Risk Sharing through Capital Gains[*]

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Abstract

We estimate channels of international risk sharing between European Monetary Union (EMU), European Union, and other OECD countries 1992–2007. We focus on risk sharing through savings, factor income flows, and capital gains. Risk sharing through factor income and capital gains was close to zero before 1999 but has increased since then. Risk sharing from capital gains, at about 6 percent, is higher than risk sharing from factor income flows for European Union countries and OECD countries. Risk sharing from factor income flows is higher for Euro zone countries, at 14 percent, reflecting increased international asset and liability holdings in the Euro area.

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1 Introduction

Income and consumption smoothing (risk sharing) between countries can increase welfare. For countries in a monetary union risk sharing may be particularly important for the functioning of the union because monetary policy is unable to address "asymmetric" shocks, the case of some countries experiencing negative shocks while others are booming. Sala-i-Martin and Sachs (1992) suggest that the risk sharing provided to states by the U.S. federal government may be essential in making the United States a successful "monetary union."[1]

Asdrubali, Sørensen, and Yosha (1996) derive a simple way of quantifying the relative contributions of various channels of income and consumption smoothing within a common framework and find, for the states in the United States, that market institutions provide significant risk sharing through income smoothing. Using this framework Sørensen and Yosha (1998) evaluate channels of risk sharing between countries in the European Union (EU) and in the Organization for Economic Cooperation and Development (OECD) and find much lower levels of risk sharing between countries. They find that the bulk of consumption risk sharing is provided by pro-cyclical government saving with some risk sharing provided by corporate saving at shorter horizons.

Another potentially important channel for risk sharing is capital gains and so far this channel has not been explored much by researchers. It is important to quantify the contribution of capital gains to risk sharing given the financial globalization of the last decade. Developed countries have expanded their gross (and to a smaller extent net) holdings of foreign assets dramatically. If, say, German investors hold large quantities of dollar denominated foreign assets while foreign countries hold liabilities of Germany, denominated in Euros, then fluctuations in asset prices and/or fluctuations in exchange rates can have very large effects on the net wealth of Germany. Obstfeld (2004), Lane and Milesi-Ferretti (2005), Gourinchas and Rey (2007), and others point out that such valuation effects can play a significant role in the process of adjustment to international imbalances. Devereux and Southerland (2010) show that capital gains typically are large and unpredictable ("transitory" in time-series jargon) and they develop a simple Dynamic Stochastic General Equilibrium (DSGE) model which incorporates capital gains. In DSGE-type models, the revaluation of foreign assets will typically be unpredictable (by the logic of the efficient market hypothesis) and due to real shocks. Bracke and Schmitz (2011) show, in an empirical paper, that

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[1]For early contributions, see von Hagen (1992), Goodhart and Smith (1993), and Bayoumi and Masson (1995).

countries with more countercyclical capital gains tend to obtain better consumption risk sharing but they do not directly include capital gains into their risk sharing calculations. We treat capital gains symmetrically with other sources of risk sharing and while countercyclical capital gains of a given size surely provide better insurance than procyclical capital gains, our metric is based on whether capital gains make income including capital gains less correlated with output after controlling for world output. Our setting takes into account the size of the gains—numerically small capital gains will not matter much even if they are strongly countercyclical.

Our sample is composed of countries in the OECD with a particular focus on members of the EU and the European Monetary Union (EMU). Risk sharing may be endogenous to the formation of a currency union and hence by grouping EU and EMU countries separately we can investigate the impact of the euro on risk sharing between EU countries.[2] A common currency is likely to reduce the costs of trading or information gathering leading to higher cross-ownership of financial assets. The removal of currency risk may further stimulate foreign direct investment and the integration of banks and bond markets will imply deeper and more liquid markets for borrowing and lending. For the EMU such patterns are documented by, for example, Adam, Jappelli, Menichini, Padula, and Pagano (2002), Baele, Ferrando, Hördahl, Krylova, and Monnet (2004), and Kalemli-Ozcan et al. (2010).[3]

We refer to the situation where consumption grows at identical rates in all countries as full risk sharing and we label the growth rate of a country-level variable minus its world-wide counterpart the "idiosyncratic" growth-rate.[4] We define risk sharing to be higher the less idiosyncratic consumption growth co-varies with idiosyncratic income growth. As argued above, there are different ways that countries can obtain risk sharing which we refer to as channels of risk sharing. The main channels are cross-ownership of assets that "smooth" income (making income growth in a country less sensitive

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[2]See Frankel and Rose (1998), De Grauwe and Mongelli (2005), and Kalemli-Ozcan, Sørensen, and Yosha (2001), who consider more carefully how the criteria for optimality of currency areas may be endogenous and provide evidence from the EMU.

[3]Sørensen, Wu, Yosha, and Zhu (2007) and Kalemli-Ozcan, Papaioannou, and Peydro (forthcoming) show that larger holdings of foreign assets are associated with more international risk sharing. Demyanyk, Ostergaard, and Sørensen (2007) demonstrate that the integration of U.S. banking markets was followed by increased income smoothing.

[4]Under the assumption that exchange rate shocks reflect supply shocks to tradeable and non-tradeable components are more sophisticated benchmark can be found as shown by Backus and Smith (1993) and Kohlmann (1995). In a world where exchange rates are buffeted by speculative and monetary shocks, models which allow for non-tradeables do not deliver simple benchmark statistics and we, therefore, prefer to base our discussion an the simplest benchmark; namely, that of the one-good model.

to output growth in that country), transfers that smooth disposable income for given income, and borrowing and lending that smooth consumption for given disposable income.

We find that smoothing through factor income flows—resulting from international cross-ownership of assets—after being negligible in the past has increased steeply since 2000, although how much depends somewhat on the exact sample of countries. Measuring risk sharing from recorded factor income flows may, however, miss the boat. The large external asset- and debt-positions built up in recent years open for the possibility that capital gains, which are typically not recorded in the national accounts, provide the bulk of risk sharing. We find that income smoothing from capital gains is more stable (over time and across samples) than income smoothing from factor income flows and of roughly the same size post-2000 (but clearly larger pre-2000). The most important source of overall international consumption risk sharing remains saving.

The remainder of the paper is laid out as follows. Section 2 outlines the basic theory of perfect risk sharing and our way of measuring the degree of risk sharing from various channels. Section 3 discusses our econometric approach while Section 4 presents the empirical results. Section 5 concludes.

2   Risk Sharing: Theory

The basic theory of international risk sharing is well known for endowment economies with one homogeneous tradable good—see Obstfeld and Rogoff (1996). Period t per capita output of country i is an exogenous random variable with a commonly known probability distribution.[5] Consumers within each country are identical with Constant Relative Risk Aversion utility functions and perfect Arrow-Debreu markets for contingent claims exist. Optimal consumption then satisfies the full risk sharing relation $c_t^i = k^i \, c_t^W$, where k^i is a country specific constant, c_t^i is country i per capita consumption, and c_t^W is world per capita consumption in period t. When risk is fully shared between countries, the consumption of a country co-moves with world consumption but not with country specific shocks.

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[5]While the one-good model is less well suited for theoretical modeling of foreign assets, alternative models at present struggles to fit the data and we, therefore, prefer a simple benchmark model which relates real shocks to output to real movements in consumption. For early treatments of more complicated models, see Canova and Ravn (1996) and Lewis (1996), who focus on international risk sharing, and Devereux and Southerland (2010) and references there for recent DSGE-modeling of international economies with real exchange rate shocks.

