign, "rest-of-the-world", macroeconomic risk affects U.S. asset markets. A "rest-of-the-world" production gap explains time variation in the U.S. stock market return while the U.S.-specific one does not. Evidence in this direction has been scarce as of yet. This finding reinforces the point that truly global risk plays a vital role in explanations of the time-variation in national stock markets. Moreover, this paper provides further evidence for the observation that both global and country-specific macroeconomic risks contribute to explaining time-variation in bond excess returns.

Appendix: Feedback of stock market risk premia on output gaps?

Dynamics on financial markets and the macroeconomy are intimately linked. However, it is common practice in the finance literature to focus on the explanatory power of macroeconomic variables for asset market dynamics but not on the reverse relation, i.e. the feedback of asset market movements on the real economy (e.g. Chen et al., 1986). In the context of the present paper, this relates to the question if time variation in national stock market excess returns explain future time variation in national production gaps.

It is beyond the scope of this paper to provide a perfect distinction between cause and effect when evaluating the joint behaviour of production gaps and stock market excess returns. But it can address the question if changes of stock prices or deviations of industrial production from trend cause movements of the other variable in a statistical sense. A simple, indicative way to look at this issue is to evaluate Granger causality (Granger, 1969) among national stock market excess returns and national production gaps at the one-month horizon.

Table A1 presents the p-values of Granger causality F-tests from vector autoregressions (VAR) of national stock market returns and national production gaps applying a lag length of one month. Translated in the context of this paper, the null hypotheses of the F-tests are that past stock market excess returns do not help to forecast stock market excess returns in the presence of past values of production gaps. The coefficients estimated in the VAR should be zero. Secondly, the VAR approach also allows to evaluate the reverse Granger causality, i.e. evaluating if past stock market returns help to forecast production gaps in the presence of past values of the production gaps.

The main results displayed in table A1 can be easily summarized. In general, past values of stock market excess returns do not Granger cause the respective national production gaps. Canada and Japan are borderline cases as the null hypothesis of stock market excess returns not Granger causing production gaps is accepted at 6% significance level for Canada and at 5% significance level for Japan. For all of the other countries, the significance level for accepting the null hypothesis is considerably higher. Hence, these results show that it is justified to focus mainly on the explanatory power of production gaps on stock market dynamics as in Cooper and Priestley (2009) and this paper. However, as the cases of Canada and Japan show, it is important to bear in mind that causality, or in this case at least Granger causality, can also follow the other direction from asset markets to the real economy. In addition, there might be contemporaneous effects that are not captured in the Granger causality test.

Table A1: P-values of Granger causality tests

(stock market excess returns and national production gaps, lag length of one month)

CND	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.07	0.14
gap_t^i	0.06	0.00

FRA	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.06	0.02
gap_t^i	0.88	0.00

GER	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.30	0.00
gap_t^i	0.32	0.00

ITA	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.13	0.02
gap_t^i	0.76	0.00

JPN	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.04	0.01
gap_t^i	0.05	0.00

UK	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.05	0.05
gap_t^i	0.86	0.00

US	$r_{t-1}^{e,i}$	gap_{t-1}^{i}
$r_t^{e,i}$	0.31	0.01
gap_t^i	0.62	0.00

Notes: This table provides the p-values from Granger causality tests of vector autoregressions that feature national stock market excess returns and national production gaps of the G7 countries. The null hypothesis is that the lagged variable does not Granger cause the other variable.

References

Asness, C.S., Moskowitz, T.J. and L.H. Pedersen (2011) "Value and Momentum 'Everywhere'", unpublished working paper AQR Capital Management, Booth School of Business Chicago, Stern School of Management New York, CEPR and NBER.

Bansal, R. and I. Shaliastovich (2010) "A Long-Run Risk Explanation of Predictability Puzzles in Bond and Currency Markets", unpublished working paper Duke University and NBER.

Bekaert, G. (1995) "Market Integration and Investment Barriers in Emerging Equity Markets", *World Bank Economic Review* 9, 75-107.

Bekaert, G., Engstrom, E. and Y. Xing (2009) "Risk, uncertainty and asset prices", *Journal of Financial Economics* 91, 59-82.

Bekaert, G. and C.R. Harvey (1995) "Time-Varying World Market Integration", *Journal of Finance* 50, 403-444.

Bekaert, G., C.R. Harvey and C. Lundblad (2007) "Liquidity and Expected Returns: Lessons from Emerging Markets", *Review of Financial Studies* 20, 1783-1831.

Borri, N. and A. Verdelhan (2011) "Sovereign Risk Premia", unpublished working paper LUISS, MIT Sloan and NBER.

Boudoukh, J., M. Richardson and R.F. Whitelaw (2008) "The Myth of Long-Horizon Predictability", *Review of Financial Studies* 21, 1577-1605.

Bossaerts, P. and P. Hillion (1999) "Implementing Statistical Criteria to Select Return Forecasting Models: What Do We Learn?", *Review of Financial Studies* 12, 405-428.

Campbell, J.Y. and Y. Hamao (1992) "Predictable Stock Returns in the United States and Japan: A Study of Long-Term Capital Market Integration", *Journal of Finance* 47, 43-69.

Campbell, J.Y. and J.H. Cochrane (1999) "By Force of Habit: A Consumption-based Explanation of Aggregate Stock Market Behaviour", *Journal of Political Economy* 107, 298-345.

Campbell, J.Y. and S.B. Thompson (2008) "Predicting Excess Returns Out-Of-Sample: Can Anything Beat the Historical Average?", *Review of Financial Studies* 21, 1509-1531.

Chan, K.C., Karolyi, G.A. and R.M. Stulz (1992) "Global financial markets and the risk premium on U.S. equity", *Journal of Financial Economics* 32, 137-167.

Chen, N.F., Roll, R. and S.A. Ross (1986) "Economic Forces and the Stock Market", *Journal of Business* 59, 383-483.

Cochrane, J.H. (2005) "Financial Markets and the Real Economy", NBER Working Paper No 11193.

Cochrane, J.H. (2008) "The Dog That Did Not Bark: A Defense of Return Predictability", *Review of Financial Studies* 21, 1533-1575.

Cochrane, J.H and M. Piazzesi (2005) "Bond Risk Premia", *American Economic Review* 95, 138-160.

