Trending Current Accounts*

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Abstract

Trending current accounts pose a challenge for intertemporal open-economy macro models. This paper shows that a two-country representative-agent business cycle model is able to explain the historical time-paths of the US and Japanese current accounts, both of which display trends but in opposite directions. Households have a state-dependent subjective discount factor such that they become relatively impatient (patient) when societal consumption is abnormally high (low). We present agents in the model with historical observations on the exogenous state variables, run the economy, and compare the current account implied by the model with the data. We find that the model generates national saving behavior that matches the current account's trend. Investment dynamics are important for explaining current account fluctuations around the trend, but not for the trend itself. The model also accounts for the timing of cyclical current account fluctuations around the trend.

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1 Introduction

Standard economic theory guides us to think of the current account as a smoothing instrument. Countries are predicted to save in the good states of nature and to dissave in the bad states. Since good and bad states tend to cancel out over time, the current account as a fraction of GDP should fluctuate around a fixed mean. Thus it is puzzling why, with the exception of a fairly pronounced recovery between 1987 and 1991, the US current account has trended down for 35 years between 1970 to 2005. The rate of decline also accelerated in 1997. Between 1991 and 1997, the current account fell by 1.5 percent of GDP but between 1997 and 2005 it fell an additional 5.9 of GDP. This persistent deterioration has captured the interest of researchers and policy makers.

The current account of Japan also poses a challenge but in the opposite direction. Beginning with a deficit near 4 percent of GDP in 1974, the Japanese current account steadily improved over time reaching 3.8 percent of GDP in 2005. A striking feature of the Japanese experience is that their current account remained in a strong surplus position even during the severe real estate and stock price deflation of the 1990s. These sorts of long-horizon current account trends have resisted explanation by standard intertemporal open economy models.[1]

This paper demonstrates that a two-country representative-agent business-cycle model is able to provide a quantitative explanation of the US and Japanese current accounts from 1970 to 2005. Not only does the model explain the contrasting and divergent trends of the external balances for these two countries, it also explains the magnitude of their cyclical movements and the timing of the current account reversals that mark their fluctuations around the trend. We employ a two-country DSGE (dynamic stochastic general equilibrium) model that is entirely standard except that the subjective discount factor in household preferences is state dependent.

What is the motivation for incorporating EDFs (endogenous discount factors) into preferences?[2] It is that the primary reason that the standard model cannot explain trending current accounts is because people with FDFs (fixed discount factors) want to save too much in the

[1]For the US, Nason and Rogers (2006) and Engel and Rogers (2006) show that standard models have a striking inability to match the trend especially since 1997. Campa and Gavilán (2007) find that present-value restrictions are unrejected for six countries (Belgium, France, Italy, Netherlands, Portugal, and Spain) in the Euro zone but these are countries whose current accounts do not display trends.

We use the term 'long-horizon' to refer to the span of our data (1970–2005) which we distinguish from the 'long-run,' which we use to describe the steady state. We do not think that the current account trends for the US and Japan is steady-state behavior.

[2]EDFs have been used in small-open economy models by Obstfeld (1982), Mendoza (1991), Schmitt–Grohe (1998), Schmitt-Grohe and Uribe (2003), and Kim and Kose (2003). This paper is the first to do so in a two-country business cycle model with the objective of understanding current account dynamics.

good state and to borrow too much in the bad state to be consistent with the data. If long-horizon current account trends are driven by divergent saving behavior between home and ROW (rest-of-world) households (and we present evidence that this is a reasonable working hypothesis), then we want the environment to induce Americans to rationally choose to be chronically low savers and for the Japanese to rationally choose to be chronically high savers.[3] In our framework this is achieved with a three-parameter model of the EDF where people become relatively impatient when societal consumption is abnormally high (above the steady state) and relatively patient when societal consumption is abnormally low. While equilibrium differences between home and foreign rates of time preference emerge in the short run, these differences vanish in the long-run. The mechanism embodied in our model works in the same direction as in Uzawa (1968) where the discount factor in his formulation is increasing in current utility. The EDF creates behavior in an infinitely lived agent setting, that is qualitatively similar to the buffer-stock saving that one observes in a population of heterogeneous and finitely-lived agents with a precautionary savings motive (Carroll (1997, 2001, 2004)). Buffer-stock behavior attenuates the desire to save in the good state and to borrow in the bad state and is consistent with the increase in the US personal saving rate since the onset of the recent crisis (2008-2009).[4]

In the quantitative analysis of the model, we feed the historical data on the model's exogenous state variables (as opposed to generating them by a computer) into the calibrated model, run the model, and observe the extent to which current account choices made by agents in the model mimic the actual time paths of the data. The nested standard two-country model under FDFs, which we take as the benchmark for comparison, performs badly. It usually predicts the current account to trend in the wrong direction for extended periods of time and typically fails to display the fluctuations and turning points found in the data. The model with EDFs in preferences on the other hand produces current account choices that successfully mimic the magnitude, trends, and cyclical fluctuations of the US and Japanese current accounts. Given that the model can account for trending (in different directions) current accounts, we ask if it is able to explain the evolution of the UK current account which has fluctuated around a modest deficit with no obvious trend. We find that the EDF model is able to explain the historical time path for the UK.

[3] In other work on saving and the current accoun, Ferrero (2007) studies the impact that demographic trends have had for the US but finds that they account for only a small fraction of the variation in the current account. Fogli and Perri (2006) show that a reduction in precautionary saving in response to the 'Great Moderation' can explain one-third of the US current account deficit in 2004.

[4] In 2007, the personal saving rate averaged 0.47 percent of national income whereas from 2008.1 through 2009.1 the average personal saving rate increased to 2.0 percent. Source: Bureau of Economic Analysis.

Modeling saving behavior is key to understanding the trend in the current account. However, variations in saving behavior tends to evolve slowly so it does not tell much of the story about current account fluctuations around the trend.[5] Thus, in addition to enriching the consumption–saving decision which is key to understanding the long-horizon trend, we show that a model with capital and investment may be necessary for explaining short-run fluctuations around the trend. This is the first paper to incorporate EDFs into a two-country business cycle model with the objective of understanding current account dynamics.

The remainder of the paper is organized as follows. The next section presents and discusses the current accounts that we seek to understand and offers some evidence to suggest why primary emphasis should be placed on saving behavior to explain the trends. Section 3 presents the two-country business cycle model upon which our quantitative work is based and discusses the dynamic properties of the model. Section 4 reports our main assessment of the model in which we examine current account outcomes implied by agent choices when they are presented with historical data on total factor productivity and exogenous government spending as the exogenous state vector. Section 5 concludes.

2 The data

The current accounts for the US, Japan, and the UK that we seek to understand are plotted as a fraction of GDP in Figure 1. One immediately sees that there is substantial differences across countries both in terms of their long-horizon trends and their cyclical behavior. The sample begins in 1970 which roughly dates the beginning of the epoch of liberalized financial markets among developed countries. The sample ends in 2005 due to data availability of the 23 high income OECD countries which we use to form the ROW.

The trending US current account. The U.S. current account has experienced a long and sustained decline over this thirty five year period. The decline from 1975 to 1987 was interrupted only by a small recovery between 1978–1979. After a four-year recovery from a four percent (of GDP) deficit in 1987 to an approximate balance in 1991, the decline resumed in 1992. In 1997, a break in the trend appears in which the rate of deterioration accelerates. The implied overall change in US indebtedness is economically significant. The cumulated value of US deficits from 1950 to 2005 shows an increase in US indebtedness that amounts to a whopping 52 percent of GDP in 2005.[6] The US current account is relatively strongly counter

[5] See Choi et al. (2008) who studied the US current account with EDFs in a two-country endowment model.

[6] This does not necessarily mean that actual U.S. net indebtedness is 52 percent of GDP since this calculation did not account for the initial net wealth and the valuation effects on the external wealth. Some authors have

cyclical. Its correlation with HP (Hodrick–Prescott) filtered GDP is -0.21.

The trending Japanese current account. The Japanese current account provides a sharp contrast to the US. Early in the sample, Japan experienced a sharp decline between 1972 and 1974 which coincides with the first oil shock. After a rapid recovery from 1974 to 1975, the Japanese account undergoes a sustained improvement in the surplus that is punctuated by modest downturns in 1990, 1996, and 2001. It is interesting to note that Japan maintains a healthy surplus during the 'lost decade' of near zero growth that followed the real estate and stock price deflation in 1990–1991. Instead of borrowing in states of low wealth and output, the Japanese increased their lending to the ROW. The Japanese current account is weakly counter cyclical. Its correlation with HP filtered GDP is -0.09.

The non trending UK current account. The UK current account occupies a middle ground between the US and Japan. This account exhibits a cycle from 1970 to 1978 that attains a surplus of nearly 3 percent of GDP in 1973. Then from 1976 to 2005, the UK current account has fluctuated around a deficit near 1.2 percent of GDP and is characterized by the absence of an obvious trend. Whereas the US and Japanese current accounts are counter cyclical, the UK account is weakly procyclical. Its correlation with HP filtered GDP is 0.10.

Current account comovers. Although the current account is the sum of the private saving less investment $(S-I)$ and the taxes less government spending $(T-G)$, our paper focuses on the implications of saving and investment behavior. The motivation for this begins with the general conclusion from recent empirical work that the $(T-G)$ component is largely irrelevant for current accounts of large countries.[7] The scarcity of evidence of a twin-deficits phenomenon is illustrated by Figure 2 which plots the current account and the fiscal surplus $(T-G)$ as fractions of GDP for our three sample countries.[8] The shaded areas identify time periods

questioned whether the U.S. net foreign asset position is as large as this calculation might suggest. Hausmann and Sturzenegger (2007) suggest that official statistics undervalue US foreign assets (their 'dark matter' argument) while Gourinchas and Rey (2007), Obstfeld and Rogoff (2005), Lane-Milesi-Ferretti (2008) and Meissner and Taylor (2008) argue since the US earns higher returns on foreign assets than foreigners do on US assets (exhoribant privilege) that the US is still a net creditor. However, Curcuru et al. (2008) argue quite forcibly that the data upon which these arguments made are not reliable.

[7] See Bems et al. (2007), Bussiere et al. (2005), Corsetti and Muller (2008), and Gruber and Kamin (2009).

[8] Source data for budget surplus: For the US, Economic Report of the President, for the UK, Office for National Statistics, and for Japan, the International Monetary Fund's International Financial Statistics. We plot these data beginning in 1973 due to the availability of the tax data.

when the current account surplus and the budget surplus move in opposite directions. The plots begin in 1973 due to availability of the tax data.

For the US, the period of the 1970s and 1980s might have suggested the possibility of a twin-deficit link as both deficits were seen to grow substantially. Upon closer inspection, however, the two series comove in only eleven of the twenty years from 1973 to 1993—a proportion indistinguishable from a realization of pure chance. Any suggestion of a twin-deficit link completely falls apart in the latter half of the sample. From 1994 to 2001 the two accounts diverge with the current account deteriorating and the budget surplus improving. Between 1993 and 2005, the current account and the budget comove in only three of twelve years.

For Japan, the rising surpluses in the current account and the budget during the 1980s also may have created the appearance of a twin-deficits phenomenon. In 1990 however, the relationship disintegrates in just as dramatic fashion as it does for the US. Between 1990 and 2005, the Japanese current account maintains a steady and persistent surplus while the government's budget undergoes a sharp and sustained decline. The two series change in the same direction in only ten out of thirty two years in the sample.

Evidence of a twin-deficits relationship is only slightly stronger in the case of the UK. In the early portion of the sample, the two series comove in twelve of fifteen years from 1973 to 1988 but comove in only six of the remaining seventeen years from 1989 to 2005. In total, the UK deficits comove in only eighteen of thirty two years.

In light of this evidence, let us suppose that the current account evolves independently of the fiscal balance. Then it must comove with the saving-investment balance. This turns out to be the case for our sample of countries. Figure 3 plots the current account and the country's saving-investment balance relative to ROW.[9] These observations have been normalized to emphasize their comovements.

For the US, the saving-investment imbalance tracks both the current account's protracted downward trend as well as the timing of the turning points that mark the cyclical fluctuations. The current account and the saving–investment balance move in opposite directions in only three years of the thirty two year sample.

For Japan, the saving-investment balance also shows a very tight relation to the current account with both series steadily rising over the sample and showing a close correspondence in their turning points..

The UK exhibits the weakest connection between the savings–investment balance and the current account. Although the two series generally comove before 1998, they diverge after-

[9] Saving is defined as GDP less consumption less taxes. Source: International Financial Statistics.

wards with the current account experiencing a sharp deterioration and the saving-investment imbalance continuing to improve.

Patterns in GDP and technology. Earlier attempts to model the US current account focused on the evolution of US GDP relative to ROW in endowment settings [Engel and Rogers (2006), Choi et al. (2008)]. Since saving and investment decisions depend heavily on output and expectations of future output it is important for them to understand what factors are driving changes in output–whether changes are primarily due to changes in inputs or technology. To the extent that output movements are different from movements in the technology, it may be important to have a model with production and investment in studying the current account. To shed light on these issues, Figure 4 plots each country's relative-to-ROW GDP and relative TFP (total factor productivity) as deviations from the mean.