If the period t utility function of country i is $\theta_t^i u(\cdot)$ where θ_t^i is an idiosyncratic taste shock (normalized so that $\Sigma_i(1/\theta_t^i) = 1$ in all periods), then consumption, assuming perfect markets for contingent output, will satisfy the relation $c_t^i = \theta_t^i k^i c_t^W$, in any state of nature. Consumption in country i is no longer a fixed fraction of world consumption as consumption is affected by aggregate shocks and by idiosyncratic taste shocks but not by other idiosyncratic shocks (including income shocks).

A testable implication is that expected consumption growth rates are identical for all countries; i.e.,

$$\Delta \log c_t^i = c \; + \; \Delta \log c_t^W \; + \; \epsilon_{it}, \tag{1}$$

where c is a constant and ϵ_{it} is an error term—due to either taste shocks or noise. An implication is that after controlling for aggregate consumption growth, the consumption growth rate of a country should not be a function of output growth of that country as long as output growth is independent of consumption taste shocks. Regression based tests for full risk sharing at the country level are conducted by Obstfeld (1994), Canova and Ravn (1996) and Lewis (1996)—see Lewis (1995) for a comprehensive survey.[6]

International models of risk sharing with a role for exchange rates in a rational expectations setting go back to Backus and Smith (1993) and Kollmann (1995). In those models, countries produce specialized goods and the real exchange rate reflects the equilibrium price of tradeables—see, for example, Benigno (2009). Coeurdacier, Kollmann, and Martin (2010) is a prominent example of a more recent literature that allows for equilibrium portfolio holdings in models with terms-of-trade shocks. Models of this type move closer to fitting the empirical data although it is difficult for models of rational consumers to capture the high volatility of international asset prices, including exchange rates.

In our empirical work, we use the standard one-good model as our benchmark and estimate the amount of risk shared through different channels. We take equation (1) as the point of departure and quantify the deviation from this benchmark. We specifically focus on the risk sharing role of capital gains in the same framework as the quantification of other channels.

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[6]The first tests for full risk sharing, using individual-level data were performed by Cochrane (1991), Mace (1991) and Townsend (1994). The International Real Business Cycle literature, most notably Backus, Kehoe, and Kydland (1992), Baxter and Crucini (1995), and Stockman and Tesar (1995) examine the prediction that the correlation of consumption across countries should be equal to unity. The data are, however, far from confirming that prediction.

2.1 *Channels of income insurance and consumption smoothing*

We consider variation in Gross Domestic Product, GDP, as the basic risk of country that may or may not be shared with other countries; i.e., we consider GDP as the exogenous endowment of country i.[7] In this article, we consider capital gains which we show in the empirical section below have very different persistence than shocks to GDP. We, therefore, have to consider the present value of shocks. If the interest rate is r, the (expected) present value of GDP of country i at time t is $W^i \equiv \frac{1}{1+r}\Sigma_{s=1}^{\infty}(\frac{1}{1+r})^s \mathrm{E_t GDP^i_{t+s}}$ and the permanent income stream that can be sustained from this is rW_i. We do not assume that Hall's (1978) Permanent Income Hypothesis holds for consumption because it is typically found not to hold exactly, see Deaton (1992), but all modern models involve forward-looking consumers optimizing subject to their intertemporal budget constraint and we therefore use the tools of permanent income theory to help decide on how to properly discount capital flows. If GDP follows a random walk (which we show below is a good approximation) then $\mathrm{E_t GDP_{t+s}} = \mathrm{GDP_t}$ and $\Delta r W^i = \Delta\mathrm{GDP}^i_t$ (since $\frac{1}{1+r}\Sigma_{s=1}^{\infty}(\frac{1}{1+r})^s = \frac{1}{r}$). The change in GDP can therefore be considered as the endowment shock, which would be the shock to permanent income if the country was in autarky where income equals product (we ignore depreciation and investment).

One way of sharing risk internationally is through international income diversification; i.e., through cross-border ownership of productive assets. Net income from foreign assets is reflected in the National Accounts data as the difference between GDP and Gross National Income (GNI). We initially ignore potential capital gains.[8] The present value of GNI is $Z^i = \frac{1}{1+r}\Sigma_{s=1}^{\infty}(\frac{1}{1+r})^s \mathrm{E_t GNI^i_{t+s}}$. The permanent income stream from this present value will be rZ^i. Because we can approximate GNI by a random walk, the innovation to this income stream is $\Delta\mathrm{GNI}^i$ by the same calculation we did for GNI. If risk is fully insured via net foreign factor income $(= \mathrm{GNI} - \mathrm{GNI})$, then GNI will satisfy

$$\Delta \log \mathrm{GNI}^i_t = c \ + \ \Delta \log \mathrm{GNI}^W_t \ + \ \epsilon_{it}. \tag{2}$$

However, capital gains are not recorded as part of GNI and the total innovation to intertemporal wealth is $\Delta r(Z_i + A^i) = \Delta\mathrm{GNI}^i + r\Delta A^i$, where A^i is net foreign assets of country i and ΔA^i is capital gains (i.e., it is the change in net foreign assets prior to the addition of savings). We show in the

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[7]GDP is not literally exogenous but allowing for investment and/or labor-leisure choice does not lead to large deviations from relation (1), see Backus, Kehoe, and Kydland (1992).

[8]Gross National Income was previously called Gross National Product.

empirical section that capital gains are transitory and very close to white noise and therefore the present expected value of capital gains (the shock to the present value of A) is then simply ΔA and permanent income stream from the shock is $r\Delta A$. We examine if gross national income including the permanent income derived from capital gains is fully shared internationally. For this exercise we need to choose a value for the interest rate and we choose $r = .05$.[9] Using the value $r = .05$ and using our empirical estimates of capital gains (CAPITALGAIN$_t^i$) as the measure of the innovation to the stock of net foreign assets, we examine if GNICG $\equiv$ GNI $+ .05 *$ CAPITALGAIN satisfies a relation similar to equation (2).

If risk is not fully shared through factor income flows and capital gains, there are further possible channels for smoothing consumption, such as depreciation and international transfers. Sørensen and Yosha (1998) find little risk sharing through these channels and we therefore lump them with the more important channel; namely, smoothing through pro-cyclical saving. Individuals save and dis-save in order to smooth consumption intertemporally.[10]

We perform panel data regressions which measure deviations from perfect risk sharing. Asdrubali, Sørensen, and Yosha (1996) show that the specification we use can be motivated from a variance decomposition which measures the fraction of shocks to GDP that are smoothed through international factor income flows, through capital gains, through saving, and the fraction of shocks that are not smoothed, namely, the residual deviation of the international consumption allocation from equation (1), the full risk sharing benchmark. For brevity, we do not give the detail here.[11] Sørensen and Yosha (1998) discuss a specification similar to ours (but not including capital gains) in detail and further decompose the contribution from personal, corporate, and government saving which we for brevity leave out here.

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[9]Alternatively, the scaling by 5 percent could be obtained with a real interest rate of 3 percent and allowing for slight persistence in the capital gains consistent with the point estimates we find in the empirical section. As long as this persistence is near zero, the 5 percent approximation is reasonable and we prefer this value to explicit estimates of persistence country-by-country because such estimates will be quite noisy for our short sample.