Constantinidis, G.M. (1990) "Habit Formation: A Resolution of the Equity Premium Puzzle" *Journal of Political Economy* 98, 519-543.

Constantinidis, G.M. and D. Duffie (1996) "Asset Pricing with Heterogeneous Consumers", *Journal of Political Economy* 104, 219-240.

Cooper, I. and R. Priestley (2009) "Time-Varying Risk Premiums and the Output Gap", *Review of Financial Studies* 22, 2801-2833.

Cooper, I. and R. Priestley (2012) "The World Business Cycle and Expected Stock Returns", forthcoming *Review of Finance*.

Dahlquist, M. and H. Hasseltoft (2011) "International Bond Risk Premia", unpublished working paper Stockholm School of Economics and University of Zurich.

Dumas, B. and B. Solnik (1995) "The World Price of Foreign Exchange Risk", *Journal of Finance* 50, 445-479.

Fama, E.F. and K.R. French (1988) "Dividend Yields And Expected Stock Returns", *Journal of Financial Economics* 22, 3-25.

Fernandez-Corugedo, E., Price, S. and A. Blake (2003) "The dynamics of consumer´s expenditure: the UK consumption ECM redux", Bank of England working paper 204.

Ferreira, Miguel A. and Pedro Santa-Clara (2011) "Forecasting stock market returns: The sum of the parts is more than the whole", *Journal of Financial Economics* 100, 514-537.

Ferson, W.E. and C.R. Harvey (1993) "The Risk and Predictability of International Stock Returns", *Review of Financial Studies* 6, 527-566.

Fisher, L.A. and G.M. Voss (2004) "Consumption, Wealth and Expected Stock Returns in Australia", *Economic Record* 80, 359-372.

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

Guo, H. (2006) "The Risk-Return Relation in International Stock Markets", *The Financial Review* 41, 565-587.

Goyal, A. and I. Welch (2008) "A Comprehensive Look at The Empirical Preformance of Equity Premium Prediction", *Review of Financial Studies* 21, 1455-1508.

Hamburg, B., Hoffmann, M. and J. Keller (2008), "Consumption, Wealth and Business Cycles: Why is Germany different?", *Empirical Economics* 34, 451-476.

Harvey, C.R. (1991) "The World Price of Covariance Risk", *Journal of Finance* 46, 111-157.

Harvey, C.R. (1995) "Predictable Risk and Return in Emerging Markets", *Review of Financial Studies* 3, 773-816.

Hasseltoft, H. (2010), "Stocks, Bonds and Long-run Consumption Risk" forthcoming *Journal of Financial and Quantitative Analysis*.

Heaton, J. and D. Lucas (2000a) "Portfolio Choice in the Presence of Background Risk", *Economic Journal* 110, 1-26.

Heaton, J. and D. Lucas (2000b) "Portfolio Choice and Asset Prices: The Importance of Entrepreneurial Risk", *Journal of Finance* 55, 1163-1198.

Hjalmarsson, E. (2010) "Predicting Global Stock Returns", *Journal of Financial and Quantitative Analysis* 45, 49-80.

Hodrick, R.J. (1992) "Dividend Yields and Expected Stock Returns: Alternative Procedures for Inference and Measurement", *Review of Financial Studies* 5, 357-386.

Hoffmann, M. (2011) "Banking Deregulation, Entrepreneurial Risk and the Predictability of US Stock Returns", unpublished working paper University of Zurich & CESifo.

Ilmanen, A. (1995) "Time-varying Expected Returns in International Bond Markets", *Journal of Finance* 50(2), 481-506.

Ioannidis, C., Peel, D. A. and K.P.G. Matthews (2006), "Expected stock returns, aggregate consumption and wealth: some further evidence", *Journal of Macroeconomics* 28, 439-445.

Koijen, R.S.J., Lustig, H. and S. Van Nieuwerburgh (2010) "The Cross-Section and Time Series of Stock and Bond Returns", unpublished working paper Booth School of Business Chicago, UCLA Anderson School of Management, New York University, CEPR and NBER.

Lettau, M. and S.C. Ludvigson (2001) "Consumption, Aggregate Wealth and Expected Stock Returns", *Journal of Finance* 56, 815-849.

Ludvigson, S.C. and S. Ng (2009) "Macro Factors in Bond Risk Premia", *Review of Financial Studies* 22, 5027-5067.

Lustig, H. and S. Van Nieuwerburgh (2005) "Housing Collateral, Consumption Insurance, and Risk Premia: An Empirical Perspective", *Journal of Finance* 60, 1167-1219.

Nagayasu, J. (2009), "Stocks, consumption, and wealth: evidence from the Tokyo Stock Exchange", in: George I. Ellison (ed), Stock Returns: Cyclicity, Prediction and Economic Consequences, NY: Nova Science Publishers, 133-156.

Newey, W.K. and K.W. West (1987) "A simple, positive semidefinite, heteroskedasticity and autocorrelation consistent covariance matrix", *Econometrica* 55, 703-708.

Nitschka, T. (2010) "International evidence for return predictability and the implications for the long-run covariation of the G7 stock markets", *German Economic Review* 11, 527-544.

Piazzesi, M., Scheider M. and S. Tuzel (2007) “Housing, Consumption, and Asset Pricing”, *Journal of Financial Economics* 83, 531-569.

Rangvid, J. (2006) “Output and Expected Returns”, *Journal of Financial Economics* 81, 595-624.

Tan, A. and G.M. Voss (2003) ”Consumption and Wealth in Australia”, *Economic Record* 79, 39-56.

Valkanov, R. (2003) “Long-horizon regressions: theoretical results and applications”, *Journal of Financial Economics* 68, 201-232.

Verdelhan, A. (2011) “The Share of Systematic Risk in Bilateral Exchange Rates”, unpublished working paper MIT Sloan and NBER.

Santos, T. and P. Veronesi (2006) “Labor Income and Predictable Stock Returns”, *Review of Financial Studies* 19, 1-44.

Yogo, M. (2006) “A Consumption-Based Explanation of Expected Stock Returns”, *Journal of Finance* 61, 539-580.