For the US, relative GDP was comparatively flat from 1970 to 1983 whereas relative TFP was falling. Since 1985, after the onset of the 'Great Moderation,' US relative GDP trends up and grows substantially while US relative TFP also grows but at a slower rate. Over the entire period, US relative GDP growth has outstripped relative TFP growth.

For Japan, trends in relative GDP and TFP show little connection to each other before 1981. The two series comove from 1981 to 1999 and diverge after that point. Relative GDP grows substantially until 1992 and then declines in just as dramatic a fashion during the lost decade and to a lesser extent after 2000.

The connection between relative TFP and GDP is tightest for the UK. The two series generally move together over the entire sample.

To summarize, the dissimilarity between relative TFP and GDP for the U.S. and Japan suggests the potential importance of working with a model with production as opposed to an endowment model. This, and lack of comovement between budget deficits and the current account lead us to focus on the $(S - I)$ component.

3 The Model

This section presents the two-country one-good DSGE model that we use for our quantitative analysis. Except for the specification of the subjective discount factor in household preferences, this is your 'garden variety' international business cycle model. There is a government in each country that engages in wasteful spending. We assume that Ricardian equivalence holds so that variations in budget deficits caused by changes in the timing of taxes don't matter, although the path of government spending levels do. We denote the Home country by '1' and ROW by

'2.'

Household budget constraints. Let the representative household in country j have $N_{j,t}$ members. Home and ROW households trade the final good and a one-period nonstate contingent private with each other. The bond pays one unit of the good next period and is in zero net supply. The firms of country $j = 1, 2$ are entirely owned by country j households and investment decisions are made by the firms. In per capita terms, current wealth consists of firm dividends $d_{j,t}$, labor income $w_{j,t}\ell_{j,t}$, and bond interest income $b_{j,t-1}$. This is allocated towards consumption $c_{j,t}$, new private bond holdings $b_{j,t}$, and to pay lump-sum taxes $\tau_{j,t}$. Let V_t be the current bond price observed by households. Then country $j's$ households face the flow budget constraint

$$N_{j,t}\left(c_{j,t} + V_t b_{j,t}\right) \leq N_{j,t}\left(w_{j,t}\ell_{j,t} + d_{j,t} - \tau_{j,t}\right) + N_{j,t-1}b_{j,t-1}. \tag{1}$$

Preferences. Typically, it is assumed that agents subjectively discount future utilities at a constant rate. International representative-agent macro models with FDF preferences, however, struggle to explain the US current account [Engel and Rogers (2006), Nason and Rogers (2005), Choi et al. (2008)]. As seen in Figure 4a, US GDP relative to ROW has increased quite steadily for some time. US households need to believe that a positive shock to relative GDP predicts further more increases in relative GDP in order for savings rates and the current account to decline as it did since 1991. The problem with this is that there is scant evidence that the growth in relative US GDP was predicted.[10] Thus, our point of departure then is to relax the FDF assumption.

Households in each country are identical and infinitely lived. Normalizing the period time endowment to 1, we write the expected lifetime utility of a country j household as defined over consumption and leisure $(1 - \ell_{j,t})$

$$E_0 \sum_{t=0}^{\infty} \theta_{j,t-1} N_{j,t} u\left(c_{j,t}, (1 - \ell_{j,t})\right), \tag{2}$$

where the period utility function is constant relative risk aversion on a quasi Cobb-Douglas index of consumption and leisure

$$u\left(c_{j,t}, (1 - \ell_{j,t})\right) = \frac{\left(c_{j,t}\left(1 - \ell_{j,t}\right)^{\mu}\right)^{1-\gamma}}{1 - \gamma}, \tag{3}$$

[10] In examining survey data from Consensus Forecasts, Engel and Rogers (2006) report that professional economic forecasters predicted US relative GDP to be flat in the 1990s. After a decade of higher than expected relative GDP, the Consensus Forecasts began to predict rising relative output.

where $\mu \geq 0$ and $\gamma \geq 0$, and $\theta_{j,t}$ is the time and state dependent subjective discount factor.

Let $\overline{c}_{j,t}$ be societal consumption at t and $\overline{c}^*_{j,t}$ be the steady-state value of societal consumption. $\overline{c}^*_{j,t}$, which may grow over time along a balanced growth path, is the reference point for what households consider the normal level of consumption. In equilibrium, societal and individual consumption in country j will coincide but at this point we maintain the distinction between individual consumption $c_{j,t}$ and average societal consumption $\overline{c}_{j,t}$ to make explicit that the household takes societal consumption as external to its problem.

Transient but abnormally high societal consumption $\left(\overline{c}_{j,t} > \overline{c}^*_{j,t}\right)$ cause people to become relatively impatient and transient but abnormally low consumption induce people to be relatively patient. These variations in the subjective discount rate are described by the three (β, η, ψ) parameter model of Choi et al. (2008),

$$\theta_{j,t} = \theta_{j,t-1}\beta_{j,t} = \theta_{j,-1}\prod_{i=0}^{t}\beta_{j,t-i}, \tag{4}$$

$$\beta_{j,t} = \beta^{\eta}_{j,t-1}\left[\beta\left(\frac{\overline{c}_{j,t}}{\overline{c}^*_{j,t}}\right)^{-\psi}\right]^{1-\eta}. \tag{5}$$

The one-period ahead discount factor $\beta_{j,t}$, which plays a key role in the intertemporal Euler equation, evolves with some persistence where the size of $\eta \in [0,1)$ determines the degree of current impatience inherited from the last period. The parameter $\psi \in [0, \bar{\psi})$, $\bar{\psi} < \infty$ regulates the elasticity $\psi(1-\eta)$ of the discount factor to abnormally high or low societal consumption. In the steady state, $\overline{c}_{j,t} = \overline{c}^*_{j,t}$ and $\beta_{j,t} = \beta_{jt-1} = \beta \in (0,1)$ which is equal across countries.

EDFs in economics. Uzawa (1968), working in a growth context, introduced a utility function in which higher instantaneous utility causes agents to become more impatient. In international macroeconomics, agents' preferences were characterized with EDFs by Obstfeld (1982) who employed a version of the Uzawa utility. In quantitative studies, EDF's have been assumed by Mendoza (1991), Schmidt–Grohe and Uribe (2003), Schmitt–Grohe (1998), and Kim and Kose (2003). These are studies of small-open economies where the role of the EDF is primarily a technical device to induce a stationary steady state in an incomplete markets environment. In the two-country context, EDFs have been used by Choi et al. (2008) who study the US current account in an endowment model.[11] These EDF's employed in open-economy macroeconomics are consistent with Uzawa's (1968) idea that people are relatively

[11] Yi (1993) studied a two-country endowment model where households value government purchases, G along with private consumption C which enter utility through a Cobb-Douglas index. The growth of government spending has the same effect as increasing impatience in our setup.

impatient in the high utility state.

The broader literature has explored implications of endogenous subjective discounting in other contexts. Becker and Mulligan (1997) argue that economists assume FDFs for the sake of convenience but there is not a general presumption that subjective discount factors should be constant. They point out that the EDF concept has been around at least since Fisher (1930) and argue that variables such as wealth, mortality, and uncertainty can affect one's rate of time preference. They develop a theory that embodies Fisher's (1930) conjecture that the wealthy are more patient than the poor.[12] Bhat and Ogaki (2008) employ EDFs to explain why parental transfers to children may decrease when the child behaves irresponsibly (impatiently). They also cite experimental studies in psychology that underscore the empirical plausibility of endogenous discounting.

The use of EDFs can be motivated by Fehr and Schmidt's (1999) concept of inequity aversion. The idea here is that individuals engage in a process of social comparison and are sensitive to what they perceive to be violations of self-centered fairness. That is, people care primarily about fairness as it pertains to themselves but not about inequities among other people. Fehr and Schmidt argue that their concept explains why people may be willing to give up something to achieve a more equitable outcome such as why firms may not cut wages in a downturn or why experiments find that self-interested individuals cooperate with others. In the macro setting, Fehr and Schmidt's concept makes contact with our EDF in the sense that in states of abnormally low societal consumption, people will reduce spending because engaging in conspicuous consumption in states of the world when others are suffering violates one's sense of fairness.

Empirical evidence that supports our EDF concept includes Juster et al. (2005) and Berben et al. (2008). Using US household level panel data Juster et al. (2005) estimate that a \$1000 capital gain on equities results in a reduction of saving by \$190. In a study using a large micro data set of Dutch households, Berben et al. (2008) find an even larger effect where a €1,000 increase in wealth is associated with a €319 reduction in saving. These empirically observed saving patterns and the implied patterns from our EDF are in turn is consistent with buffer-stock saving behavior discussed by Carroll (1997, 2001, 2004) exhibited by finitely-lived consumers who have a precautionary motive for saving.

Firms. Let $Y_{j,t}$ be output, $K_{j,t}$ the capital stock, and $L_{j,t} = N_{j,t}x_{j,t}\ell_{j,t}$ be labor input of country j. The per capita labor input $\ell_{j,t}$ benefits from labor-augmenting technical progress

[12] Becker and Mulligan's (1997) notion isn't necessarily inconsistent with Uzawa's idea because the Fisher conjecture is about a cross-sectional relation whereas Uzawa's is a time-series notion.

$x_{j,t}$. The aggregate production technology available to country j is

$$Y_{j,t} = A_{j,t} K_{j,t}^{\alpha} \left(N_{j,t}\ell_{j,t}\right)^{1-\alpha}, \tag{6}$$

where $A_{j,t}$ is a technology shock inclusive of $x_{j,t}^{1-\alpha}$. The capital stock evolves as

$$K_{j,t+1} = I_{j,t} + (1-\delta) K_{j,t} - \Gamma\left(I_{j,t}, K_{j,t}\right), \tag{7}$$

where $I_{j,t}$ is gross investment and $\Gamma\left(I_{j,t}, K_{j,t}\right)$ is a quadratic capital adjustment cost

$$\Gamma\left(I_{j,t}, K_{j,t}\right) = \frac{\xi_K}{2}\left[\frac{I_{j,t}}{K_{j,t}} - \left(\lambda_Y - 1 + \delta\right)\right]^2 K_{j,t}, \tag{8}$$

and λ_Y is the gross growth rate of the economy. Dividends paid by firms to their owners are

$$N_{j,t} d_{j,t} = D_{j,t} = Y_{j,t} - w_{j,t} L_{j,t} - I_{j,t}.$$

The firm's problem is to maximize the expected present value of future dividends

$$E_0 \sum_{t=0}^{\infty} Q_{j,t}\left(Y_{j,t} - w_{j,t} L_{j,t} - I_{j,t}\right), \tag{9}$$

subject to the production function (6) and the law of motion for the capital stock (7) under a perfectly competitive environment. Since the country j firms are owned by country j residents, it follows that the equilibrium time discount factor for dividends must obey $Q_{j,t+1}/Q_{j,t} = \beta_{j,t} u_{j,Ct+1}/u_{j,Ct}$ where $u_{j,Ct} = \partial u\left(c_{j,t}, 1 - l_{j,t}\right)/\partial c_{j,t}$.

Government. Governments engage in wasteful spending $G_{j,t} = N_{j,t} g_{j,t}$ which they finance with lump-sum taxes $N_{j,t}\tau_{j,t}$. They face the flow budget constraint[13]

$$N_{jt} g_{j,t} = N_{j,t}\tau_{j,t}. \tag{10}$$

Equilibrium. To complete the model, the following market clearing conditions are imposed,

$$\sum_{j=1}^{2} Y_{j,t} = \sum_{j=1}^{2}\left(N_{j,t} c_{j,t} + I_{j,t} + G_{j,t}\right), \tag{11}$$

$$\sum_{j=1}^{2} N_{j,t} b_{j,t} = 0. \tag{12}$$

[13]The government financing issues are not relevant to our analysis because these agents are Ricardian. This is in line with the empirical evidence of the low explanatory power of budget deficits on current account deficits. Thus, we could include government bonds in the model but they would be redundant.

(11) says that world output is either consumed by households or governments or is invested. (12) says that the non state contingent bonds are in zero net supply. We can now state the equilibrium of this model.

Definition. *An equilibrium is a collection of allocations for consumers* $\{c_{j,t}, \ell_{j,t}, b_{j,t}\}_{j=1}^{2}$ *a collection of allocations for firms* $\{Y_{j,t}, I_{j,t}, \ell_{j,t}\}_{j=1}^{2}$ *, real wages* $\{w_{j,t}\}_{j=1}^{2}$ *and bond prices* $\{V_t\}$ *such that the consumer allocations maximize (2) subject to (3)–(1), the firm's allocations maximize (9) subject to (6)–(8), and the resource constraints (11)–(12) are satisfied.*

Upon solving the model, the current account balance to GDP ratio is computed as the change in net indebtedness

$$cay_t = \frac{V_t N_{1,t} b_{1,t} - V_{t-1} N_{1,t-1} b_{1,t-1}}{Y_{1,t}}. \tag{13}$$

Solution, calibration, and parameter assignments

The model is solved by log-linearizing around a stationary steady state and assumes that exogenous technology shocks and government consumption are driven by stationary (cyclical) first-order autoregressive processes. The parameters governing the exogenous state variables are estimated from detrended total factor productivity and government spending data. In detrending the data, we assumed that there is a balanced long-run per capita growth path and imposed a common trend for Home (country 1) and ROW (country 2).[14] For each Home–ROW pair, let $z_{1,t}$ and $z_{2,t}$ be the detrended log Home and ROW technology shocks and let $z_{3,t}$ and $z_{4,t}$ be detrended log Home and ROW government purchases. These are assumed to follow the AR(1) process

$$z_{i,t} = \rho_i z_{i,t-1} + \epsilon_{i,t}, \quad i = 1, \ldots, 4, \tag{14}$$

where $(\epsilon_{1,t}, \epsilon_{2,t})' \overset{nid}{\sim} (0, \sigma)$, and $(\epsilon_{3,t}, \epsilon_{4,t})' \overset{nid}{\sim} (0, \omega)$. Note that the technology shock innovation $\epsilon_{1,t}$ may be contemporaneously correlated with $\epsilon_{2,t}$ and the government spending innovation $\epsilon_{3,t}$ may be contemporaneously correlated with $\epsilon_{4,t}$ but the technology shock innovations are not correlated with the government spending innovations.