[10]Baxter and Crucini's (1995) show that even if only a riskless asset can be traded, equation (1) will approximately hold if shocks to GDP are transitory. That is, when shocks to GDP are transitory, borrowing and lending in the credit market is a close substitute for income insurance. In contrast, if shocks to GDP are highly persistent, consumption smoothing through trade in a riskless bond will not approximate the allocation in equation (1); namely, the credit market will not closely mimic the role of capital markets—shocks that were not insured ex-ante on capital markets will not be smoothed ex-post on credit markets.

[11]A working paper version of this article, which gives the details, is available from the authors on request.

3 Estimation

3.1 *Estimating Determinants of Net Capital Gains*

In order to help interpret the results involving capital gains, we conduct a minor study of determinants of capital gains in a descriptive (non-causal) sense. Changes in exchange rates are likely to result in capital gains for countries with large holdings of assets and liabilities because assets and liabilities often are denominated in different currencies. For example, many countries hold foreign currency reserves in U.S. dollars and those reserves will increase in value if the dollar does. Similarly, swings in stock market valuations are likely to result in capital gains and losses. We regress country-level capital gains normalized by GDP on the value of external equity assets and liabilities, on external debt assets and liabilities, on the change in the exchange rate (the amount of appreciation), on interest rates, on the interaction of external debt assets and liabilities with changes in the exchange rate, on the interaction of debt assets with the change in the U.S. interest rate (10-year bond yield), on the interaction of debt liabilities with the change in domestic interest rate, on the interaction of equity assets and liabilities with currency appreciation, and on the interaction of equity assets and liabilities with the value of the U.S. stock index and the national stock index, respectively. A depreciation will lead to domestic liabilities losing value in dollar terms if they are denominated in domestic currency and we expect to find increasing U.S. interest rates associated with a depreciation of the value of foreign bonds.

We estimate the following panel regression:

$$
\begin{aligned}
\text{CAPITALGAIN}_t^i \;=\;& \delta_0 \;+\; \delta_1 \,\text{ASSET}_t^i \;+\; \delta_2 \,\text{LIABILITY}_t^i \;+\; \delta_3 \,\text{INDEX}_t^i \\
&+\; \delta_4 \,\text{INDEX}_t^{\text{US}} \;+\; \delta_5 \,\Delta\text{EXCH}_t^i \;+\; \delta_5 \,X_t^i ;
\end{aligned}
\tag{3}
$$

where ASSET is (the vector of) equity and debt assets, LIABILITY is debt and equity liabilities, INDEX^i is the value of the stock index of country i or the interest rate of country i, INDEX^{US} is the corresponding U.S. index (approximating world stock prices/interest rates), EXCH is the dollar exchange rate, while the X terms refer to interaction variables. The interaction variables enter in the form (say, for debt assets and currency appreciation): $(\text{DEBT(A)}_t^i - \overline{\text{DEBT(A)}}_{\cdot}^{\,i}) * (\Delta\text{EXCH}_t^i - \overline{\Delta\text{EXCH}}_{\cdot}^{\,i})$ where $\overline{X}_{\cdot}^{\,i}$ for any variable X is the average over time for country i.

3.2 *Estimating channels of risk sharing*

The following panel regressions are estimated:

$$
\begin{aligned}
\Delta \log \text{GDP}_t^i - \Delta \log \text{GNI}_t^i &= \nu_{f,t} + \beta_f \; \Delta \log \text{GDP}_t^i + \epsilon_{f,t}^i \; , \\
\Delta \log \text{GNI}_t^i - \Delta \log \text{GNICG}_t^i &= \nu_{d,t} + \beta_k \; \Delta \log \text{GDP}_t^i + \epsilon_{d,t}^i \; , \\
\Delta \log \text{GNICG}_t^i - \Delta \log \text{C}_t^i &= \nu_{\tau,t} + \beta_\tau \; \Delta \log \text{GDP}_t^i + \epsilon_{\tau,t}^i \; , \\
\Delta \log \text{C}_t^i &= \nu_{u,t} + \beta_u \; \Delta \log \text{GDP}_t^i + \epsilon_{u,t}^i \; ,
\end{aligned}
\tag{4}
$$

where $\nu_{.,t}$ are time fixed effects. The time fixed effects capture year-specific impacts on growth rates, most notably the impact of growth in aggregate output. Furthermore, with time fixed effects the β-coefficients are weighted averages of year-by-year cross-sectional regressions. To take into account autocorrelation in the residuals, we assume that the error terms in each equation and in each country follow an AR(1) process. Since the samples are short, we assume that the autocorrelation parameters are identical across countries.

We further allow for state-specific variances of the error terms. In practice, we estimate the system in (4) by a two step Generalized Least Squares (GLS) procedure. Data are differenced at the yearly frequency. Because our method is based on panel estimations with time fixed effects, it yields fully consistent estimates even if there are worldwide taste shocks.

4 Results

4.1 *Data*

The National Accounts variables, GDP, GNI, consumption, savings, population, exchange rates, and consumer price indices (CPI), are obtained from the OECD National Accounts, Main Aggregates (Volume I) and Detailed Tables (Volume II), 1990-2007. The GDP series is transformed into real per capita terms by dividing by population and deflating by CPI.

The OECD countries in our sample consist of all members except Luxembourg (very small and atypical), Iceland (incomplete data), and the Czech Republic, Hungary, Mexico, Poland, Slovakia, and Turkey (less developed countries). We use subsets of OECD members in various regressions:

EMU countries with the exception of Luxembourg,[12] and EU-countries, which denotes all the 2003 member countries, excluding Luxembourg.[13] We do not have the data needed to construct capital gains for Belgium, Japan, Greece, Norway, and Portugal before 2000 so results before then are shown without those countries, while results after 2000 are shown for both the samples without those countries and for the full EMU, EU, and OECD samples.

4.2 *Calculation of Capital Gains from External Assets*

Net capital gains from external assets are not directly available. Therefore, we employ the method of Lane and Milesi-Ferretti (2005) who provide a detailed accounting framework which separates the basic factors—trade imbalances, investment income flows, and capital gains. Net capital gains from foreign assets are derived as

$$\text{CAPITALGAIN}_t = \Delta\text{NFA}_t - \text{CA}_t - \text{ERR}_t, \tag{5}$$

where CAPITALGAIN_t is the capital gains on foreign assets, NFA_t is the net foreign asset position of the domestic country i at time t while the current account, CA_t is the balance on goods, services, and current transfers while the error term ERR_t includes factors such as capital account transfers and errors and omissions that lead to discrepancies between a country's current account and net inflows of capital.[14] Curcuru, Dvorak, Warnock (2008) point out that assigning the error term to capital gains leads to very large estimated rates-of-return (when capital gains are included) on U.S. foreign asset holdings—returns which they convincingly argue are inconsistent with other sources of information. We, therefore, alternatively set the error term to zero in equation (5) (implicitly assigning the errors to the current account data). While this results in significant changes in the levels of the calculated capital gains, the results that we present are robust to this change and we therefore only present results using the convention of equation (5).

We calculate the net foreign asset position using the IMF's balance of payment components. The net foreign asset position, NFA_t, is roughly defined as the sum of the net debt, net equity,

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[12]Our EMU sample consists of Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, and Spain.

[13]The EU sample consists of the EMU sample plus Denmark, Sweden, and the UK.