Tables

Table 1: Correlation coefficients of output gaps

	CND	FRA	GER	ITA	JPN	UK	US
CND	1	0.64	0.31	0.50	0.13	0.37	0.63
		(0.58;0.69)	(0.23;0.39)	(0.43;0.56)	(0.04;0.22)	(0.30;0.45)	(0.57;0.68)
FRA		1	0.63	0.80	0.33	0.57	0.76
			(0.57;0.68)	(0.77;0.83)	(0.25;0.40)	(0.51;0.63)	(0.72;0.80)
GER			1	0.59	0.74	0.32	0.32
				(0.53;0.65)	(0.70;0.78)	(0.24;0.40)	(0.24;0.40)
ITA				1	0.43	0.64	0.73
					(0.35;0.50)	(0.58;0.69)	(0.69;0.77)
JPN					1	0.29	0.17
						(0.21;0.37)	(0.08;0.27)
UK						1	0.78
							(0.74;0.81)
US							1

Notes: This table presents the pairwise correlation coefficients of the G7 countries' output gaps over the sample period from January 1970 to February 2011. The numbers in parenthesis indicate the range of the correlation coefficients in the 95% confidence interval.

Table 2: Univariate forecast (one month) regressions

of stock excess returns on production gaps

	(I)		(II)		(III)	
	gap_{t-2}^{i}	R^2	gap_{t-2}^{G7-i}	R^2	gap_{t-2}^{US}	R^2
$r_t^{e,CND}$	-0.07 (-1.69)	0.00	-0.12 * (-2.24)	0.01	-0.02 (-055)	-0.00
$r_t^{e,FRA}$	-0.15 * (-2.64)	0.01	-0.18 * (-3.49)	0.01	-0.04 (-0.88)	-0.00
$r_t^{e,GER}$	-0.20 * (-3.73)	0.02	-0.16 * (-3.09)	0.01	-0.07 (-1.61)	0.00
$r_t^{e,ITA}$	-0.14 * (-2.42)	0.01	-0.10 (-1.25)	0.00	0.01 (0.18)	-0.00
$r_t^{e,JPN}$	-0.11 * (-2.81)	0.02	-0.17 * (-3.12)	0.02	-0.05 (-1.15)	0.00
$r_t^{e,UK}$	-0.11 * (-2.91)	0.01	-0.26 * (-4.84)	0.03	-0.12 * (-3.52)	0.02
$r_t^{e,US}$	-0.10 * (-2.91)	0.01	-0.21 * (-4.58)	0.03		

Notes: This table provides estimates from one-month ahead forecast regressions of country *i*'s stock market excess return on country *i*'s production gap (column (I)), the average production gap of the other six countries (column (II)) and the U.S. production gap. The forecast regressions take the following form:

$$r_t^{e,i} = \alpha + \beta^i gap_{t-2}^{i} + \nu_t^i \qquad \text{(I)}$$

$$r_t^{e,i} = \alpha + \beta^i gap_{t-2}^{G7-i} + \nu_t^i \qquad \text{(II)}$$

$$r_t^{e,i} = \alpha + \beta^i gap_{t-2}^{US} + \nu_t^i \qquad \text{(III)}$$

Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. The sample period runs from January 1970 to February 2011. The R^2 statistic is adjusted for the number of regressors.

Table 3: Multivariate forecast (one month) regressions

of stock excess returns on production gaps, term spreads and dividend-price ratios

	(I)			(II)			
	$gap_{t-2}^{common,i}$	$gap_{t-2}^{idio,i}$	R^2	$gap_{t-2}^{common,i}$	$gap_{t-2}^{idio,i}$	ts_{t-1}^{i}	R^2
$r_t^{e,CND}$	− 0.19 * (−2.25)	− 0.03 (−0.53)	0.01	− 0.16 (−1.64)	− 0.01 (−0.26)	0.00 (0.74)	0.01
$r_t^{e,FRA}$	− 0.20 * (−3.38)	− 0.04 (−0.35)	0.01	− 0.16 * (−2.74)	− 0.04 (−0.37)	0.00 (1.57)	0.02
$r_t^{e,GER}$	− 0.21 * (−3.14)	− 0.18 * (−2.22)	0.02	− 0.19 * (−2.86)	− 0.15 (−1.68)	0.00 (1.07)	0.02
$r_t^{e,ITA}$	− 0.09 (−1.30)	− 0.26 * (−2.05)	0.01	− 0.09 (−1.39)	− 0.26 * (−2.09)	− 0.00 (−0.48)	0.01
$r_t^{e,JPN}$	− 0.26 * (−3.21)	− 0.08 (−1.84)	0.02	− 0.25 * (−3.14)	− 0.08 (−1.78)	0.00 (0.78)	0.02
$r_t^{e,UK}$	− 0.31 * (−4.67)	0.02 (0.43)	0.03	− 0.34 * (−3.63)	0.03 (0.58)	− 0.00 (−0.57)	0.03
$r_t^{e,US}$	− 0.20 * (−4.64)	0.01 (0.27)	0.03	− 0.23 * (−4.13)	0.00 (0.02)	− 0.00 (−0.91)	0.03

	(III)			
	$gap_{t-2}^{common,i}$	$gap_{t-2}^{idio,i}$	dp_{t-1}^{i}	R^2
$r_t^{e,CND}$	− 0.20 * (−2.36)	− 0.03 (−0.57)	− 0.00 (−0.48)	0.01
$r_t^{e,FRA}$	− 0.21 * (−3.28)	− 0.06 (−0.42)	− 0.00 (−0.52)	0.01
$r_t^{e,GER}$	− 0.21 * (−3.12)	− 0.19 * (−2.27)	− 0.00 (−0.13)	0.02
$r_t^{e,ITA}$	− 0.09 (−1.38)	− 0.27 * (−2.14)	− 0.01 (−0.87)	0.01
$r_t^{e,JPN}$	− 0.25 * (−3.00)	− 0.07 (−1.50)	0.00 (0.52)	0.02
$r_t^{e,UK}$	− 0.27 * (−3.24)	0.15 (1.33)	0.03 (1.31)	0.05
$r_t^{e,US}$	− 0.19 * (−4.42)	0.02 (0.41)	0.00 (0.20)	0.03