For commonly encountered parameters, we assign values that are standard in the literature. We set capital depreciation at 10 percent per annum, the risk aversion parameter at 2, capital's

[14] The productivity shock relates back to the production function as $\ln(A_{it}) = (1-\alpha) x_t + z_{it} = [(1-\alpha)\lambda_Y] t + z_{it}$ since we assume that x_t grows at the constant rate λ_Y.

share at 0.34 the adjustment cost parameter at 0.5, and the steady-state subjective discount factor at 0.96. These assignments are recorded in Table 1.

Table 1. Common parameter value settings	
β	0.96
γ	2.0
α	0.34
δ	0.10
ξ_K	0.50

Taking the common parameter values and parameters governing the exogenous state variables as given, the discount factor parameters are estimated with Bayesian MCMC (Markov chain monte Carlo) methods using Dynare. The data used in estimation are consumption to output ratios for Home and ROW. For the US–ROW case, the parameter estimates are shown in Table 2. The estimates imply that the discount factor is persistent and slow moving (η is relatively large). The implied discount factor elasticity with respect to consumption is $\psi(1-\eta) = 0.006$. Starting at a steady state discount factor $\beta = 0.96$ a 2 percent increase in consumption increases the discount factor and implies a modest reduction in the rate of time preference from 4.167 percent to 4.156 percent in the current period.

Table 2: Parameter values for the US–ROW model

	Parameter	Estimate	s.e.	Error variances and covariances	
Technology	ρ_1	0.809	0.094	σ_{11}	$(0.0137)^2$
	ρ_2	0.959	0.075	σ_{22}	$(0.0179)^2$
				σ_{12}	4.8×10^{-5}
Government	ρ_3	0.926	0.037	ω_{11}	$(0.0134)^2$
	ρ_4	0.954	0.049	ω_{22}	$(0.0178)^2$
				ω_{12}	4.7×10^{-5}
		Posterior Mean	Confidence Interval (90%)		
Discount	η	0.977	0.976	0.977	
factor	ψ	0.245	0.242	0.227	

3.1 Impulse responses under US-ROW parameter settings

In addition to the parameter values discussed above, we assume the relative size of ROW to the US is constant and set the ratio to $N_{2,t}/N_{1,t} = 1.74$ which is the sample average of the GDP ratio. The responses are percent deviations from the steady state and are reported both under EDF and FDF specifications. Hollow symbols denote FDF model responses whereas solid symbols denote EDF responses. Responses of US variables are plotted with squares and responses of ROW variables are plotted with circles.[15]

Responses to a positive Home (US) technology shock. These results are shown in Figure 5. We see that for the traditional (FDF) business cycle model, a positive Home technology shock leads to increased Home consumption, investment, labor input, and output. ROW consumption also increases, but ROW investment, labor input, and output decline. Also, the interest rate increases and the Home current account goes into surplus. The initial improvement in the technology increases the Home real wage which leads to increased labor supply. Through the labor–leisure choice Euler equation, Home consumption increases. The higher technology also increases capital productivity which increases Home investment. Because the technology shock is transient, Home agents have a consumption smoothing motive and attempt to transfer some of the consumption value of the shock into the future. They do this by attracting the ROW to increase consumption which is channeled through the Home current account surplus. From the ROW labor–leisure Euler equation, the increased consumption reduces ROW labor input which then leads to a decline in ROW capital productivity, investment, and output.

Next, examine the solid symbols that represent responses under EDF preferences. Here, a positive technology shock increases Home consumption and Home labor input but higher consumption now makes Home agents less patient. The Home discount factor declines and induces a larger jump in consumption than when the discount factor is constant. The magnification in the consumption response attenuates the increase in labor input which in turn dampens the response of output, the marginal product of capital, and investment. Because Home desires to consume more, less of the output gain is shared with ROW which results in a smaller current account surplus under EDF. This results in a smaller increase in ROW consumption, labor input, and output.

Another difference between the EDF and FDF models is that under EDF, there is a reversal of the current account during the adjustment. The relative impatience of Home keeps Home

[15] In the FDF model, we include a very small cost to holding bonds to ensure that there is a fixed steady state. The cost is small enough so that the short-run dynamic responses are unaffected.

consumption high farther into the future as output declines back towards its steady state value. Eventually, Home consumption lies above output and the current account switches from a surplus to a deficit. As Home's debt burden grows over time, the current account will again reverse. The long-run approach to the steady state can be oscillatory.

Responses to a positive ROW technology shock. With FDF preferences, Figure 6 shows that the responses to a positive ROW technology shock are qualitatively similar to the responses to a US shock. ROW consumption, investment, labor and output increase as does Home consumption. Home's current account, investment, labor and output decline. The ROW technology shock is substantially more persistent than the US shock ($\rho_2 = 0.959$ versus $\rho_1 = 0.809$) and this additional persistence causes these impulse responses to be more persistent than the responses to the US technology shock.

Under EDF preferences, ROW consumption, investment, labor and output increase, and US investment, labor, and output decline. However, the US consumption response to the ROW technology shock is not symmetric to the ROW consumption response to a US shock. Here, US consumption declines following the ROW shock. Because of the high persistence of the ROW shock, ROW households view it as closer to a permanent shock than a transient one. As a result of this and the relative impatience that it imparts, ROW consumption is more responsive to the technology shock and more persistent. ROW's desire for consumption is sufficiently great that it borrows from Home who cuts back on its consumption and runs a current account surplus. A sequence of positive ROW technology shocks would help the US to bring its current account back into balance.

Responses to a positive US government spending shock. Figure 7 shows the responses to a positive US government spending shock. Under FDF, the shock raises Home and ROW labor input and output, lowers Home and ROW consumption and ROW investment, and has very small effect on Home investment. The increased government consumption leaves fewer resources available at Home so that Home consumption needs to decline and Home labor input to rise. Since investment increases at Home due to an increase in capital productivity resulting from higher labor inputs, the adjustment comes by crowding out consumption. This leads to an increase in Home output and a current account deterioration as the jump in output and contraction in consumption are more than offset by increased government consumption. The current account surplus experienced by ROW is generated by a decline in ROW consumption and investment. The increase in demand at Home raises ROW output, which comes from an increase in ROW labor input. Thus the government spending shock leads people to work more and consume less.

The qualitative responses are the same under EDF. Home country responses are magnified, however, and except for investment, ROW responses are dampened. When the government spending shock hits, reduced Home consumption increases the discount factor. The relative patience of Home agents attenuates the decline of the current account and increases Home investment.

The impulse responses following a shock to ROW government expenditures are very similar and are put in the appendix to save on space.

4 An explanation of trending current accounts

This section reports on our attempt to use the model to explain the current account time series of the US, Japan, and the UK from 1970 to 2005. We run the economy by showing agents in the model the historical technology and government spending data which they consider to be the realization of the exogenous state vector. We then compare the current account implied by choices made by people in the model to the choices made by people in the real world (the current account data). Paths implied by FDF and EDF versions of the model are generated for comparison. In each case, the model is calibrated to match the initial (1970) level of the Home country's international indebtedness.[16]

The US current account. Figure 8 shows the results of this experiment for the US. The FDF model overstates the level of the current account. Before 1991 the FDF current account shows a slight downward trend but is excessively volatile. Also, the timing of the implied turning points are a poor match to the data. A more serious embarrassment for the FDF model is that it predicts a counterfactual sustained current account improvement from 1991 through 2005 which culminates in an implied surplus of 8 percent of GDP. This is qualitatively similar to the path generated by Engel and Rogers (2006). The correlation between the data and the FDF current account is -0.40 in levels and 0.03 in first differences.

The EDF model captures the overall downward trend of the current account throughout the sample. This model also mimics the dominant cyclical movements around the trend and is generally able to replicate the turning points. Between 1970 and 1997, the model's turning points lead the data by a year or two. Especially noteworthy is the ability of the model to capture the acceleration in the current account deterioration from 2000 through 2005. The

[16] That is, we choose initial bond holdings $b_{1,t-1}$ such that the model matches $cay_{1970} - tby_{1970}$ in the data.

correlation between the data and the EDF implied current account is 0.82 in levels and 0.50 in first differences.

The EDF model enjoys two additional degrees of freedom over the FDF model, so is it the case that any five-parameter model of preferences can explain these data? To address this question, consider the model in which household preferences exhibit habit persistence. We let the country–wide stock of consumption habit $h_{j,t}$, evolve according to

$$h_{j,t} = \rho_h h_{j,t-1} + (1 - \rho_h)\,\bar{c}_{j,t}. \tag{15}$$

The habit stock is external to the household whose expected lifetime utility is

$$E_0 \sum_{t=0}^{\infty} \beta^t N_{j,t} \frac{\left((c_{j,t} - \theta h_{j,t-1})\,(1 - \ell_{j,t})^{\mu}\right)^{1-\gamma}}{1-\gamma}. \tag{16}$$

We set the parameter values $\rho_h = 0.85$ and $\theta = 0.85$ to bias the results in favor of the model by making the habits be very persistent. This increases the influence of habit on intertemporal decisions.[17] Figure 9 shows the external habit current account follows the same general pattern as the FDF current account but the path implied by the habit model lie even farther away from the data.

To see why this is the case, consider the dynamic response following a technology shock. Under FDF preferences, a positive shock increases the interest rate and next period's consumption growth. Under habit, the interest rate is related to the difference between consumption growth and habit growth whereas under FDF it is related only to consumption growth. Thus habit allows a smoother consumption response to the technology shock. Because the low-frequency movements of the current account arise primarily from changes in saving motivations, the habit model fails to explain the current account due to the intensification of consumption smoothing that comes with habits.

Achieving balance in the US current account. The impulse response analysis showed that the current account improves in the short run following positive US and ROW technology shocks, negative US government spending shocks and positive ROW government spending shocks. If we take the history up through 2005 as given and shut down future innovations to

[17] Gruber (2004) derived a present value model for the current account based on habit formations and found that the estimated value of θ, with $\rho_h = 0$, for the U.S. is 0.816 and significant. Also, in the literature with habit formations, the persistence parameter value of 0.65 is widely used for quarterly frequency simulations. In our simulation exercises, we intentionally assign higher values for these parameters to show that even with strong effects of habits, the model does not perform well in predicting the time paths of the current accounts in the U.S. For a wide range of the parameter values, the model predictions are similar.

three of the four exogenous state variables, what does the path of the fourth variable look like if the US current account is to be balanced in five years?

Obviously, future paths of the exogenous state variables that achieve a balanced current account are not unique, and our calculations do not necessarily achieve the balance with smooth landing. Under one such set of future paths for the EDF model, a zero current account can be achieved if for five years, US total factor productivity grows at 7 percent per year, if ROW total factor productivity grows at 2.7 percent per year, if ROW government spending grows by 26 percent per year or if US government spending declines by 22 percent per year. Achieving balance by fiscal contraction would be even more drastic than the adjustments undertaken at the state level by California. If current US government purchases are normalized to be 100, government's size would have to decline to 33.3 in year five.

The Japanese current account. The relative size of ROW to Japan is set as $N_2/N_1 = 4.89$ where ROW is composed of the U.S. and the 23 highest income OECD countries without Japan. Parameters that characterize the long-run behavior of the model are set as listed in Table 1. However, just as one would not want to force the parameters that govern the technology and government spending processes to be the same here, there is no compelling reason to force different societies to have the same short-run discount factor dynamics. As we did for the US, we obtain Bayesian MCMC estimates of ψ and η for Japan–ROW using consumption and income data. These, and estimated parameters for the exogenous state variables ares shown in Table 3. Here, the discount factor is estimated to be less persistent than in the US case. The discount factor elasticity with respect to consumption is $\psi\,(1-\eta) = 0.051$. A two percent increase in consumption would imply a decline in the subjective rate of time preference from 4.167 to 4.065 percent.