[14]Detailed codes and descriptions of each variable extracted from the International Financial Statistics Database (IFS) are listed in Lane and Milesi-Ferretti (2001).

net foreign direct investment (FDI) positions, and foreign exchange reserves. We use the following identity to calculate the foreign asset position of country i at time t:

$$\text{NFA}_t = \text{DEBT(A)}_t + \text{EQUITY(A)}_t + \text{FDI(A)}_t + \text{FX}_t - \text{DEBT(L)}_t - \text{EQUITY(L)}_t - \text{FDI(L)}_t \ , \tag{6}$$

where DEBT(A), EQUITY(A) and FDI(A) are the stocks of debt, equity, and FDI assets. Similarly DEBT(L), EQUITY(L) and FDI(L) are the stocks of debt, equity and FDI liabilities respectively, and FX refers to the foreign exchange reserves of the country. All variables used in creating the net foreign asset position are extracted from the IMF International Financial Statistics (IFS).

To estimate the panel data regression for determinants of capital gains, we utilize annual returns on equity and debt for OECD members. The data for standard national stock indices are taken from Morgan Stanley Capital International Database (MSCI) for 1992 through 2007. MSCI provides the national stock indices that have become the most widely used international equity benchmarks by institutional investors. For debt returns, for the same sample, we use the 10-year risk-free bond returns extracted from the IFS.

4.3 *Figures*

Figure 1 about here

Figure 1 displays the average, maximum, and minimum capital gains by country. Most countries have average capital gains near 0 but annual capital gains can be as high as +50 percent or –70 percent of GDP, as seen for Finland.

Figure 2 about here

Figure 2 displays the average absolute value of capital gains as percent of GDP for the average of EU and OECD countries, respectively.[15] It is apparent that capital gains have become significantly

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[15]The values of capital gains to GDP ratios are averaged cross-sectionally to obtain the OECD and EU values. EU: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Ireland, the Netherlands, Portugal, Spain, Sweden, and the UK. OECD: EU plus Australia, Japan, Korea, Switzerland, and the United States.

larger (relative to GDP) since the mid-1990s. In most years, capital gains are numerically larger for the OECD countries, although the difference is typically minor.

Figure 3 about here

Figure 3 displays the ratio of capital gains to GDP and GDP-growth year-by-year for the United States. In the theoretical literature, it is often pointed out that terms-of-trade may provide "automatic risk sharing" in the sense that productivity shocks cause output growth which, if country output is specialized, will cause real exchange rate depreciation (larger supply of a country-specific good depresses its price), thereby providing a resource transfer from high growth to low growth countries. While such mechanisms may be at play for some countries they do not seem important for the United States or the other countries in our sample (not shown for space considerations), where no systematic relation between growth and capital gains is apparent. One can also tell from the Figure that capital gains typically are not persistent, even if the United States enjoyed a sequence of positive capital gains from 2002 to 2007.

If the equity issued by a country's firms is mainly held abroad and this equity appreciates, the country suffers adverse capital gains. We illustrate this mechanism for the case of Finland where Nokia dominated the capitalization of Finish stocks from the late 1990s.

Figure 4 about here

Indeed, Figure 4 clearly reveals how huge run-ups in the value of Nokia in 1999 and 2000 let to negative capital gains for Finland (the large percentage value increase seen for Nokia in early 1990s had no such effect since Nokia was not as large then).[16] One can also discern a tendency for positive capital gains to be associated with periods of depreciation of the Finish currency.

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[16]Exchange rate is Finnish markka (later Euro) per USD. Positive (negative) changes indicate depreciation (appreciation) of the national currency.

4.4 *Income insurance and consumption smoothing between EMU and OECD countries*

Table 1 about here

Table 1 displays descriptive statistics for most variables used. Consumption, GDP, and GNI growth is between 1.7 and 1.9 percent on average with the standard deviation of consumption growth being the lowest consistent with risk sharing. Equity and debt assets and liabilities are about 13-16 percent of GDP on average and debt liabilities constitute 23 percent. The average exchange rate depreciation vis-a-vis the United States is close to 0 but the standard deviations are very large. Average stock market appreciation has been very high during our sample period. The interaction terms all display high variance and one can observe that non-U.S. interest rates have dropped faster than U.S. ones on average, while non-U.S. stock markets have appreciated faster.

Table 2 about here

Correlations between regressors are shown in Table 2. In general, most correlations are fairly low, although the levels of assets and liabilities tend to be highly correlated because some countries are financially open and have large gross positions while other countries tend to be more closed and hold small gross positions.

Table 3 about here

Table 3 provides information on determinants of capital gains in a descriptive sense. A first look at the coefficients and partial R-squares reveals that large capital gains tend to be associated with large holdings of foreign debt and equity in periods where the domestic currency depreciates. In the early sample, countries obtain capital gains on foreign debt assets when the foreign interest rate (approximated by the U.S. rate) falls (as expected) but this effect is not very significant and not important as measured by the partial R-squares—this is probably because interest rate changes are muted compared to the variation in exchange rates and stock indices. Capital gains on equity,

when the U.S. market appreciates, are marginally significant but negative capital gains are found in countries with large equity liabilities when the domestic market value increases—as expected.

Table 4 about here

Table 4 estimates a panel autoregressive model (with country-specific intercepts) of order one of the form $X_{it} = \mu_i + \alpha X_{it-1} + e_{it}$ where X is log(GDP), the ratio of CAPITALGAIN$_t$ to GDP, or the ratio of foreign net factor income to GDP. A coefficient α of unity implies that X is a random walk while a value of 0 implies that X is white noise. The top panel shows that capital gains are close to white noise with a significant positive coefficient to the lag but the point estimate of 0.16 implies that the process is much closer a white noise process than to a random walk which corresponds well with the country-by-country estimates of persistence of valuation gains presented in Devereux and Southerland (2010). GDP has a point estimate for the lag of 0.99 for which implies that GDP almost exactly behaves like a random walk consistent with a large literature that find persistent shock to output. Factor income is also persistent and close to a random walk. The bottom panel displays the statistics and P-values for Im-Pesaran-Smith unit root tests and there is very strong evidence that capital gains are not persistent while there is no evidence against GDP or net factor income having unit roots.

Table 5 about here

Our main findings are in Table 5. Risk sharing from (net foreign) factor income flows is highest in the EMU since year 2000 where the significant coefficient of 14 percent for the full EMU sample indicates substantial risk sharing. This result is consistent with increased foreign asset holdings facilitated by the common currency. This channel is not significant for the full EU sample which technically is likely to be caused by procyclical factor income in Denmark, Sweden, and the UK during this sample period. We also do not find significant risk sharing from factor income flows in the broader OECD sample. Capital gains robustly (and significantly for the larger EU and OECD samples) are associated with about 6 percent risk sharing. Overall, the amount of (*cum*

capital gains) income smoothing is twice as large as one would estimate using only factor income flows recorded in the national accounts and smoothing from capital gains is a steady source of risk sharing. Pre-2000, the income smoothing estimated from factor income flows is a puzzling negative number for all three country groups but adding smoothing from capital gains results in a more reasonable coefficient of about 0. One might have expected higher risk sharing from capital gains for the EMU countries, which are likely to hold larger stocks of international assets, but Table 3 revealed that capital gains to a large extent are caused by exchange rate movements and this source of variation is not present for intra-EMU holdings.