Notes: This table provides estimates from one-month ahead forecast regressions of country *i*'s stock market excess return on that component of country *i*'s production gap that is perfectly correlated with the average production gap of the other six countries, $gap_t^{common,i}$, and that component that is orthogonal to it, $gap_t^{idio,i}$ (column (I)) and in addition to the two production gap components on the country *i*'s term spread, i.e. the yield difference between a long-term government bond and a short-term interest rate (column (II)) as well as the country-specific log dividend-price ratio (column (III)). The forecast regressions take the following form:

$$r_t^{e,i} = \alpha + \beta_1^i gap_{t-2}^{common,i} + \beta_2^i gap_{t-2}^{idio,i} + \nu_t^i \qquad \text{(I)}$$

$$r_t^{e,i} = \alpha + \beta_1^i gap_{t-2}^{common,i} + \beta_2^i gap_{t-2}^{idio,i} + \beta_3^i ts_{t-1}^i + \nu_t^i \qquad \text{(II)}$$

$$r_t^{e,i} = \alpha + \beta_1^i gap_{t-2}^{common,i} + \beta_2^i gap_{t-2}^{idio,i} + \beta_3^i dp_{t-1}^i + \nu_t^i \qquad \text{(III)}$$

Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. The sample period runs from January 1970 to February 2011. The R^2 statistic is adjusted for the number of regressors.

Table 4: Multivariate, one-month forecast regressions for different subsample periods

Panel A: sample period January 1970 to June 1990

	$gap^{common,i}_{t-2}$	$gap^{idio,i}_{t-2}$	ts^{i}_{t-1}	R^2
$r^{e,CND}_t$	-0.07 (−0.82)	-0.09 (−0.90)	0.00 (0.53)	-0.00
$r^{e,FRA}_t$	-0.17 (−1.65)	0.09 (0.48)	0.00 (0.77)	0.01
$r^{e,GER}_t$	-0.17 (−1.94)	-0.31 * (−2.11)	0.00 (0.59)	0.02
$r^{e,ITA}_t$	0.07 (0.51)	-0.31 * (−1.98)	-0.00 (−018)	0.02
$r^{e,JPN}_t$	-0.25 * (−2.94)	0.02 (0.18)	0.00 (1.08)	0.03
$r^{e,UK}_t$	-0.49 * (−3.23)	0.12 (1.07)	-0.00 (−0.35)	0.03
$r^{e,US}_t$	-0.21 * (−2.21)	-0.09 (−0.68)	0.00 (0.21)	0.02

Panel B: sample period July 1990 to February 2011

	$gap^{common,i}_{t-2}$	$gap^{idio,i}_{t-2}$	ts^{i}_{t-1}	R^2
$r^{e,CND}_t$	-0.70 * (−1.99)	0.01 (0.05)	-0.00 (−0.95)	0.02
$r^{e,FRA}_t$	-0.16 (−1.70)	-0.27 (−1.36)	0.00 (0.88)	0.02
$r^{e,GER}_t$	-0.12 (−1.60)	-0.35 (−1.63)	0.00 (0.51)	0.02
$r^{e,ITA}_t$	-0.30 * (−3.41)	-0.51 * (−2.66)	-0.01 (−1.46)	0.04
$r^{e,JPN}_t$	-0.14 (−1.91)	-0.05 (−0.49)	-0.00 (−0.14)	0.01
$r^{e,UK}_t$	-0.53 * (−2.50)	0.26 (1.14)	-0.00 (−1.40)	0.02
$r^{e,US}_t$	-0.32 * (−2.62)	0.14 (1.01)	-0.00 (−0.93)	0.03

Notes: This table provides estimates from one-month ahead forecast regressions of country *i*'s stock market excess return on that component of country *i*'s production gap that is perfectly correlated with the average production gap of the other six countries, $gap_t^{common,i}$, that component that is orthogonal to it, $gap_t^{idio,i}$ and in addition to the two production gap components on the country *i*'s term spread, i.e. the yield difference between a long-term government bond and a short-term interest rate The forecast regressions take the following form:

$$r_t^{e,i} = \alpha + \beta_1^i gap_{t-2}^{common,i} + \beta_2^i gap_{t-2}^{idio,i} + \beta_3^i ts_{t-1}^i + \nu_t^i$$

Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. Panel A provides the estimates for the sample period from January 1970 to June 1990. Panel B gives the estimates for the sample period from July 1990 to February 2011. The R^2 statistic is adjusted for the number of regressors.

Table 5: Long-horizon forecast regressions

Panel A: 12 month forecast horizon

	Actual estimates			Implied estimates		
	$gap_t^{common,i}$	$gap_t^{idio,i}$	R^2	$gap_t^{common,i}$	$gap_t^{idio,i}$	R^2
$r_{t,t+h}^{e,CND}$	-1.68 (-2.20)	-0.52 (-1.10)	0.07	-2.06	-0.30	0.10
$r_{t,t+h}^{e,FRA}$	-1.86 (-2.21)	0.22 (0.36)	0.07	-2.19	-0.25	0.10
$r_{t,t+h}^{e,GER}$	-2.08 (-2.41)	0.27 (0.50)	0.07	-2.32	-1.29	0.20
$r_{t,t+h}^{e,ITA}$	-1.89 (-1.38)	0.60 (0.69)	0.03	-0.99	-1.02	0.10
$r_{t,t+h}^{e,JPN}$	-3.21 * (-2.76)	0.98 (1.48)	0.14	-2.87	-0.81	0.20
$r_{t,t+h}^{e,UK}$	-2.28 * (-2.92)	-0.00 (-0.00)	0.15	-3.38	0.18	0.30
$r_{t,t+h}^{e,US}$	-1.51 * (-2.96)	-0.21 (-0.56)	0.15	-2.14	0.14	0.29

Panel B: 24 month forecast horizon

	Actual estimates			Implied estimates		
	$gap_t^{common,i}$	$gap_t^{idio,i}$	R^2	$gap_t^{common,i}$	$gap_t^{idio,i}$	R^2
$r_{t,t+h}^{e,CND}$	-2.98 (-2.18)	-0.89 (-1.34)	0.10	3.71	-0.50	0.16
$r_{t,t+h}^{e,FRA}$	-4.16 (-2.44)	-0.06 (-0.06)	0.15	-3.97	0.30	0.16
$r_{t,t+h}^{e,GER}$	-4.31 (-1.99)	0.27 (0.30)	0.11	-4.25	-1.65	0.34
$r_{t,t+h}^{e,ITA}$	-3.61 (-1.87)	0.06 (0.04)	0.11	-1.80	-1.06	0.17
$r_{t,t+h}^{e,JPN}$	-7.65 * (-4.08)	1.55 (1.25)	0.26	-5.24	-1.39	0.34
$r_{t,t+h}^{e,UK}$	-3.72 * (-4.23)	0.34 (0.62)	0.17	-6.10	0.26	0.48