Table 3: Parameter values for the Japanese model

	Parameter	Estimate	s.e.	Error variances and covariances	
Technology	ρ_1	0.896	0.057	σ_{11}	$(0.021)^2$
	ρ_2	0.744	0.116	σ_{22}	$(0.017)^2$
				σ_{12}	8.302×10^{-5}
Government	ρ_3	0.936	0.0168	ω_{11}	$(0.017)^2$
	ρ_4	0.929	0.0541	ω_{22}	$(0.015)^2$
				ω_{12}	-1.094×10^{-6}
		Posterior mean	Confidence interval (90%)		
Discount	η	0.792	0.778	0.809	
factor	ψ	0.246	0.238	0.255	

The data and implied current accounts for Japan are shown in Figure 10. The FDF model performs poorly. It over predicts current account surpluses by an order of magnitude from the data (over 30 percent of GDP in 1992), it trends in the wrong direction from 1992 to 2000, and it captures almost none of the cyclical fluctuations. The correlation between the data and the FDF predicted current account is -0.26 in levels and -0.14 in first differences.

The EDF model successfully matches the sustained upward trend in the current account data and generally mimics the cyclical fluctuations. The implied turning points are in accord with turning points in the data (1979, 1986, 1990, 1996), and lead by one year those turning points in 1974, 2001, and 2004. The correlation between the data and the EDF predicted current account is 0.40 in levels. In first differences from 1971 to 2005, the correlation is -0.06, however from 1975 to 2005 it is 0.14.

The UK current account. Parameter estimates of short-run parameters for the UK model are shown in Table 4. The technology shocks and the discount factor shows less persistence for the UK compared to the US and Japan. The estimated elasticity of the discount factor to consumption implies that a two percent increase in consumption would lower the subjective discount rate from 4.167 to 3.629 percent.

Table 4: Parameter values for the UK model					
	Parameter	Estimate	(s.e.)	Error variances and covariances	
Technology	ρ_1	0.844	(0.094)	σ_{11}	$(0.022)^2$
	ρ_2	0.830	(0.102)	σ_{22}	$(0.016)^2$
				σ_{12}	2.174×10^{-4}
Government	ρ_3	0.888	(0.079)	ω_{11}	$(0.015)^2$
	ρ_4	0.935	(0.025)	ω_{22}	$(0.013)^2$
				ω_{12}	5.973×10^{-5}
		Posterior mean	Confidence interval (90%)		
Discount	η	0.429	0.423	0.434	
factor	ψ	0.463	0.463	0.464	

Figure 11 shows the implied current account paths for UK–ROW. The relative size of ROW to the UK is set at 15.06. The FDF model predicts a sustained and counterfactual decline in the UK current account from an 8 percent of GDP surplus in 1970 to nearly a 10 percent deficit in 1983. Except for a few years between 1970 and 1974, the FDF current account generally moves in the opposite direction from the data. The correlation between the FDF prediction and the data is -0.18 in levels and -0.29 in first differences.

The EDF implied current account does not show a trend and generally matches the magnitude, directional movements, volatility and turning points of the data. The EDF model leads the 1974 reversal by a year, matches the 1981 break, leads the 1989 reversal by two years and matches the 1998 reversal. The correlation between the EDF predicted current account and the data is 0.36 in levels and 0.10 in first differences.

5 Conclusions

Persistently trending current accounts have posed a challenge for intertemporal macroeconomic models. The data suggests that persistently trending current accounts for the US and Japan are driven primarily by a saving imbalance of that country relative to the rest of the world. Investment dynamics do not appear to be a key driver of the trends but are an important element concerning fluctuations of these current accounts around the trend.

This paper shows that a two-country one-good business cycle model populated with representative households with state-dependent subjective discount factors creates saving and investment dynamics that has high explanatory power for the current account. The model is capable of explaining the downward trending US current account, the upward trending Japanese current account, the magnitudes and timing of fluctuations around the trend, and the nontrending UK current account. We are not arguing that endogenous subjective discounting is the only explanation for trending current accounts. Other mechanisms such as changing demographic patterns and lifecycle effects, changing perceptions of risk and implications for precautionary saving, market imperfections and so on are potentially quite important. The point that we want to underscore is that embedding the endogenous discount factor in preferences is a sufficient ingredient in the representative household business cycle framework to produce an account of these trending current accounts. Ours is, to our knowledge, the first paper to achieve a faithful and realistic replication of these data.

The behavioral implications that are key for our purpose though is that individuals (and countries) will tend to borrow or to save less in good states of nature and to save or borrow less in bad states. Endogenous discount factors have been employed in other research in international economics, but this is the first paper to do so in a business-cycle model to explain the current account. Neither the standard model whose households have a fixed subjective discount factor nor preferences that exhibit habit persistence comes even close to explaining the data.

6 Appendix

Data description. All real variables stated in constant US dollars by converting constant foreign currency unit values into 2000 US dollars by 2000 official nominal exchange rates. This method follows the recommendation by Engel and Rogers (2006). To obtain quantities for ROW, we sum up these real values in 2000 USD for 23 high income OECD countries (less home country under consideration) whose 2005 per capita gross national income exceeded \$10.726 . The 23 high income countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

GDP is measured at purchaser's prices, which is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

Real government expenditures, real investment, consumption, GDP, and the 2000 nominal exchange rate obtained from the World Bank's *World Development Indicators,* except for the US whose data comes from the OECD's *Quarterly National Accounts.* Total employment obtained from International Labour Organization's *Labor Statistics Data Base.* Current account data for the US, Japan, and the UK from 1970–1992 generously provided by Alan Taylor. From 1993–2005, these data are from the *World Development Indicators.* Japanese tax data from the International Monetary Fund's *International Financial Statistics Database.* US tax data from the *Economic Report of the President.* UK surplus on current budget of the public sector obtained from UK Government Office National Statistics.

Capital stocks are constructed using the perpetual inventory method inclusive of adjustment costs. Our data on real investment begins in 1960 so to estimate the initial (1960) capital stock, we first estimate the 10 year (linear) trend of log investment from 1960-1969. Second, we assume that the capital stock in 1960 is on the trend,

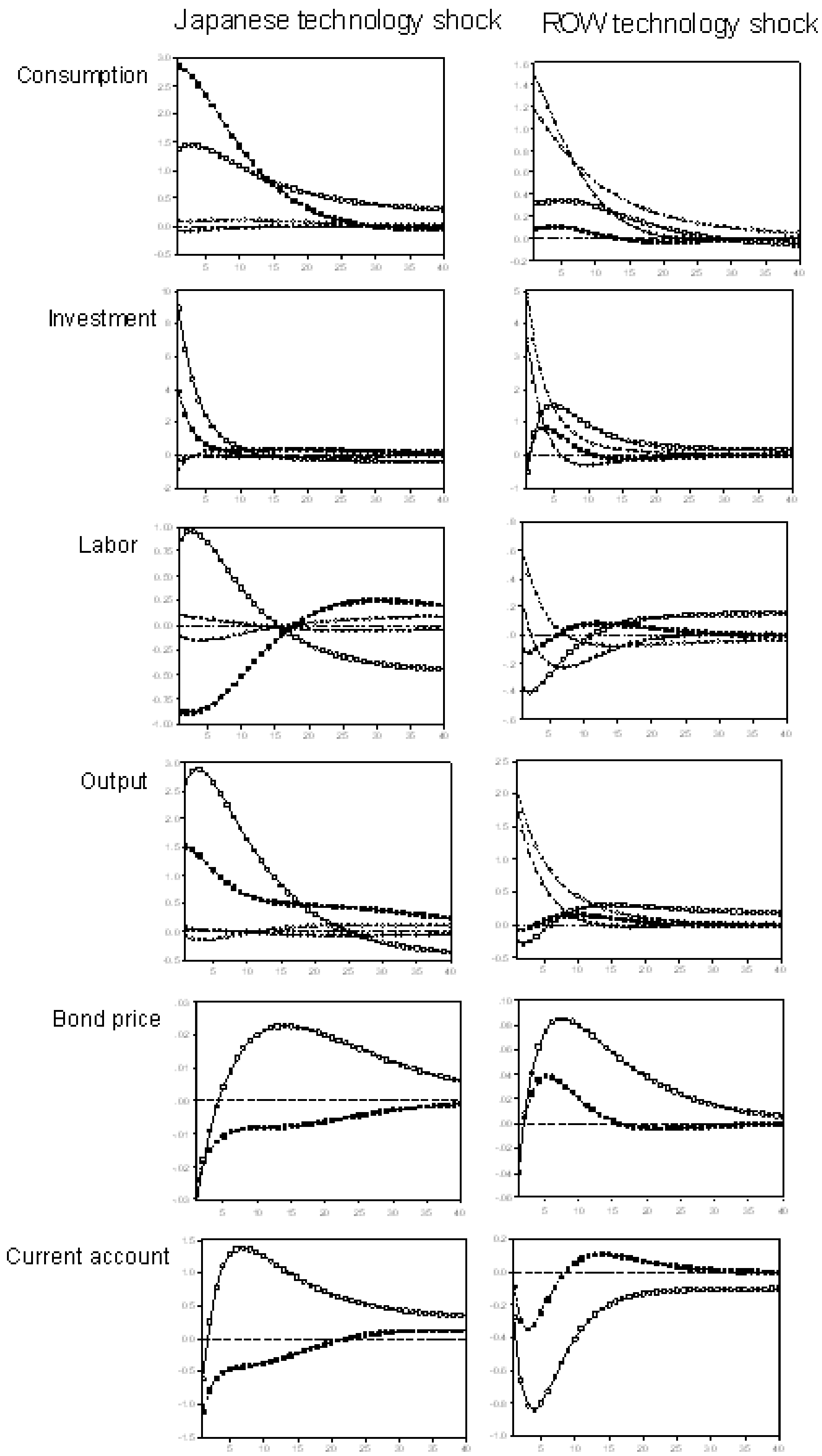
$$K_{1960} = \frac{I_{1960,trend}}{(e^{\lambda_I} - 1 + \delta)}$$

where λ_I is the 10 year trend, and δ is the depreciation rate. The capital data series is then built up recursively using the formula

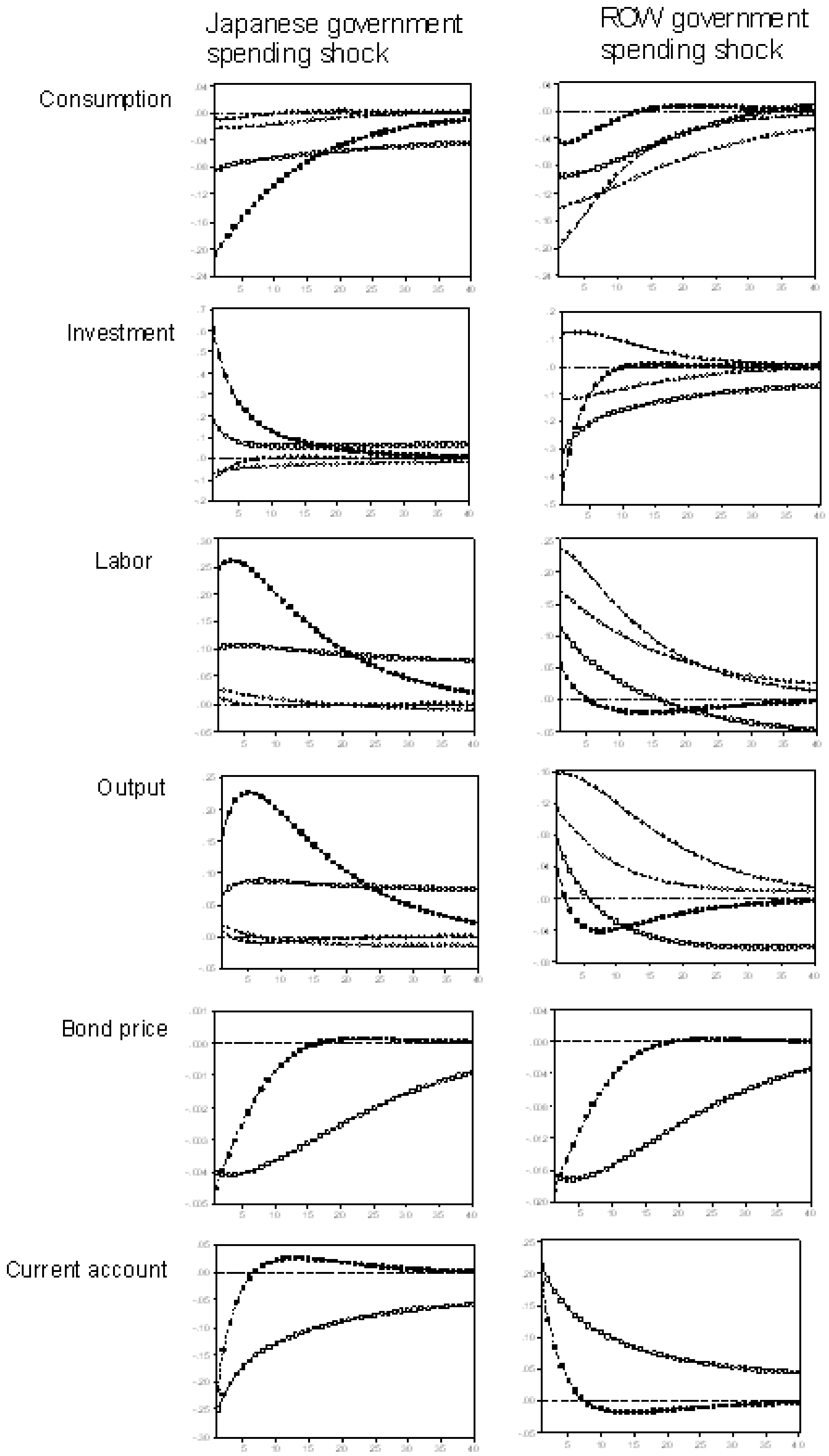
$$K_{t+1} = (1-\delta)\,K_t + I_t - \frac{\xi_K}{2}\left[\frac{I_t}{K_t} - (\lambda - 1 + \delta)\right]^2 K_t,$$

where λ is the trend of the aggregate economy which is obtained from the Home and ROW common GDP trend estimation from 1970-2005, The adjustment cost coefficient is set to $\xi_K = 0.5$.