In general, the measurement and timing of factor income flows is not well understood and it is possible that a more correct picture of risk sharing from cross-ownership of assets is obtained by adding the estimated risk sharing from capital gains to measured risk sharing from factor income. If we add the first two rows of Table 5, the picture is one of zero risk sharing from cross-ownership before 2000—likely because the gross holdings were small relative to GDP—with significant risk sharing from this channels since 2000. The risk sharing obtained through capital gains are consistent with *some* risk sharing from endogenous prices but we stop well short of doing any analysis of causality.

The bulk of risk sharing is provided by (private and government) saving but the picture is still very different from the picture of Sørensen and Yosha who find that pre-1990. saving was the only significant source of risk sharing. Risk sharing between countries, and especially between EMU countries, is slowly becoming closer to that of the United States where Asdrubali, Sørensen, and Yosha (1996) find that the bulk of risk sharing is provided by private capital markets. Private markets have the potential to perform risk sharing more efficiently, for example, by better monitoring of recipients of capital flows, and it is important to follow this development carefully and ignoring the impact of capital gains will lead to a potentially serious underestimate of the risk sharing arising from foreign capital holdings.

5   Concluding Remarks

We estimate the amount of risk sharing between EMU, EU, and other OECD countries during the period 1992–2007, focusing on the role of capital gains. This unexplored channel of risk sharing

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is potentially important given the quadrupling of foreign assets and liabilities during the period of financial globalization. We find that risk sharing through factor income flows and capital gains was close to zero before 1999 but has increased since then. Risk sharing from capital gains is 6 percent for all three groups of countries, an amount that is as big as risk sharing from factor income flows for the European Union countries and twice as big as risk sharing from factor income flows for the OECD countries. For the EMU countries risk sharing from factor income flows dominates risk sharing from measured factor income flows.

The amount of risk sharing through measured factor income flows is quite volatile while the amount of risk sharing provided by capital gains is stable across country samples and time periods. Possibly, this is due to capital gains responding systematically (with opposite sign) to growth with domestic assets increasing in price in good times as we illustrated with Nokia's stock price in the case of Finland.

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Table 1: **Descriptive Statistics**

	Mean	Stdev1	Stdev2
ΔC	1.67	1.15	1.25
ΔGDP	1.83	1.29	1.49
ΔGNI	1.85	1.47	1.64
CAPITALGAIN	0.12	9.35	8.30
CAPITALGAIN(2)	-0.22	9.30	8.21
EQUITY(A)	13.66	13.91	8.33
DEBT(A)	15.31	16.81	10.19
EQUITY(L)	16.49	21.36	9.49
DEBT(L)	23.49	25.47	12.61
ΔEXCH	0.04	4.57	8.46
ΔEQUITYINDEX^i	19.68	35.06	34.63
ΔEQUITYINDEX^{us}	9.97	0.00	19.95
ΔINT.RATE^i	-3.81	3.65	7.49
ΔINT.RATE^{us}	-2.67	0.00	10.73
DEBT(A)*ΔINT.RATE^{us}	-25.38	140.00	167.94
DEBT(L)*ΔINT.RATE^i	-95.73	342.56	440.62
EQUITY(A)*ΔEQUITYINDEX^{us}	218.36	278.73	397.35
EQUITY(L)*ΔEQUITYINDEX^i	545.21	1468.48	1173.67
DEBT(A)*ΔEXCH	-34.84	120.86	154.60
DEBT(L)*ΔEXCH	-37.67	240.69	321.48
EQUITY(A)*ΔEXCH	-17.48	113.58	138.89
EQUITY(L)*ΔEXCH	1.90	167.32	171.45

Sample: 1992-2007. Countries included: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the UK, and the United States. Stdev1 (cross section) is the time average of $[(1/n)\sum_i(X_{it}-\bar{X}_t)^2]^{1/2}$ where $\bar{X}_t$ is the period t average of X_{it} across countries and n is the number of countries. Stdev2 (time series): Average across countries of $[(1/T)\sum_t(X_{it}-\bar{X}_i)^2]^{1/2}$ where $\bar{X}_i$ is the time average of X_{it} for country i and T is number of the years in the sample. All coefficients are multiplied by 100. CAPITALGAIN in this table is the ratio of net capital gains to GDP for each country. CAPITALGAIN(2) is an alternative measurement of capital gains where errors and omissions are omitted in the capital gains calculation. EQUITY(A) is the ratio of foreign equity assets to GDP and DEBT(A) is the ratio of foreign debt assets to GDP. EQUITY(L) and and DEBT(L) are the ratios of foreign equity and debt liabilities to GDP. CAPITALGAIN, EQUITY(A), DEBT(A), EQUITY(L), and DEBT(L) variables are all in percentages. ΔGDP and ΔGNI are changes in the logarithm of real GDP and GNI per capita. ΔC is the change in the logarithm of total consumption per capita. ΔEXCH is the annual percentage change in the value of the country i's currency per U.S. dollar. ΔINT.RATE^i is the annual percentage change in 10-year government bond yields for the countries in the sample. ΔINT.RATE^{us} is the annual percentage change in the 10-year U.S. government bond yield. ΔEQUITYINDEX^i is the annual percentage changes in the Morgan Stanley Capital International equity index for the countries in the sample. ΔEQUITYINDEX^{us} is the annual percentage change in the U.S. MSCI equity index.

Table 2: **Correlation Matrix**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) CAPITALGAIN	1.00																	
(2) DEBT(A)	−0.11	1.00																
(3) DEBT(A) * ΔEXCH	0.05	−0.46	1.00															
(4) DEBT(A) * ΔINT.RATE^i	−0.08	−0.03	0.30	1.00														
(5) DEBT(L)	−0.13	0.82	−0.40	−0.02	1.00													
(6) DEBT(L) * ΔEXCH	0.09	−0.37	0.85	0.23	−0.31	1.00												
(7) DEBT(L) * ΔINT.RATE^{us}	0.03	0.05	0.09	0.47	−0.01	−0.04	1.00											
(8) EQUITY(A)	−0.01	0.79	−0.27	0.03	0.75	−0.23	0.10	1.00										
(9) EQUITY(A) * ΔEXCH	0.03	−0.30	0.85	0.23	−0.28	0.83	0.15	−0.22	1.00									
(10) EQUITY(A) * ΔEQUITYINDEX^{us}	−0.13	0.59	−0.22	0.42	0.53	−0.20	0.12	0.66	−0.25	1.00								
(11) ΔEQUITYINDEX	0.01	−0.03	0.10	0.15	0.02	0.12	0.07	0.06	0.13	0.11	1.00							
(12) EQUITY(L)	−0.19	0.61	−0.10	0.02	0.50	−0.07	0.08	0.06	−0.04	0.40	0.14	1.00						
(13) EQUITY(L) * ΔEXCH	0.04	−0.19	0.69	0.19	−0.18	0.64	0.04	0.67	0.73	−0.17	0.21	0.27	1.00					
(14) EQUITY(L) * ΔEQUITYINDEX^i	−0.11	0.06	0.13	0.15	0.09	0.15	0.10	−0.11	0.15	0.11	0.71	0.44	0.55	1.00				
(15) ΔEXCH	0.14	−0.18	0.60	0.13	−0.15	0.81	−0.07	0.13	0.63	−0.13	0.10	0.01	0.55	0.14	1.00			
(16) ΔINT.RATE^i	0.06	0.10	0.02	0.34	0.09	−0.10	0.77	0.17	0.00	0.15	0.17	0.12	0.02	0.14	−0.17	1.00		
(17) ΔEQUITYINDEX^{us}	−0.03	0.25	−0.12	0.33	0.21	−0.16	0.15	0.23	−0.14	0.59	0.26	0.11	−0.01	0.08	−0.18	−0.18	1.00	
(18) ΔINT.RATE^{us}	−0.01	0.07	0.08	0.54	0.05	−0.00	0.43	0.10	0.07	0.29	0.32	0.09	0.07	0.17	−0.04	−0.04	0.63	1.00

See Table 1 for definitions of the variables.