Table 5 continued

$r^{e,US}_{t,t+h}$	-2.37 (-2.66)	-0.12 (-0.22)	0.14	-3.79	0.18	0.45

Panel C: 36 month forecast horizon

	Actual estimates			Implied estimates		
	$gap^{common,i}_t$	$gap^{idio,i}_t$	R^2	$gap^{common,i}_t$	$gap^{idio,i}_t$	R^2
$r^{e,CND}_{t,t+h}$	-3.57 * (-3.01)	-1.54 (-1.95)	0.15	-5.03	-0.63	0.19
$r^{e,FRA}_{t,t+h}$	-6.75 * (-4.52)	0.11 (0.10)	0.28	-5.42	-0.31	0.20
$r^{e,GER}_{t,t+h}$	-6.02 (-2.36)	-0.06 (-0.05)	0.17	-5.86	-1.75	0.43
$r^{e,ITA}_{t,t+h}$	-5.83 * (-3.20)	-1.25 (-0.84)	0.24	-2.48	-1.06	0.21
$r^{e,JPN}_{t,t+h}$	-9.48 * (-3.88)	1.74 (1.25)	0.28	-7.21	-1.78	0.43
$r^{e,UK}_{t,t+h}$	-3.94 * (-3.32)	0.74 (0.83)	0.12	-8.30	0.30	0.60
$r^{e,US}_{t,t+h}$	-2.55 (-2.60)	-0.54 (-0.64)	0.13	-5.06	0.23	0.53

Notes: This table provides estimates from 12, 24 and 36-month ahead forecast regressions of country *i*'s stock market excess return on that component of country *i*'s production gap that is perfectly correlated with the average production gap of the other six countries, $gap^{common,i}_t$, and that component that is orthogonal to it, $gap^{idio,i}_t$ The forecast regressions take the following form:

$$r^{e,i}_{t,t+h} = \alpha + \beta^{i,h}_1 gap^{common,i}_{t-2} + \beta^{i,h}_2 gap^{idio,i}_{t-2} + \nu^i_{t,t+h}$$

with *h* the forecast horizon in months. Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. The sample period runs from January 1970 to February 2011. The R^2 statistic is adjusted for the number of regressors.

The columns "implied estimates" give point estimates and R^2 statistics implied by the one-month forecast regressions from table 3 under the null hypothesis of no predictability (Boudoukh et al., 2008).

Table 6: Univariate forecast regressions (quarterly frequency)

of stock excess returns on rest-of-the-world production gap

	univariate		multivariate		
	gap_{t-1}^{G7-i}	R^2	gap_{t-1}^{G7-i}	cay_{t-1}^{US}	R^2
$r_t^{e,CND}$	-0.44^* (−2.39)	0.03	-0.44^* (−2.34)	0.02 (0.06)	0.03
$r_t^{e,FRA}$	-0.55^* (−2.81)	0.03	-0.51^* (−2.61)	0.38 (0.79)	0.03
$r_t^{e,GER}$	-0.55^* (−3.38)	0.03	-0.51^* (−3.00)	0.35 (0.71)	0.03
$r_t^{e,ITA}$	-0.40 (−1.59)	0.01	-0.39 (−1.48)	0.14 (0.23)	0.00
$r_t^{e,JPN}$	-0.58^* (−3.30)	0.04	-0.64^* (−3.00)	-0.51 (−0.96)	0.04
$r_t^{e,UK}$	-0.84^* (−4.11)	0.11	-0.81^* (−4.19)	0.29 (0.78)	0.10
$r_t^{e,US}$	-0.66^* (−3.83)	0.08	-0.58^* (−3.41)	0.78^* (2.18)	0.10

Notes: This table provides estimates from one-period ahead forecast regressions of country *i*'s stock market excess return on the average production gap of the other six countries when both regressand and regressor are measured at the quarterly frequency. The left column presents the estimates from univariate regressions of the form:

$$r_t^{e,i} = \alpha + \beta^i gap_{t-1}^{G7-i} + \nu_t^i$$

The right column additionally takes into account that earlier studies provided evidence for the explanatory power of short-run variation in the US consumption-wealth ratio, *cay*, for foreign stock market returns. The forecast regression then obeys

$$r_t^{e,i} = \alpha + \beta^i gap_{t-1}^{G7-i} + \gamma^i cay_{t-1}^{US} + \nu_t^i$$

Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. The sample period runs from the first quarter of 1970 to the fourth quarter of 2010. The R^2 statistic is adjusted for the number of regressors.

Table 7: Principal component coefficients

	PC1	PC2	PC3	PC4	PC5	PC6	PC7
CND	0.31	0.27	0.70	0.50	-0.05	0.29	-0.05
FRA	0.36	0.10	0.20	-0.35	0.27	-0.20	0.77
GER	0.31	-0.39	0.21	-0.31	0.61	0.06	-0.49
ITA	0.44	0.04	-0.04	-0.53	-0.60	0.38	-0.14
JPN	0.35	-0.76	-0.08	0.39	-0.28	-0.17	0.18
UK	0.38	0.19	-0.63	0.30	0.33	0.47	0.11
US	0.46	0.39	-0.17	0.10	-0.08	-0.70	-0.33
% variance	57.13	22.21	8.99	5.39	2.84	2.19	1.24

Notes: This table presents the principal component coefficients of the G7 countries' output gaps. The last row of this table '% variance' indicates how much of the common variation in the output gaps is explained by the respective principal component.