Impulse responses to technology for Japan–ROW



Impulse responses to government shock for Japan–ROW



As in the text, we use squares for Home country responses, circles for ROW responses, solid symbols for the model with EDFs and hollow symbols for the model with FDFs.

Japanese technology shock. Under FDF preferences, a positive shock to Japanese technology raises their consumption, investment, labor input, and output. Because Japan's economy is much smaller than the US, this model behaves more like a small open economy. The Japanese technology shock has almost no effect on ROW variables. Except for a deficit in the initial period, a positive technology shock sends the Japanese current account into surplus on account of the smoothing motive.

Under EDF preferences, the positive Japanese technology shock generates and even larger increase in Home consumption and investment, a smaller increase in output. Because the effect on consumption is magnified to such an extent, leisure increases and the labor input declines which dampens the expansion in Japanese output. To pay for the large expansion in consumption and investment, which outweigh the expansion in output, the current account must decline.

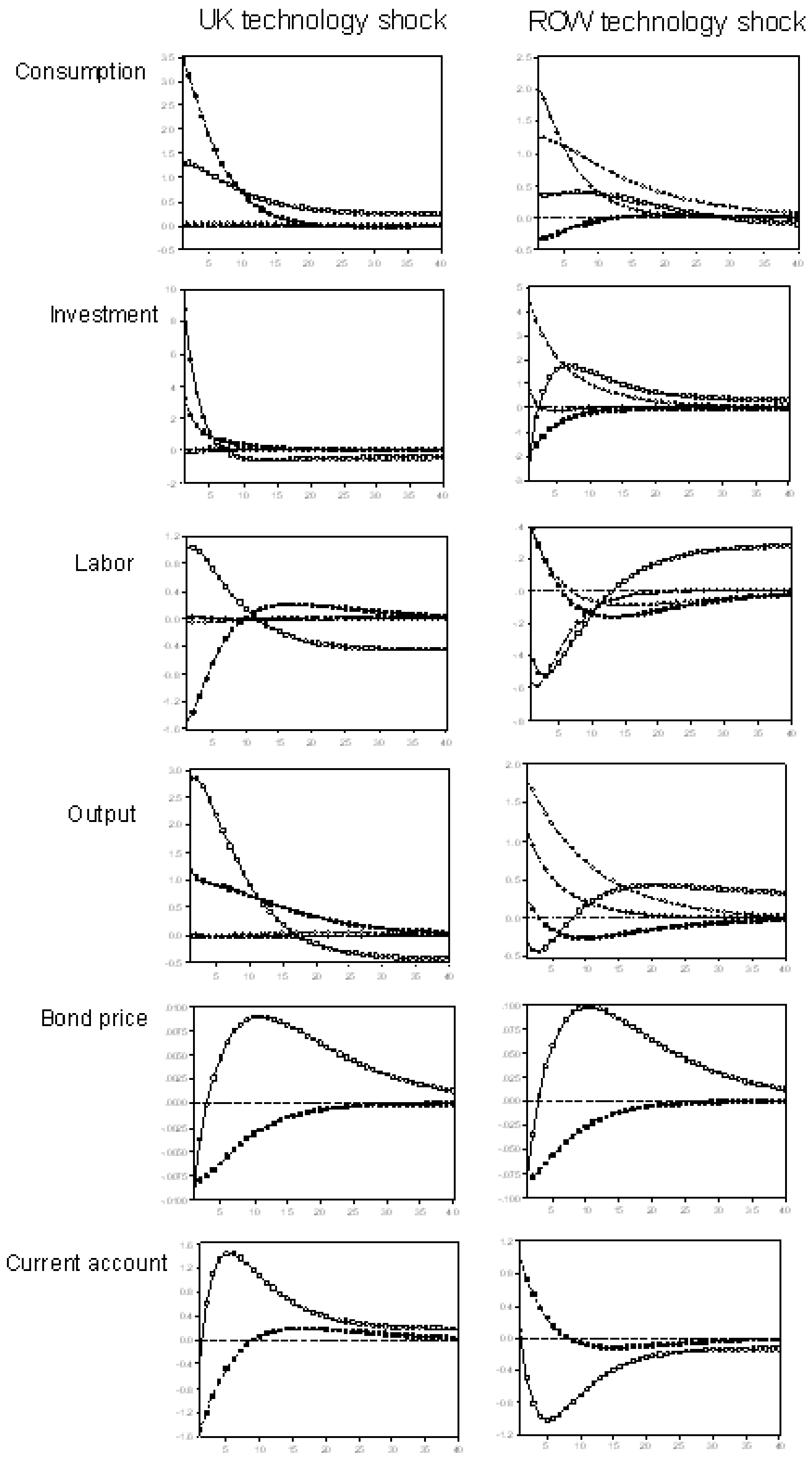
ROW technology shock. A positive ROW technology shock generates the qualitatively traditional response patterns under FDF and EDF preferences. Consumption and investment increases in Japan and in the ROW. Labor input increases in ROW but declines in Japan. ROW is in effect, sharing the positive shock with Japan. For a given real wage, the increased Japanese consumption needs to be accompanied by an increase in leisure. As a result, Japanese labor input declines. The positive ROW technology shock sends the Japanese current account into deficit.

Japanese government spending shock. A positive shock to Japanese government spending has almost no effect on the ROW. At home, output, investment, and labor input all increase while consumption is crowded out and the current account goes into deficit.

ROW government spending shock. The qualitative response is the same under FDF and EDF. The ROW government spending shock causes Japanese consumption and investment to decline, labor input and output to increase. ROW investment, labor input, and output increase while ROW consumption declines. The Japanese current account goes into surplus.

The impulse responses for UK–ROW are qualitatively the same as those for Japan–ROW.

Impulse responses to technology for UK–ROW



Impulse responses to government for UK–ROW

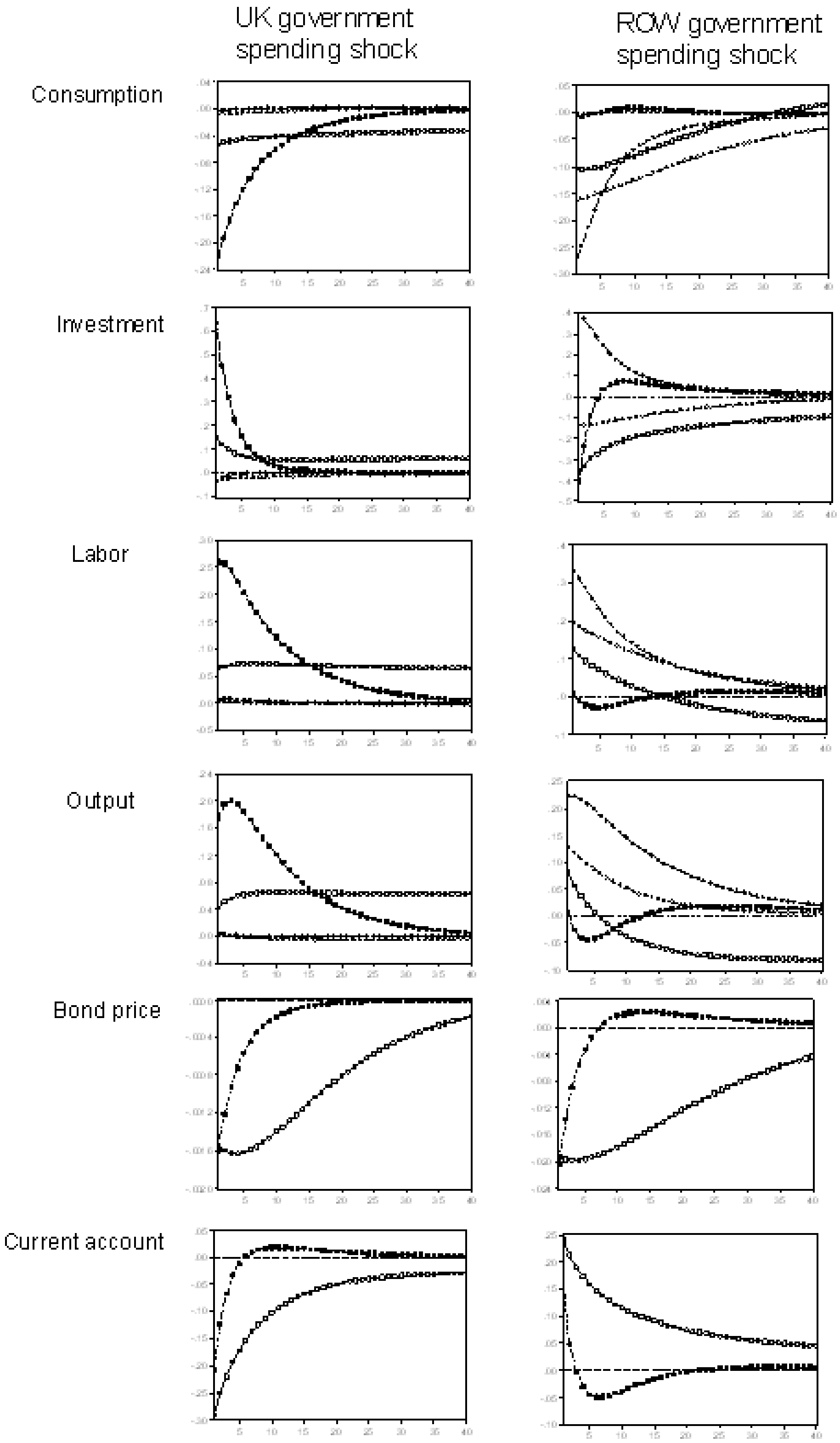


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Figure 1: Current account to GDP ratios. Source: Alan Taylor (1970–1992) and World Development Indicators (1993–2005).