Table 3: **Determinants of Net Capital Gains**

	OECD* $1992 - 2000$	OECD* $2000 - 2007$	OECD $2000 - 2007$
DEBT(A)$_{t-1}$	0.32* (0.18,0.06)	0.04 (0.13,0.00)	0.02 (0.12,0.00)
DEBT(L)$_{t-1}$	0.26*** (0.09,0.06)	−0.02 (0.12,0.02)	0.03 (0.11,0.01)
EQUITY(A)$_{t-1}$	0.32 (0.23,0.10)	−0.18 (0.17,0.06)	−0.21 (0.17,0.05)
EQUITY(L)$_{t-1}$	−0.73*** (0.14,0.01)	0.26** (0.13,0.03)	0.28** (0.13,0.04)
DEBT(A)$_{t-1}$*ΔINT.RATE^{us}	−1.61 (1.13,0.01)	0.23 (0.85,0.02)	0.04 (0.82,0.01)
DEBT(L)$_{t-1}$*ΔINT.RATE^{i}	−1.08 (0.90,0.00)	0.00 (0.47,0.02)	-0.05 (0.44,0.00)
EQUITY(A)$_{t-1}$*ΔEQUITYINDEX^{us}	0.79* (0.51,0.02)	0.47* (0.30,0.05)	0.56 (0.35,0.04)
EQUITY(L)$_{t-1}$*ΔEQUITYINDEX^{i}	−0.39** (0.15,0.01)	−0.39*** (0.19,0.03)	−0.37** (0.19,0.03)
DEBT(A)$_{t-1}$*ΔEXCH	2.67*** (0.89,0.04)	5.16*** (2.00,0.02)	3.92** (1.81,0.04)
DEBT(L)$_{t-1}$*ΔEXCH	−0.65 (1.45,0.00)	−3.57*** (1.52,0.08)	−2.84** (1.42,0.02)
EQUITY(A)$_{t-1}$*ΔEXCH	0.57 (2.19,0.00)	3.97*** (1.51,0.06)	3.50** (1.46,0.07)
EQUITY(L)$_{t-1}$*ΔEXCH	−0.93 (3.74,0.03)	−2.62* (1.40,0.02)	−2.87 (2.34,0.07)
ΔEXCH	0.12** (0.06,0.06)	0.36*** (0.14,0.02)	0.33*** (0.13,0.02)
ΔEQUITYINDEX^{i}	−0.02 (0.02,0.02)	−0.01 (0.03,0.01)	-0.01 (0.03,0.01)
ΔINT.RATE^{i}	−0.13* (0.08,0.01)	0.00 (0.15,0.02)	0.05 (0.09,0.00)
ΔEQUITYINDEX^{us}	0.01 (0.05,0.00)	0.07 (0.06,0.00)	0.04 (0.06,0.03)
ΔINT.RATE^{us}	0.13 (0.09,0.00)	−0.09 (0.15,0.00)	−0.04 (0.13,0.01)
R^2	0.81	0.62	0.48

OECD: Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Italy, Japan, Netherlands, New Zealand, Portugal, Spain, Sweden, the UK, and the United States. OECD* does not include Belgium, Greece, Japan, Norway, and Portugal. Each column shows GLS estimates from a regression of net annual capital gains on various explanatory factors. Standard errors are on the left and partial R^2's are on the right in parentheses. The dependent variable is the ratio of the net annual capital gains of country i to GDP. See Table 1 for details.

Table 4: **Capital Gain, Net Factor Income and GDP: Persistence**

	AR(1) regressions		
	CAPITALGAIN	GDP	NFI
CONSTANT	−3.77	22.92	−0.02
	(3.20)	(1.00)	(0.04)
Coef. to lag	0.16	0.99	0.97
	(0.04)	(0.01)	(0.02)

	Panel Unit Root Tests		
	CAPITALGAIN	GDP	NFI
Test Statistics	−6.62	47.21	0.57
P-values	0.00	1.00	0.71

In the upper panel, we present the estimated parameters of the following equations: $\text{CAPITALGAIN}_t = \alpha_c + \beta_c \text{CAPITALGAIN}_{t-1} + u_t$, $\text{GDP}_t = \alpha_g + \beta_g \text{GDP}_{t-1} + u_t$ and $\text{NFI}_t = \alpha_n + \beta_n \text{NFI}_{t-1} + u_t$. Standard errors in parenthesis. CAPITALGAIN_t is capital gains which in the regressions reported in this table are normalized by GDP. In the second equation, GDP_t is measured in natural logarithms. NFI_t is the ratio of net international factor income (GDP-GNI) to GDP. The sample consists of Australia, Austria, Belgium, Canada, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, New Zealand, Portugal, Spain, Sweden, the UK, and the United States. Time period 1992–2007. In the lower panel (testing for panel unit roots), we employ the Im, Pesaran, and Shin (2003) panel unit root test with the null hypothesis of variables having a unit root.

Table 5: **Smoothing via Factor Income, Savings, and Net Capital Gain**

	EMU* 92–00	EMU* 00–07	EMU 00-07	EU* 92–00	EU* 00–07	EU 00–07	OECD* 92–00	OECD* 00–07	OECD 00–07
β_f	−2	6	14	−5	1	5	−3	−4	4
	(7)	(4)	(5)	(5)	(3)	(5)	(3)	(4)	(4)
β_k	3	6	6	4	4	6	5	7	7
	(1)	(4)	(4)	(2)	(7)	(3)	(1)	(3)	(3)
β_s	30	38	24	28	45	33	51	53	44
	(12)	(11)	(11)	(12)	(13)	(10)	(7)	(10)	(7)
β_u	71	46	56	63	49	55	46	43	45
	(8)	(9)	(9)	(9)	(9)	(9)	(6)	(6)	(7)