Table 8: One month ahead forecast regressions

on first principal component of national production gaps

	PC^1_{t-2}	R^2
$r_t^{e,CND}$	-0.05^* (-2.19)	0.01
$r_t^{e,FRA}$	-0.07^* (-3.39)	0.01
$r_t^{e,GER}$	-0.07^* (-3.47)	0.01
$r_t^{e,ITA}$	-0.04 (-1.53)	0.00
$r_t^{e,JPN}$	-0.07^* (-3.39)	0.02
$r_t^{e,UK}$	-0.09^* (-4.77)	0.03
$r_t^{e,US}$	-0.08^* (-4.47)	0.03

Notes: This table provides estimates from one-month ahead forecast regressions of country *i*'s stock market excess return on the first principle component of the G7 countries' production gaps, PC^1. The forecast regressions take the following form:

$$r_t^{e,i} = \alpha + \beta^i PC^1_{t-2} + v_t^i$$

Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. The sample period runs from January 1970 to February 2011. The R^2 statistic is adjusted for the number of regressors.

Table 9: Out-of-sample forecast regressions

	Panel A: R^2_{oos} (%)		Panel B: CE Gains	
	$gap_{t-2}^{common,i,HP}$	$gap_{t-2}^{common,i,HP} + gap_{t-2}^{idio,i,HP}$	$gap_{t-2}^{common,i,HP}$	$gap_{t-2}^{common,i,HP} + gap_{t-2}^{idio,i,HP}$
CND	-0.27	-0.10	0.07	0.07
FRA	1.20	1.21	-0.06	0.08
GER	0.32	0.38	0.05	0.05
ITA	1.30	1.33	0.05	0.05
JPN	3.33	3.33	0.07	0.07
UK	3.32	3.35	0.09	0.09
US	-0.37	2.69	0.08	0.08

Notes: Panel A gives a R^2 statistic that shows if the excess return predicted by the forecast variables delivers lower mean squared errors than the historical mean return. A positive value indicates that it does. This statistic is displayed when only the common component in production gaps is used to forecast the respective country's stock market return and when both common and country-specific components are used. This statistic obeys

$$R^2_{oos} = 1 - \frac{\sum_{t=1}^{T} (r_t^e - \hat{r}_t^e)^2}{\sum_{t=1}^{T} (r_t^e - \bar{r}_t^e)^2} \tag{14}$$

in which $\hat{r}_t^e$ denotes the forecast of excess returns up to t-1 and $\bar{r}_t^e$ represents the historical mean excess return calculated up to t-1.

Panel B of this table gives the annualized differences between certainty equivalents of trading strategies from using the common or both common and country-specific components of national production gaps to make portfolio allocation decisions and certainty equivalents from a portfolio strategy employing the mean historical stock market excess return as predictor of expected returns. The certainty equivalents are calculated from $ce = \bar{r}^{p,i} - \frac{\gamma}{2}\sigma^{p,i,2}$ with risk aversion $\gamma = 2$.

Table 10: Forecast regressions of annual US bond excess return on global and country-specific production gap varieties

Sample period: January 1970 to December 2003

	(I)		(II)		(III)		
	gap_t^{US}	R^2	gap_t^{G7-US}	R^2	gap_t^{common}	gap_t^{idio}	R^2
2 year bond	$-0.10*$ (−7.25)	0.23	$-0.10*$ (−4.52)	0.11	$-0.10*$ (−4.43)	$-0.09*$ (−4.63)	0.23
3 year bond	$-0.14*$ (−6.18)	0.19	$-0.11*$ (−3.64)	0.06	$-0.12*$ (−3.50)	$-0.16*$ (−4.52)	0.19
4-year bond	$-0.18*$ (−6.54)	0.18	$-0.14*$ (−3.53)	0.05	$-0.14*$ (−3.48)	$-0.21*$ (−4.77)	0.18
5-year bond	$-0.19*$ (−6.31)	0.15	$-0.15*$ (−3.64)	0.04	-0.16 (−3.60)	$-0.22*$ (−5.08)	0.15

Notes: This table provides estimates from 1-year ahead forecast regressions of country *i*'s bond excess return on country *i*'s production gap (column (I)), the average production gap of the other six countries (column (II)) and on that component of the US production gap that is orthogonal to the average production gap of the other six countries, gap_t^{idio} The forecast regressions take the following form:

$$brx_t^N = \alpha + \beta^N gap_{t-13}^{US} + \nu_t \quad \text{(I)}$$

$$brx_t^N = \alpha + \beta^N gap_{t-13}^{G7-US} + \nu_t \quad \text{(II)}$$

$$brx_t^N = \alpha + \beta^{N,common} gap_{t-13}^{common} + \beta^{N,idio} gap_{t-13}^{idio} + \nu_t \quad \text{(III)}$$

Newey-West (Newey and West, 1987) corrected t-statistics appear below the estimates in parenthesis. Asterisk indicates significance at 95% confidence level if both Newey-West corrected and Valkanov (2003) corrected t-statistics indicate significance at this confidence level. The R^2 statistic is adjusted for the number of regressors.

Swiss National Bank Working Papers published since 2004:

2004-1 Samuel Reynard: Financial Market Participation and the Apparent Instability of Money Demand

2004-2 Urs W. Birchler and Diana Hancock: What Does the Yield on Subordinated Bank Debt Measure?

2005-1 Hasan Bakhshi, Hashmat Khan and Barbara Rudolf: The Phillips curve under state-dependent pricing

2005-2 Andreas M. Fischer: On the Inadequacy of Newswire Reports for Empirical Research on Foreign Exchange Interventions

2006-1 Andreas M. Fischer: Measuring Income Elasticity for Swiss Money Demand: What do the Cantons say about Financial Innovation?