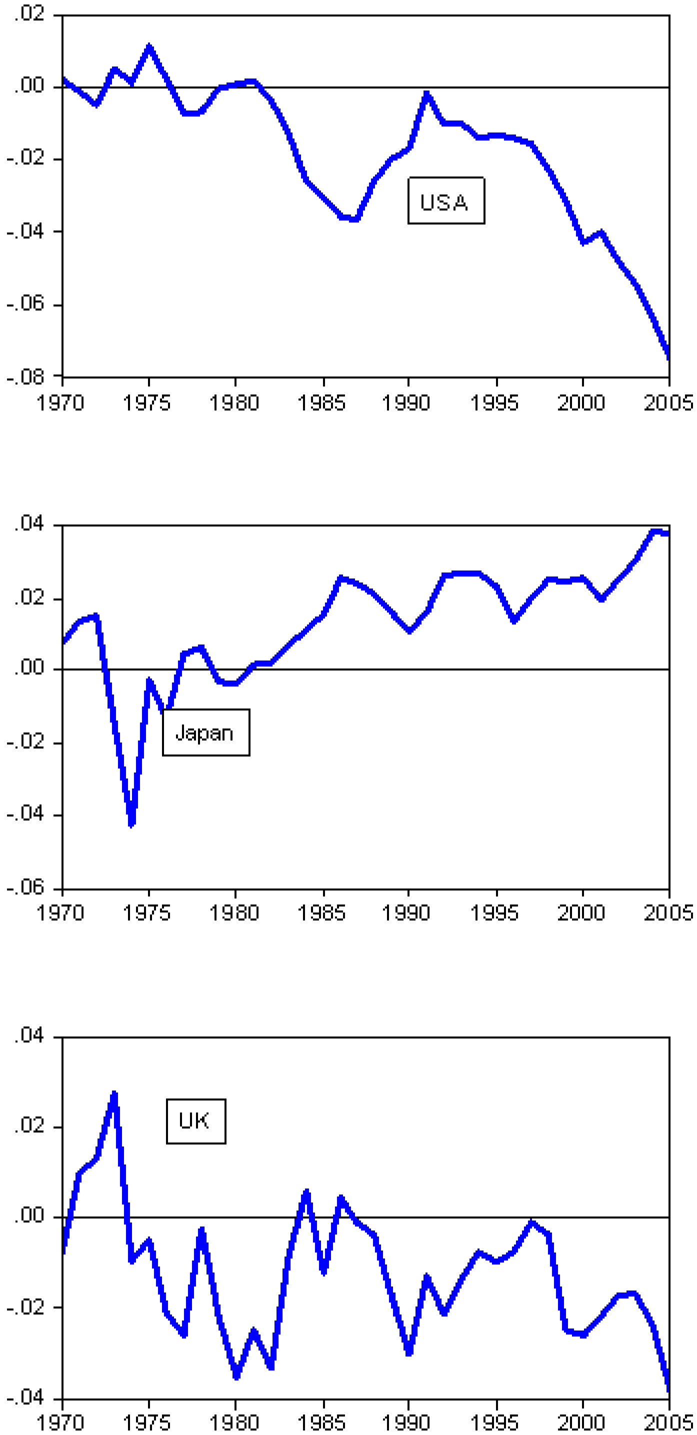


Figure 2a. United States

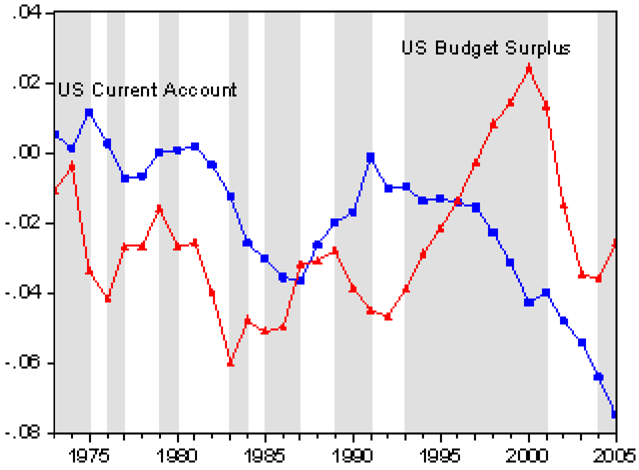


Figure 2b. Japan

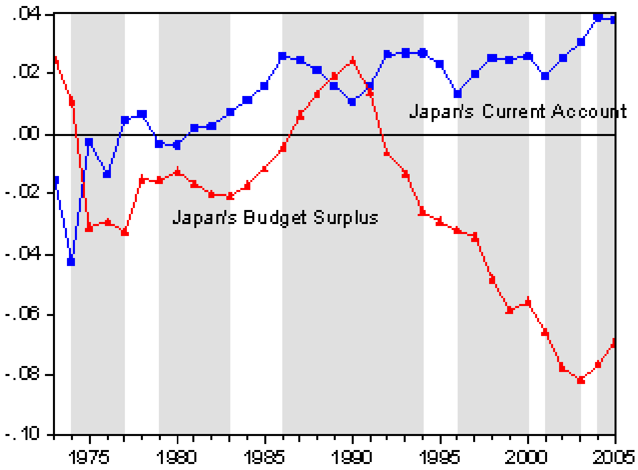


Figure 2c. United Kingdom

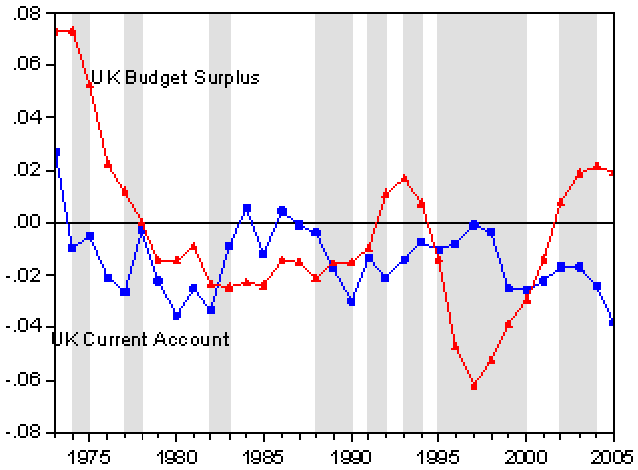


Figure 3a. Normalized observations for US

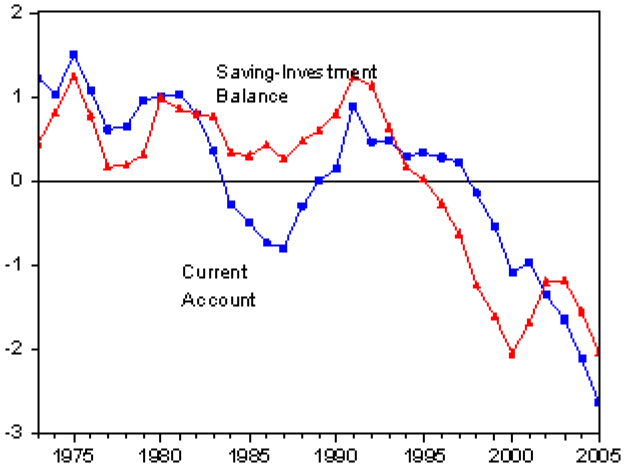


Figure 3b. Normalized observations for Japan

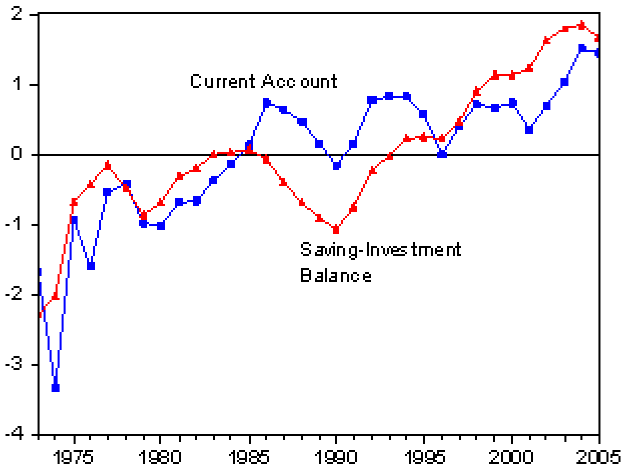


Figure 3c. Normalized observations for the UK

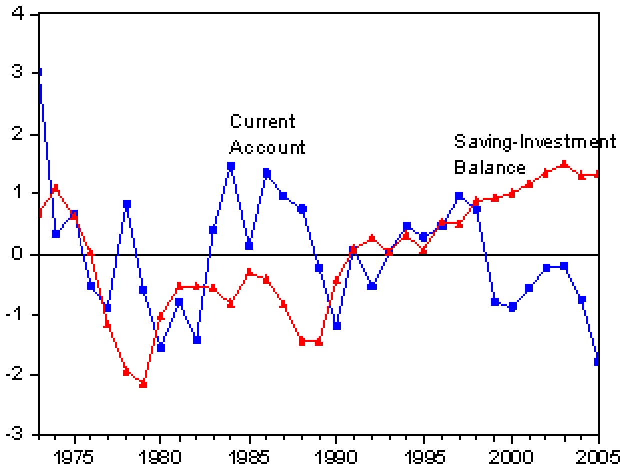


Figure 4a

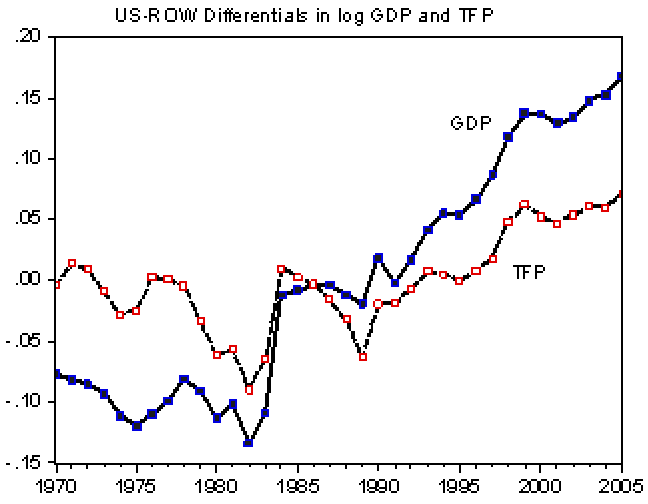


Figure 4b

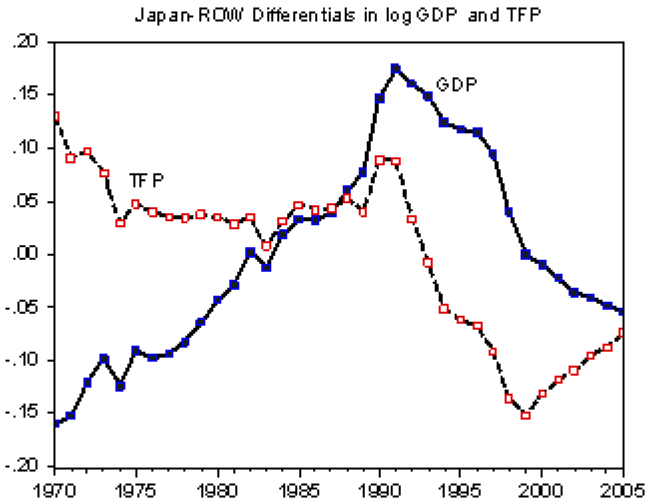


Figure 4c

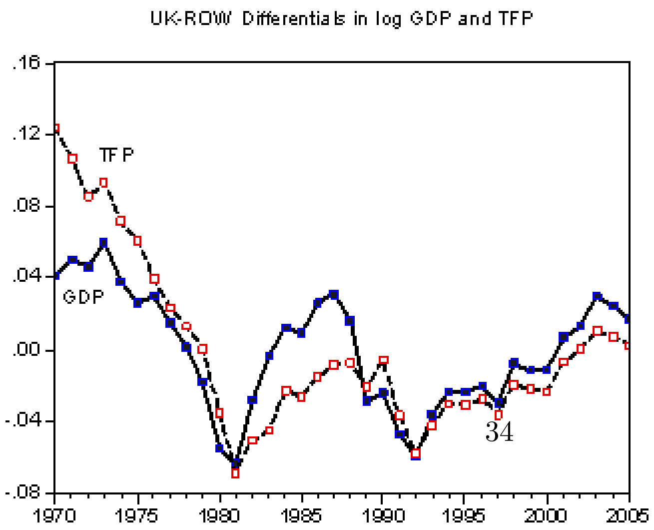


Figure 5. Impulse Responses to US technology shock. Squares are US responses. Circles are ROW responses. FDF: hollow symbols, EDF: solid symbols

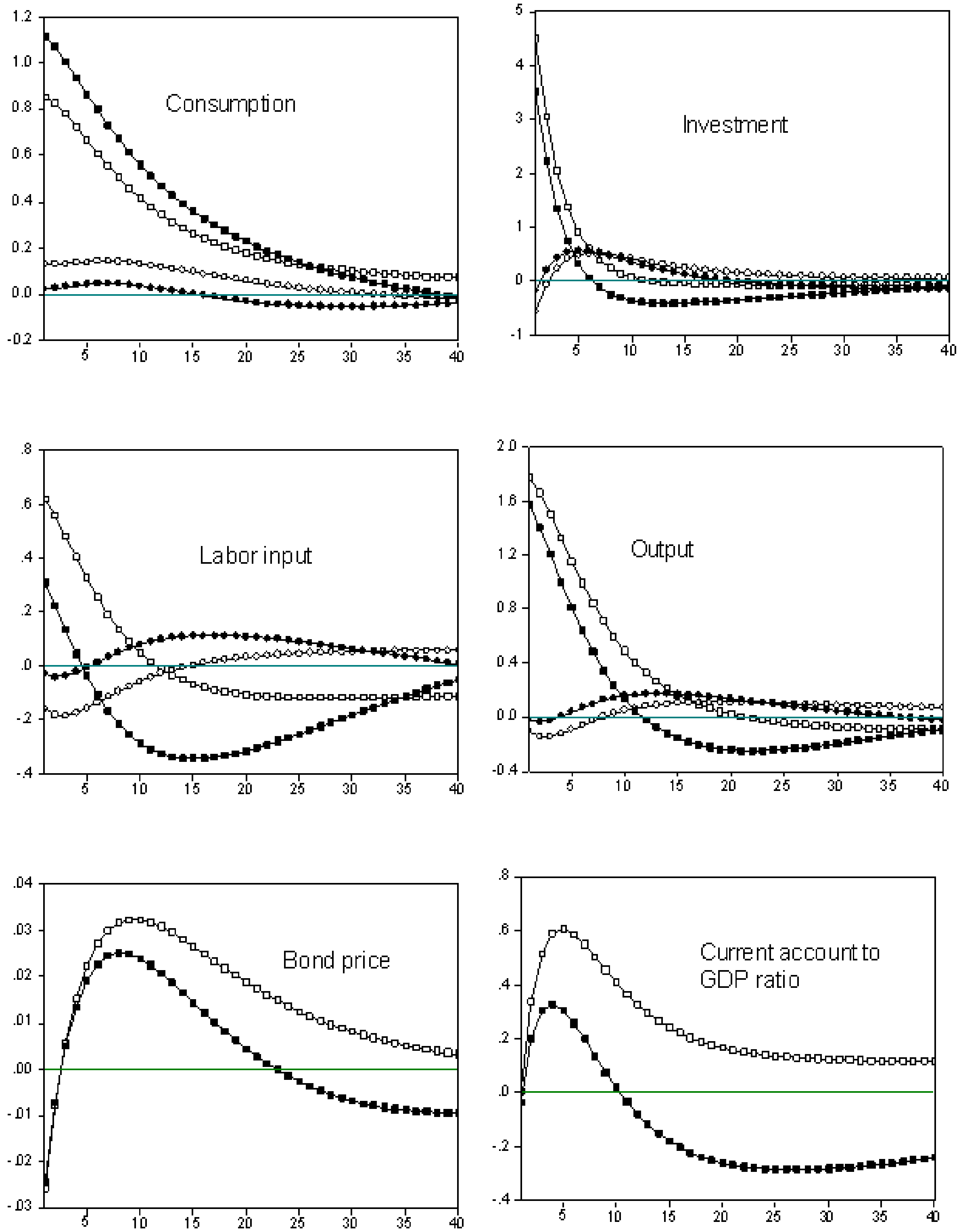


Figure 6. Impulse Responses to ROW technology shock. Squares are US responses. Circles are ROW responses. FDF: hollow symbols, EDF: solid symbols