EMU: Austria, Belgium, Finland, France, Germany, Greece, Italy, Netherlands, Portugal, and Spain. EU: EMU plus Denmark, Sweden, and the UK. OECD: EU plus Australia, Canada, Japan, Korea, New Zealand, Norway, and the United States. EMU*, EU*, OECD* are without Belgium, Greece, Japan, Norway, and Portugal for which capital gains are not available before 2000. The interpretation of the numbers is the percentages of GDP-shocks absorbed via the channels international net factor income flows (β_f), international capital gains (β_k), and saving (β_s). β_u is the fraction unsmoothed. Standard errors in parentheses. Feasible GLS, estimating country weights and correction for autocorrelation using the Prais-Winsten adjustment. β_f is the slope in the regression of $\Delta \log \text{GDP}^i - \Delta \log \text{GNI}^i$ on $\Delta \log \text{GDP}^i$, β_k is the slope in the regression of $\Delta \log \text{GNI}^i - \Delta \log(\text{GNI} + 0.05^*\text{CAPITALGAIN})^i$ on $\Delta \log \text{GDP}^i$, β_s is the slope in the regression of $\Delta \log(\text{GNI} + 0.05^*\text{CAPITALGAIN})^i - \Delta \log(\text{C})^i$ on $\Delta \log \text{GDP}^i$, and β_u is the slope in the regression of $\Delta \log \text{C}^i$ on $\Delta \log \text{GDP}^i$.
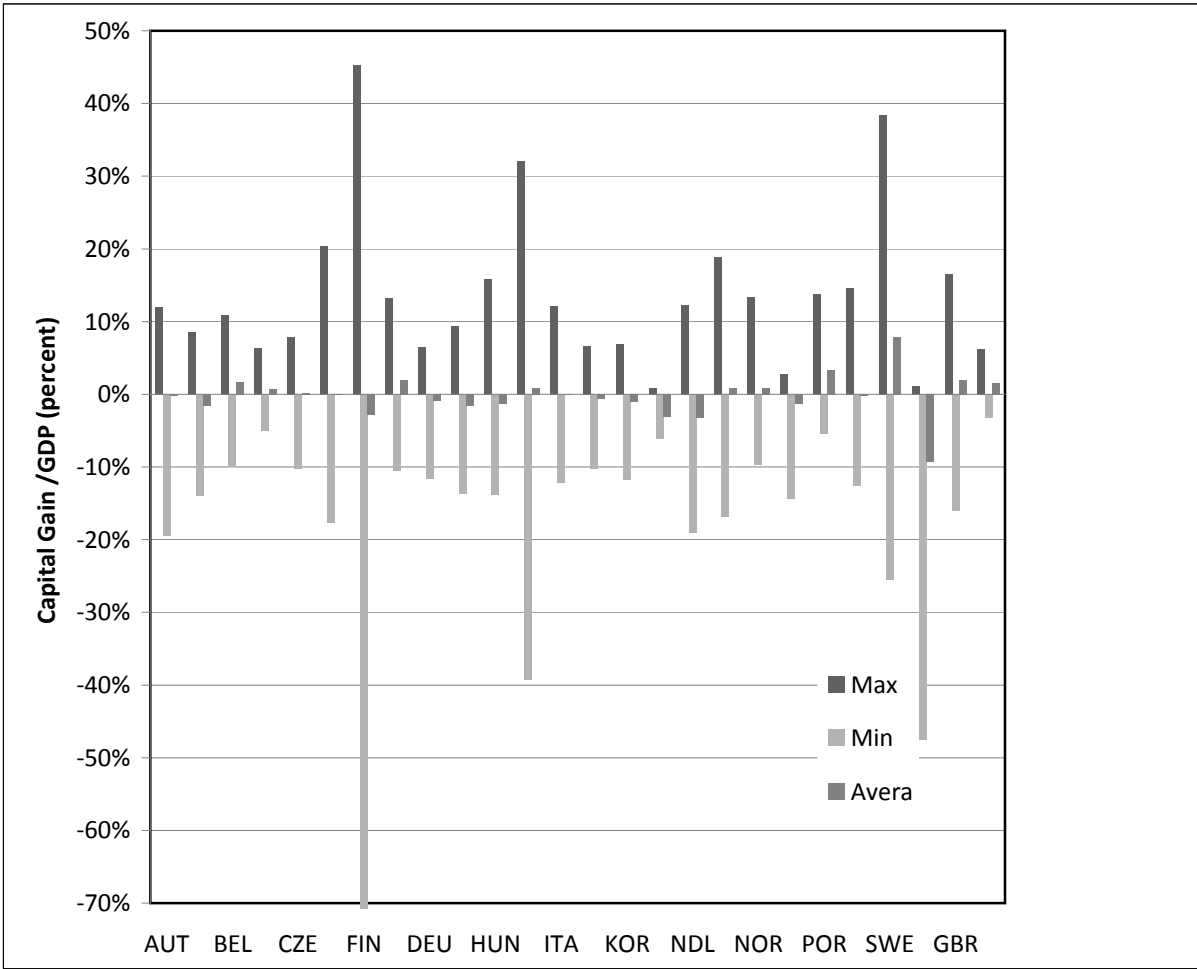
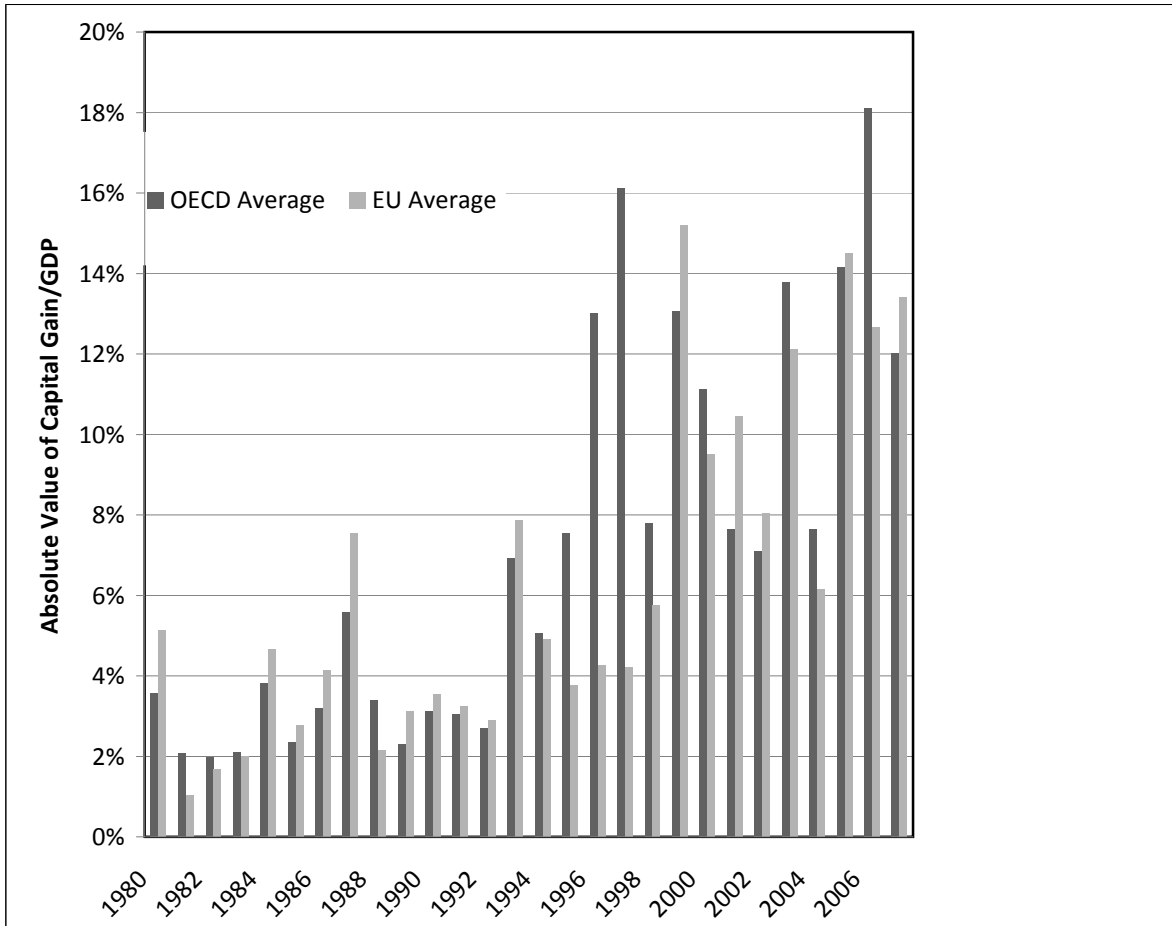FIGURE 1 Capital gain to GDP ratio

