A quantitative assessment of the decline in the U.S. current account ☆

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ABSTRACT

Low frequency changes in the U.S. current account can be understood in terms of the influence of differences in productivity growth rates across time and across countries using standard growth theory. In particular, the secular decline is primarily driven by the increase in the U.S. TFP growth rate relative to its trading partners. Differences in population growth rates or fiscal policy have no significant effects on the low frequency changes in the U.S. current account.

1. Introduction

The net national saving rate and the current account balance have been declining in the U.S. since the 1960s. Fig. 1 shows that the saving rate has declined from an average of 15% in 1960s to 10% in 1980s and 8.6% in 1990s while the current account balance (CA) has declined from a small surplus to a 5% deficit in 2004.

Several explanations have been put forward to understand the causes of the current account deficit. Fogli and Perri (2006) argue that the decline in U.S. business cycle volatility has led to lower precautionary saving resulting in lower current account balances. Mendoza et al. (2009) suggest that the U.S. has been accumulating foreign liabilities because the financial markets in the rest of the world are not as well developed. Backus et al. (2005) mention that the current account deficit in the U.S. may be mainly due to the weak economic conditions in several high-surplus countries relative to the U.S. Attanasio et al. (2007), Domeij and Floden (2006), Henriksen (2005), and Krueger and Ludwig (2007) highlight the importance of demographic differences between regions leading to large and persistent current account imbalances.[1]

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[1] These deficits have been a source of concern for many. For example, Obstfeld and Rogoff (2004) predict that the current account imbalances in the U.S. will result in a 30% depreciation of the dollar. Roubini and Setser (2005) suggest that the U.S. is on an unsustainable and dangerous path. Summers (2004) cautions that the current account deficit in the U.S. has all the hallmarks of a particularly serious situation.
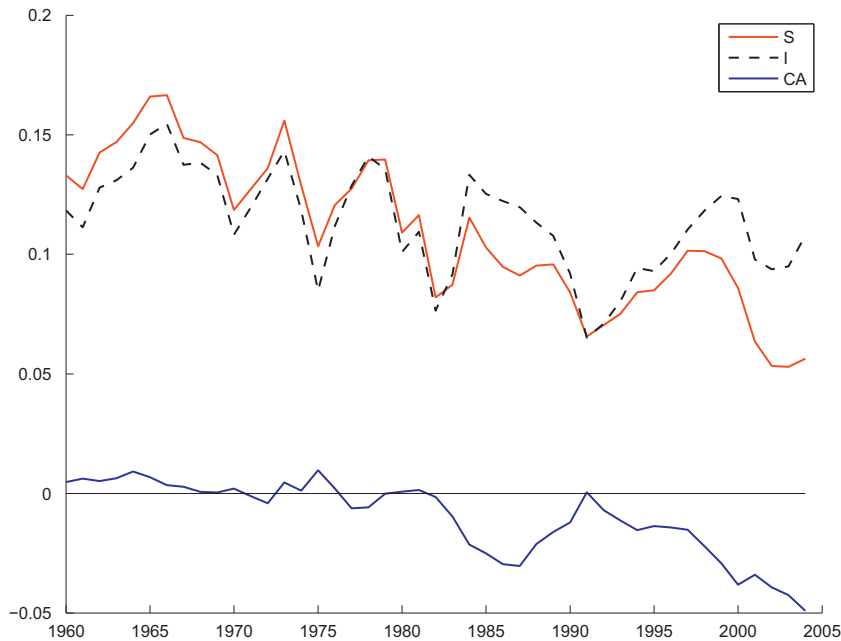
Fig. 1. U.S. saving and investment rate and the CA balance. U.S. data on net national saving and investment as a percent of net national product and the CA balance as a percent of GNP between 1960 and 2004.

Demographic factors have also been considered in explaining the secular decline in the saving rate. For example, Gokhale et al. (1996) attribute the decline in the saving rate to the redistribution of resources through social security and medicare, from young consumers with low marginal propensities to consume, to older generations with high marginal propensities to consume.[2]

This paper explores the quantitative implications of changes in TFP growth rates, factor income tax rates, population growth rates and depreciation rates in the U.S. relative to its trading partners on the secular movements in the net national saving and investment rates and the current account balance using the standard growth theory.[3] There have been significant changes in these exogenous factors since 1960s in the U.S. and the rest of the world (ROW). We specify a two-country, perfect foresight economy where differences between the U.S. and the ROW with respect to the exogenous variables are introduced as driving forces. For the ROW, attention is restricted to a subset of OECD countries for which there are consistent measurements of their TFP growth rates, population growth rates, shares of government purchases in output, and tax rates on capital and labor income for 1960–2004.

The key finding is that low frequency changes in the U.S. current account can be understood in terms of the influence of differences in productivity growth rates across time and across countries. The secular decline in the U.S. current account balance is primarily driven by the increase in the U.S. TFP growth rate relative to the ROW. Secular movements in the U.S. saving and investment, however, are mainly driven by domestic factors including the population growth rate and the depreciation rate as well as the U.S. TFP growth rate.

The paper is organized as follows. Section 2 presents the growth model used in the paper and its calibration. The quantitative findings are presented in Section 3. Concluding remarks are given in Section 4. The online appendix available on this journal's supplementary material website contains results from our sensitivity analysis, data sources and calibration details.