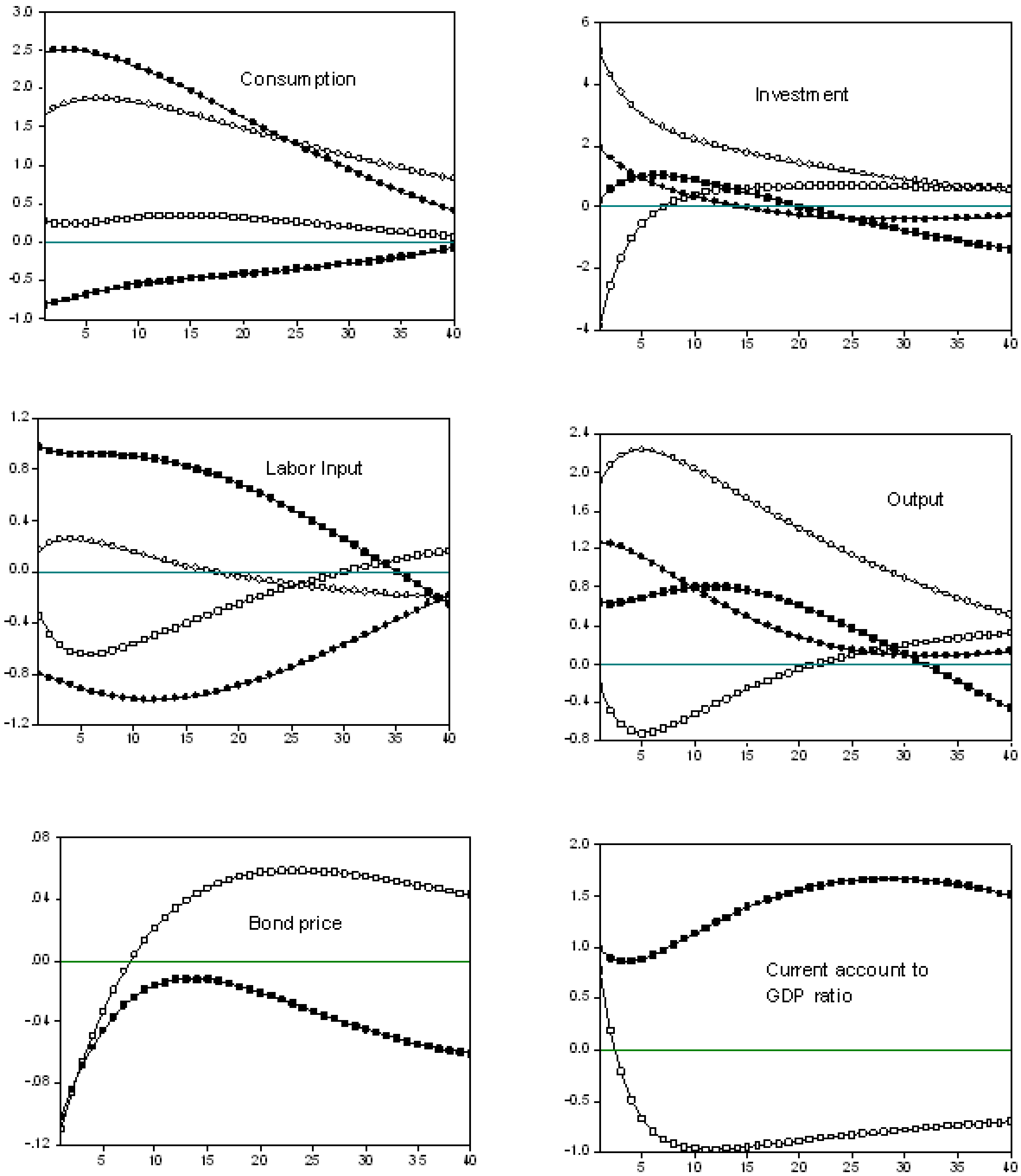


Figure 7. Impulse Responses to US government purchase shock. Squares are US responses. Circles are ROW responses. FDF: hollow symbols, EDF: solid symbols

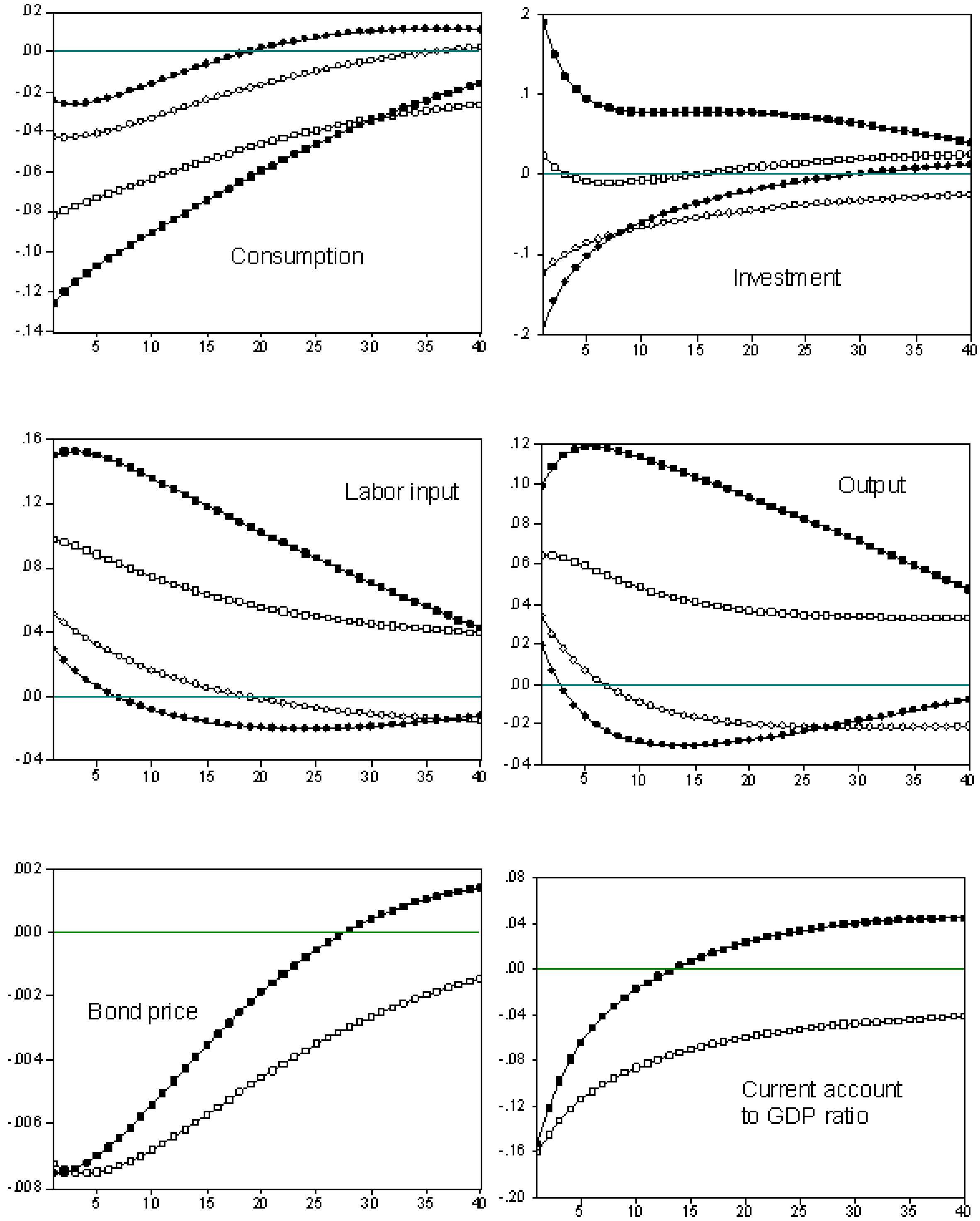
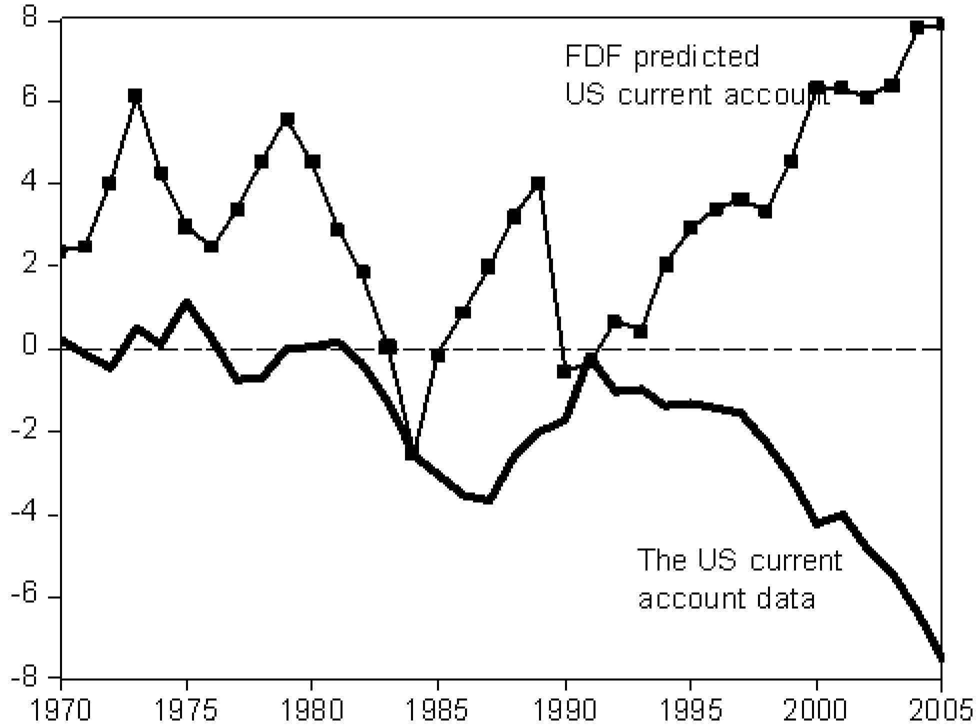


Figure 8


FDF predicted
US current account
The US current
account data
8
6
4
2
0
-2
-4
-6
-8
1970
1975
1980
1985
1990
1995
2000
2005