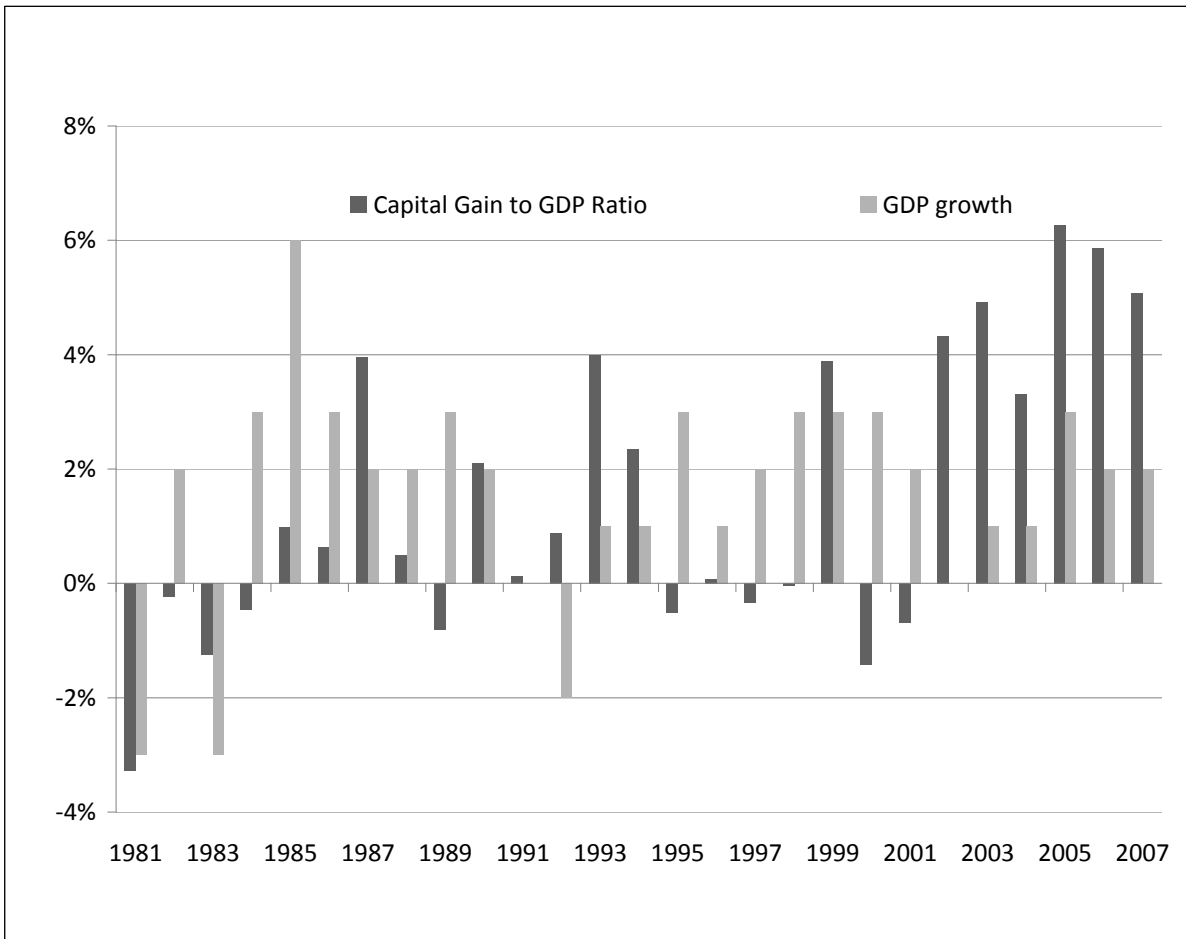FIGURE 2 Capital gain to GDP ratio for OECD and EU samples
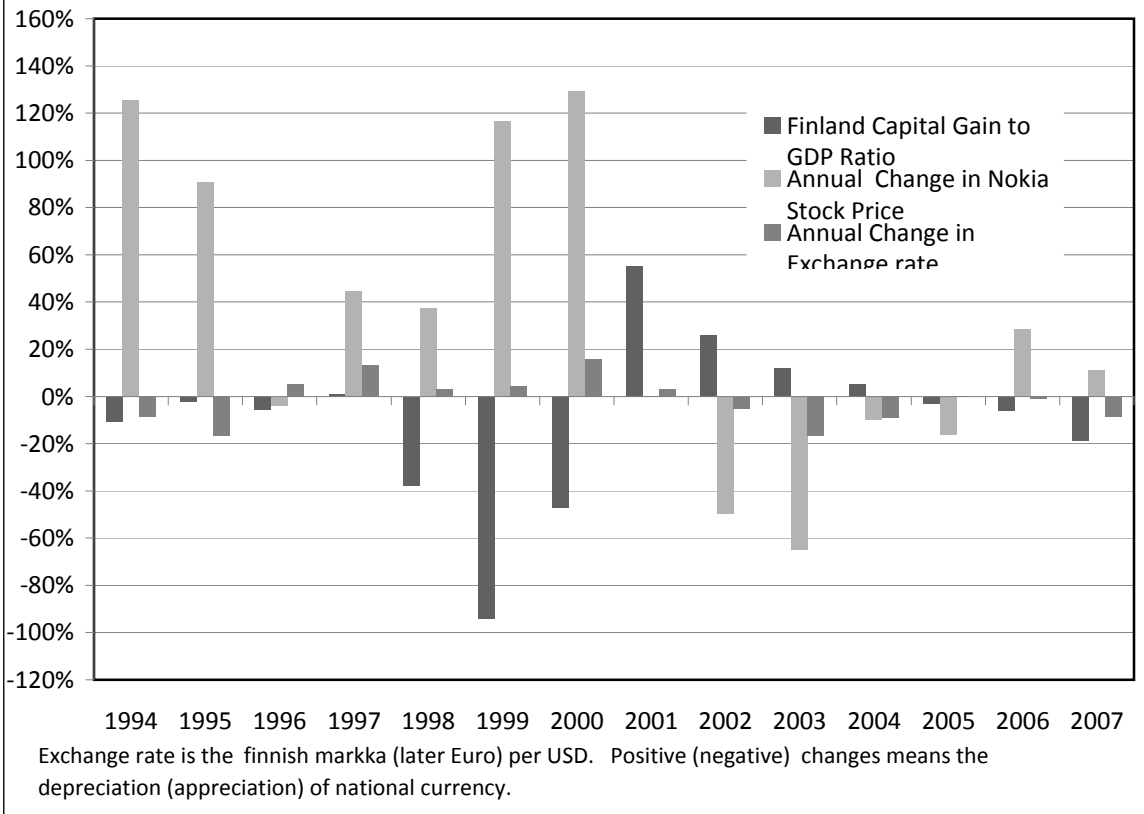
FIGURE 3 Annual capital gain to GDP, United States

FIGURE 4 Finland