2006-2 Charlotte Christiansen and Angelo Ranaldo: Realized Bond-Stock Correlation: Macroeconomic Announcement Effects

2006-3 Martin Brown and Christian Zehnder: Credit Reporting, Relationship Banking, and Loan Repayment

2006-4 Hansjörg Lehmann and Michael Manz: The Exposure of Swiss Banks to Macroeconomic Shocks – an Empirical Investigation

2006-5 Katrin Assenmacher-Wesche and Stefan Gerlach: Money Growth, Output Gaps and Inflation at Low and High Frequency: Spectral Estimates for Switzerland

2006-6 Marlene Amstad and Andreas M. Fischer: Time-Varying Pass-Through from Import Prices to Consumer Prices: Evidence from an Event Study with Real-Time Data

2006-7 Samuel Reynard: Money and the Great Disinflation

2006-8 Urs W. Birchler and Matteo Facchinetti: Can bank supervisors rely on market data? A critical assessment from a Swiss perspective

2006-9 Petra Gerlach-Kristen: A Two-Pillar Phillips Curve for Switzerland

2006-10 Kevin J. Fox and Mathias Zurlinden: On Understanding Sources of Growth and Output Gaps for Switzerland

2006-11 Angelo Ranaldo: Intraday Market Dynamics Around Public Information Arrivals

2007-1 Andreas M. Fischer, Gulzina Isakova and Ulan Termechikov: Do FX traders in Bishkek have similar perceptions to their London colleagues? Survey evidence of market practitioners' views

2007-2 Ibrahim Chowdhury and Andreas Schabert: Federal Reserve Policy viewed through a Money Supply Lens

2007-3 Angelo Ranaldo: Segmentation and Time-of-Day Patterns in Foreign Exchange Markets

2007-4 Jürg M. Blum: Why 'Basel II' May Need a Leverage Ratio Restriction

2007-5 Samuel Reynard: Maintaining Low Inflation: Money, Interest Rates, and Policy Stance

2007-6 Rina Rosenblatt-Wisch: Loss Aversion in Aggregate Macroeconomic Time Series

2007-7 Martin Brown, Maria Rueda Maurer, Tamara Pak and Nurlanbek Tynaev: Banking Sector Reform and Interest Rates in Transition Economies: Bank-Level Evidence from Kyrgyzstan

2007-8 Hans-Jürg Büttler: An Orthogonal Polynomial Approach to Estimate the Term Structure of Interest Rates

2007-9 Raphael Auer: The Colonial Origins Of Comparative Development: Comment. A Solution to the Settler Mortality Debate

2007-10 Franziska Bignasca and Enzo Rossi: Applying the Hirose-Kamada filter to Swiss data: Output gap and exchange rate pass-through estimates

2007-11 Angelo Ranaldo and Enzo Rossi: The reaction of asset markets to Swiss National Bank communication

2007-12 Lukas Burkhard and Andreas M. Fischer: Communicating Policy Options at the Zero Bound

2007-13 Katrin Assenmacher-Wesche, Stefan Gerlach, and Toshitaka Sekine: Monetary Factors and Inflation in Japan

2007-14 Jean-Marc Natal and Nicolas Stoffels: Globalization, markups and the natural rate of interest

2007-15 Martin Brown, Tullio Jappelli and Marco Pagano: Information Sharing and Credit: Firm-Level Evidence from Transition Countries

2007-16 Andreas M. Fischer, Matthias Lutz and Manuel Wälti: Who Prices Locally? Survey Evidence of Swiss Exporters

2007-17 Angelo Ranaldo and Paul Söderlind: Safe Haven Currencies

2008-1 Martin Brown and Christian Zehnder: The Emergence of Information Sharing in Credit Markets

2008-2 Yvan Lengwiler and Carlos Lenz: Intelligible Factors for the Yield Curve

2008-3 Katrin Assenmacher-Wesche and M. Hashem Pesaran: Forecasting the Swiss Economy Using VECX* Models: An Exercise in Forecast Combination Across Models and Observation Windows

2008-4 Maria Clara Rueda Maurer: Foreign bank entry, institutional development and credit access: firm-level evidence from 22 transition countries

2008-5 Marlene Amstad and Andreas M. Fischer: Are Weekly Inflation Forecasts Informative?

2008-6 Raphael Auer and Thomas Chaney: Cost Pass Through in a Competitive Model of Pricing-to-Market

2008-7 Martin Brown, Armin Falk and Ernst Fehr: Competition and Relational Contracts: The Role of Unemployment as a Disciplinary Device

2008-8 Raphael Auer: The Colonial and Geographic Origins of Comparative Development

2008-9 Andreas M. Fischer and Angelo Ranaldo: Does FOMC News Increase Global FX Trading?

2008-10 Charlotte Christiansen and Angelo Ranaldo: Extreme Coexceedances in New EU Member States' Stock Markets

2008-11 Barbara Rudolf and Mathias Zurlinden: Measuring capital stocks and capital services in Switzerland

2008-12 Philip Sauré: How to Use Industrial Policy to Sustain Trade Agreements

2008-13 Thomas Bolli and Mathias Zurlinden: Measuring growth of labour quality and the quality-adjusted unemployment rate in Switzerland

2008-14 Samuel Reynard: What Drives the Swiss Franc?

2008-15 Daniel Kaufmann: Price-Setting Behaviour in Switzerland – Evidence from CPI Micro Data

2008-16 Katrin Assenmacher-Wesche and Stefan Gerlach: Financial Structure and the Impact of Monetary Policy on Asset Prices

2008-17 Ernst Fehr, Martin Brown and Christian Zehnder: On Reputation: A Microfoundation of Contract Enforcement and Price Rigidity

2008-18 Raphael Auer and Andreas M. Fischer: The Effect of Low-Wage Import Competition on U.S. Inflationary Pressure

2008-19 Christian Beer, Steven Ongena and Marcel Peter: Borrowing in Foreign Currency: Austrian Households as Carry Traders

2009-1 Thomas Bolli and Mathias Zurlinden: Measurement of labor quality growth caused by unobservable characteristics

2009-2 Martin Brown, Steven Ongena and Pinar Yeşin: Foreign Currency Borrowing by Small Firms

2009-3 Matteo Bonato, Massimiliano Caporin and Angelo Ranaldo: Forecasting realized (co)variances with a block structure Wishart autoregressive model

2009-4 Paul Söderlind: Inflation Risk Premia and Survey Evidence on Macroeconomic Uncertainty

2009-5 Christian Hott: Explaining House Price Fluctuations

2009-6 Sarah M. Lein and Eva Köberl: Capacity Utilisation, Constraints and Price Adjustments under the Microscope

2009-7 Philipp Haene and Andy Sturm: Optimal Central Counterparty Risk Management

2009-8 Christian Hott: Banks and Real Estate Prices

2009-9 Terhi Jokipii and Alistair Milne: Bank Capital Buffer and Risk Adjustment Decisions

2009-10 Philip Sauré: Bounded Love of Variety and Patterns of Trade

2009-11 Nicole Allenspach: Banking and Transparency: Is More Information Always Better?