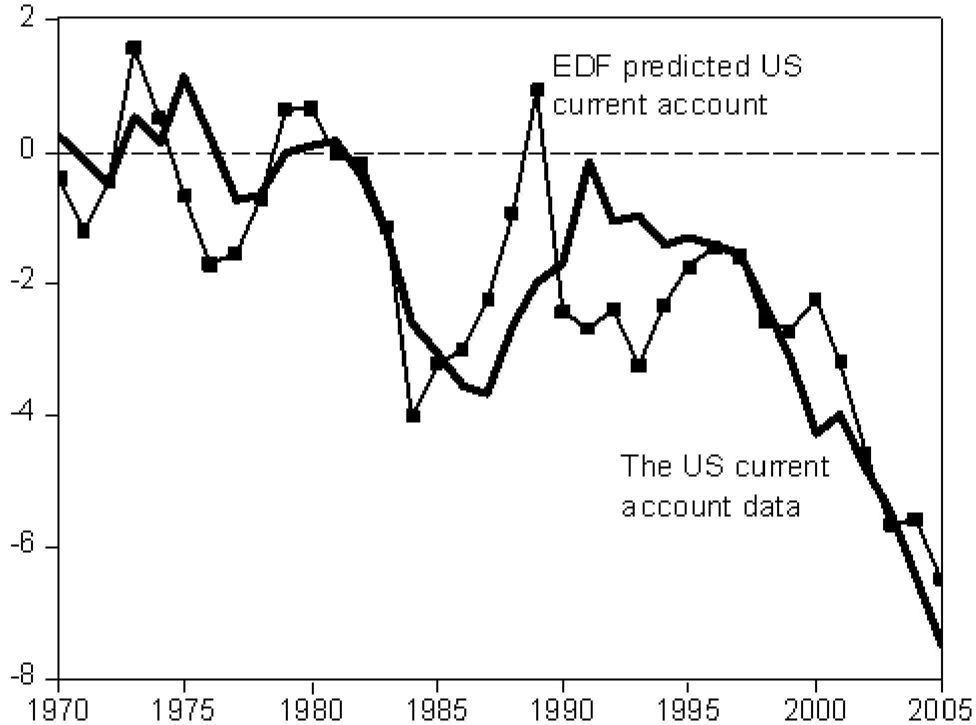
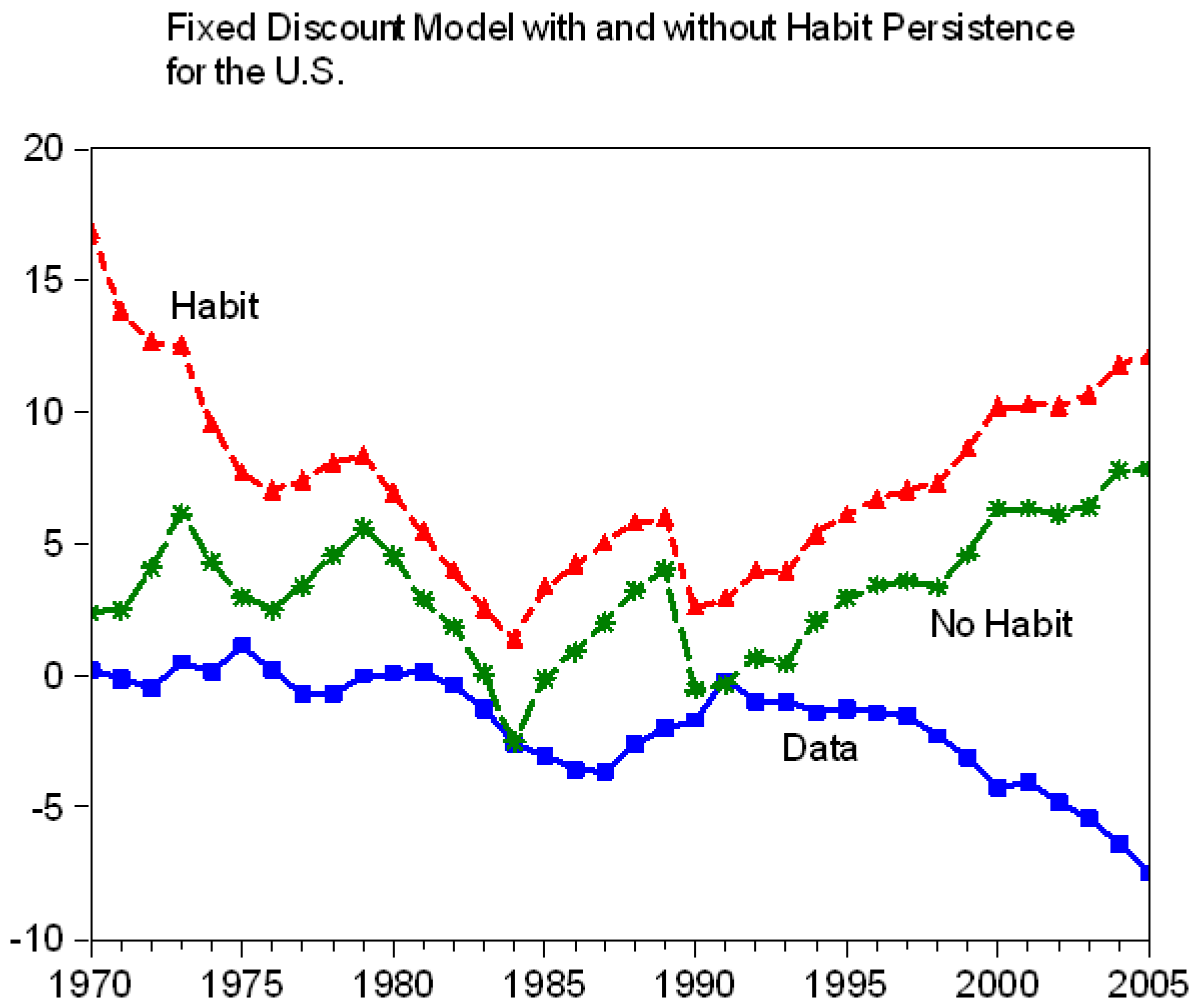

EDF predicted US
current account
The US current
account data
2
0
-2
-4
-6
-8
1970
1975
1980
1985
1990
1995
2000
2005

Figure 9


Fixed Discount Model with and without Habit Persistence for the U.S.
20
15
10
5
0
-5
-10
Habit
No Habit
Data
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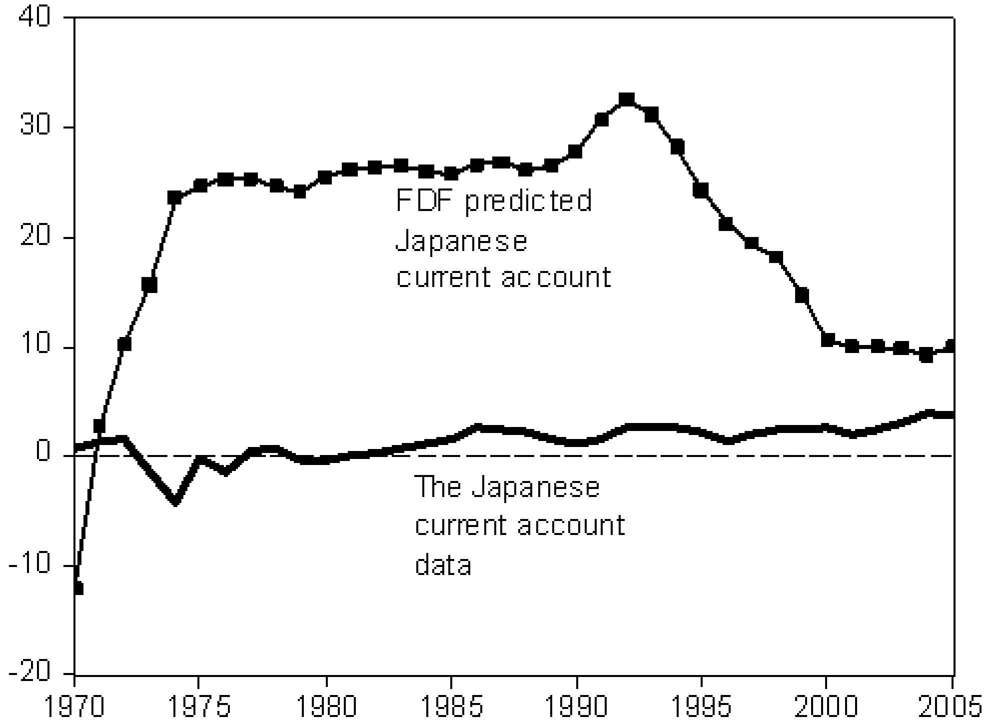
1975
1980
1985
1990
1995
2000
2005

Figure 10



40
30
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1975
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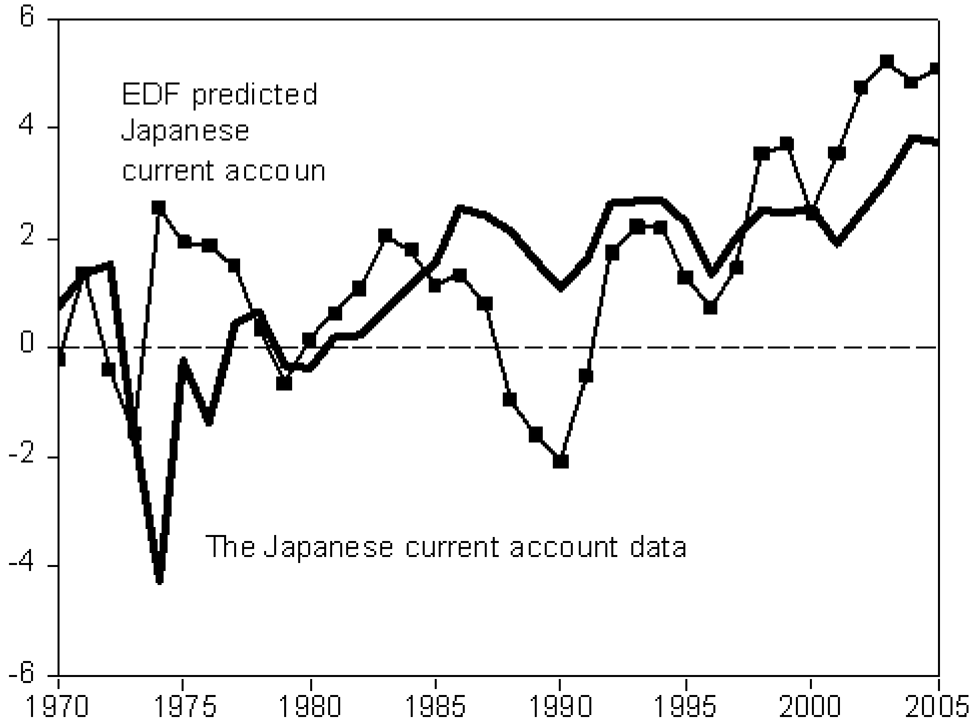
1995
2000
2005
FDF predicted
Japanese
current account
The Japanese
current account
data



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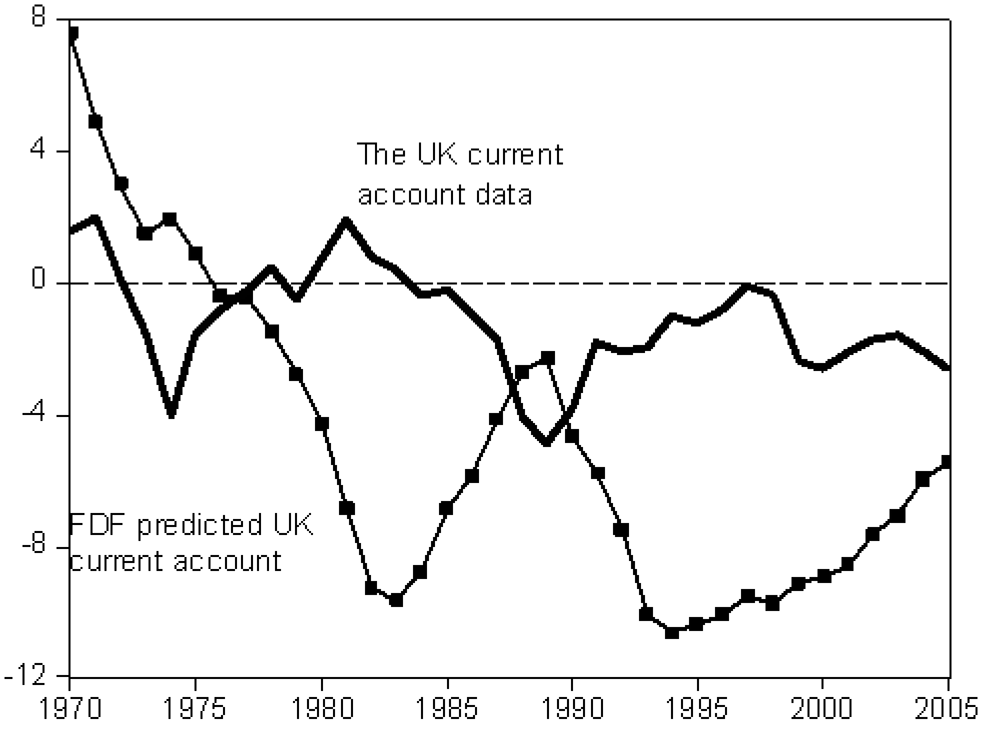
EDF predicted
Japanese
current accoun
The Japanese current account data

Figure 11



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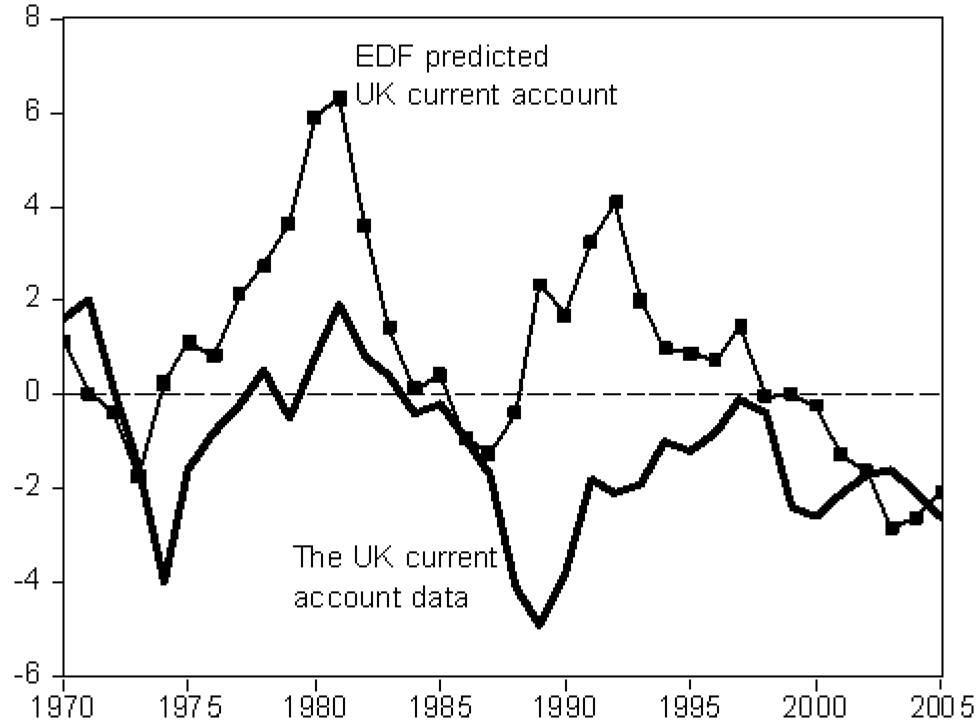
2005
The UK current
account data
FDF predicted UK
current account



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2005
EDF predicted
UK current account
The UK current
account data