2009-12 Philip Sauré and Hosny Zoabi: Effects of Trade on Female Labor Force Participation

2009-13 Barbara Rudolf and Mathias Zurlinden: Productivity and economic growth in Switzerland 1991-2005

2009-14 Sébastien Kraenzlin and Martin Schlegel: Bidding Behavior in the SNB's Repo Auctions

2009-15 Martin Schlegel and Sébastien Kraenzlin: Demand for Reserves and the Central Bank's Management of Interest Rates

2009-16 Carlos Lenz and Marcel Savioz: Monetary determinants of the Swiss franc

2010-1 Charlotte Christiansen, Angelo Ranaldo and Paul Söderlind: The Time-Varying Systematic Risk of Carry Trade Strategies

2010-2 Daniel Kaufmann: The Timing of Price Changes and the Role of Heterogeneity

2010-3 Loriano Mancini, Angelo Ranaldo and Jan Wrampelmeyer: Liquidity in the Foreign Exchange Market: Measurement, Commonality, and Risk Premiums

2010-4 Samuel Reynard and Andreas Schabert: Modeling Monetary Policy

2010-5 Pierre Monnin and Terhi Jokipii: The Impact of Banking Sector Stability on the Real Economy

2010-6 Sébastien Kraenzlin and Thomas Nellen: Daytime is money

2010-7 Philip Sauré: Overreporting Oil Reserves

2010-8 Elizabeth Steiner: Estimating a stock-flow model for the Swiss housing market

2010-9 Martin Brown, Steven Ongena, Alexander Popov, and Pinar Yeşin: Who Needs Credit and Who Gets Credit in Eastern Europe?

2010-10 Jean-Pierre Danthine and André Kurmann: The Business Cycle Implications of Reciprocity in Labor Relations

2010-11 Thomas Nitschka: Momentum in stock market returns: Implications for risk premia on foreign currencies

2010-12 Petra Gerlach-Kristen and Barbara Rudolf: Macroeconomic and interest rate volatility under alternative monetary operating procedures

2010-13 Raphael Auer: Consumer Heterogeneity and the Impact of Trade Liberalization: How Representative is the Representative Agent Framework?

2010-14 Tommaso Mancini Griffoli and Angelo Ranaldo: Limits to arbitrage during the crisis: funding liquidity constraints and covered interest parity

2010-15 Jean-Marc Natal: Monetary Policy Response to Oil Price Shocks

2010-16 Kathrin Degen and Andreas M. Fischer: Immigration and Swiss House Prices

2010-17 Andreas M. Fischer: Immigration and large banknotes

2010-18 Raphael Auer: Are Imports from Rich Nations Deskilling Emerging Economies? Human Capital and the Dynamic Effects of Trade

2010-19 Jean-Pierre Danthine and John B. Donaldson: Executive Compensation: A General Equilibrium Perspective

2011-1 Thorsten Beck and Martin Brown: Which Households Use Banks? Evidence from the Transition Economies

2011-2 Martin Brown, Karolin Kirschenmann and Steven Ongena: Foreign Currency Loans – Demand or Supply Driven?

2011-3 Victoria Galsband and Thomas Nitschka: Foreign currency returns and systematic risks

2011-4 Francis Breedon and Angelo Ranaldo: Intraday patterns in FX returns and order flow

2011-5 Basil Guggenheim, Sébastien Kraenzlin and Silvio Schumacher: Exploring an uncharted market: Evidence on the unsecured Swiss franc money market

2011-6 Pamela Hall: Is there any evidence of a Greenspan put?

2011-7 Daniel Kaufmann and Sarah Lein: Sectoral Inflation Dynamics, Idiosyncratic Shocks and Monetary Policy

2011-8 Iva Cecchin: Mortgage Rate Pass-Through in Switzerland

2011-9 Raphael A. Auer, Kathrin Degen and Andreas M. Fischer: Low-Wage Import Competition, Inflationary Pressure, and Industry Dynamics in Europe

2011-10 Raphael A. Auer and Philip Sauré: Spatial Competition in Quality, Demand-Induced Innovation, and Schumpeterian Growth

2011-11 Massimiliano Caporin , Angelo Ranaldo and Paolo Santucci de Magistris: On the Predictability of Stock Prices: a Case for High and Low Prices

2011-12 Jürg Mägerle and Thomas Nellen: Interoperability between central counterparties

2011-13 Sylvia Kaufmann: K-state switching models with endogenous transition distributions

2011-14 Sébastien Kraenzlin and Benedikt von Scarpatetti: Bargaining Power in the Repo Market

2012-01 Raphael A. Auer: Exchange Rate Pass-Through, Domestic Competition, and Inflation: Evidence from the 2005/08 Revaluation of the Renminbi

2012-02 Signe Krogstrup, Samuel Reynard and Barbara Sutter: Liquidity Effects of Quantitative Easing on Long-Term Interest Rates

2012-03 Matteo Bonato, Massimiliano Caporin and Angelo Ranaldo: Risk spillovers in international equity portfolios

2012-04 Thomas Nitschka: Banking sectors' international interconnectedness: Implications for consumption risk sharing in Europe

2012-05 Martin Brown, Steven Ongena and Pinar Yeşin: Information Asymmetry and Foreign Currency Borrowing by Small Firms

2012-06 Philip Sauré and Hosny Zoabi: Retirement Age across Countries: The Role of Occupations

2012-07 Christian Hott and Terhi Jokipii: Housing Bubbles and Interest Rates

2012-08 Romain Baeriswyl and Camille Cornand: Reducing overreaction to central bank's disclosures: theory and experiment

2012-09 Bo E. Honoré, Daniel Kaufmann and Sarah Lein: Asymmetries in Price-Setting Behavior: New Microeconometric Evidence from Switzerland

2012-10 Thomas Nitschka: Global and country-specific business cycle risk in time-varying excess returns on asset markets

Swiss National Bank Working Papers are also available at www.snb.ch, section Publications/Research
Subscriptions or individual issues can be ordered at Swiss National Bank, Fraumünsterstrasse 8, CH-8022 Zurich,
fax +41 44 631 81 14, E-mail library@snb.ch