2. The model

Consider a perfect foresight, two-country growth economy. In each country $i = \{1, 2\}$, there is a stand-in household with N_t^i working-age members at date t. Households are assumed to own the capital, K_t^i, and rent it to businesses. Both physical capital and labor are immobile across countries. There is a risk-free bond traded internationally each period. This allows for national saving in one country to finance either domestic or foreign investment. The representative household in country i

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maximizes

$$\sum_{t=0}^{\infty} \beta^t N_t^i (\log c_t^i + \alpha \log(1 - h_t^i))$$

subject to

$$B_{t+1}^i + C_t^i + X_t^i + \phi K_t^i \left(\frac{X_t^i}{K_t^i} - \varphi^i\right)^2 \le B_t^i(1 + r_t^B) + (1 - \tau_{h,t}^i)w_t^i H_t^i + r_t^i K_t^i - \tau_{k,t}^i(r_t^i - \delta_t^i)K_t^i + TR_t^i - \pi_t^i, \quad (1)$$

where $c_t^i = C_t^i / N_t^i$ is per-member household consumption, $h_t^i = H_t^i / N_t^i$ is the fraction of hours worked per member of the household, H_t^i is total hours worked by all working-age members of the household, and B_t^i is the beginning of period bond holdings by residents of country i at date t. B_0^i is a given initial condition. β is the subjective discount factor, α is the share of leisure in the utility function, and r_t^B is the world interest rate. $\tau_{h,t}^i$ and $\tau_{k,t}^i$ are tax rates on labor and capital income, respectively, w_t^i is the real wage, TR_t^i is a government transfer, π_t^i is a lump sum tax, r_t^i is the rental rate of capital, and δ_t^i is the time-t depreciation rate in country i. The law of motion for the capital stock is given by

$$K_{t+1}^i = (1 - \delta_t^i)K_t^i + X_t^i, \quad (2)$$

where K_0^i a given initial condition. The size of the household evolves over time exogenously at the rate $n_t^i = N_t^i / N_{t-1}^i$.

Following the literature, quadratic adjustment costs are assumed for each country's capital accumulation represented by $\phi K_t^i(X_t^i/K_t^i - \varphi^i)^2$.[4] In general, adjustment costs lead to smoother fluctuations in the current account. This allows us to concentrate on understanding the secular patterns in the current account.[5]

The aggregate production function is given by

$$Y_t^i = A_t^i (K_t^i)^\theta (H_t^i)^{1-\theta},$$

where θ is the income share of capital and A_t is TFP, which grows exogenously at the rate $g_t^i = A_t^i / A_{t-1}^i$.

In each country i, there is a government that taxes income from labor and capital (net of depreciation) and uses the proceeds to finance exogenous streams of government purchases G_t^i and government transfers TR_t^i. A lump sum tax π_t^i is used to ensure that the government budget constraint is satisfied each period:

$$G_t^i + TR_t^i = \tau_{h,t}^i w_t^i H_t^i + \tau_{k,t}^i(r_t^i - \delta_t^i)K_t^i + \pi_t^i.$$

The national accounting identity in country i is given by

$$C_t^i + I_t^i + G_t^i + B_{t+1}^i = Y_t^i + B_t^i(1 + r_t^B)$$

or

$$C_t^i + I_t^i + G_t^i + CA_t^i = Y_t^i + B_t^i r_t^B = GNP_t^i,$$

where $I_t^i = X_t^i + \phi K_t^i(X_t^i/K_t^i - \varphi^i)^2$ is gross investment inclusive of adjustment costs and $CA_t^i = B_{t+1}^i - B_t^i$ is the current account balance for country i.

2.1. Competitive equilibrium

Definition of competitive equilibrium: Given a government policy $\{G_t^i, TR_t^i, \tau_{h,t}^i, \tau_{k,t}^i, \pi_t^i\}_{t=0}^\infty$, for $i = 1, 2$, a competitive equilibrium consists of allocations $\{C_t^i, I_t^i, H_t^i, K_{t+1}^i, Y_t^i, B_t^i\}_{t=0}^\infty$ and prices $\{w_t^i, r_t^i, r_t^B\}$ such that:

1. given policy and prices, the allocation solves the household's problem in each i,
2. given policy and prices, the allocation solves the firm's profit maximization problem with factor prices given by $w_t^i = (1 - \theta)A_t^i(K_t^i)^\theta(H_t^i)^{-\theta}$ and $r_t^i = \theta A_t^i(K_t^i)^{\theta-1}(H_t^i)^{1-\theta}$,
3. the government budgets are satisfied,
4. the goods market clears for each country: $C_t^i + I_t^i + G_t^i + NX_t^i = Y_t^i$, where $NX_t^i = CA_t^i - B_t^i r_t^B$ is net exports for country i,
5. r_{t+1}^B is such that the international bond market clears: $B_{t+1}^1 = B_{t+1}^2$.

Equilibrium conditions: For each country, the equilibrium conditions of this model can be described with the following equations below:

$$\frac{\alpha h_t^i}{1 - h_t^i} = (1 - \tau_{h,t}^i)(1 - \theta)\frac{Y_t^i}{C_t^i}, \quad (3)$$

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[4] To make sure that the steady state in the economy with adjustment costs is the same as the one without, we set the parameter φ^i equal to the investment–capital ratio at the steady state, $(g^i)^{1/(1-\theta)}n^i - 1 + \delta^i$, where the TFP growth rate g^i, population growth rate n^i and the depreciation rate δ^i denote the values of their counterparts on the balanced growth path.

[5] The sensitivity of the numerical results to the adjustment cost parameter is examined in the Appendix.

$$q_t^i = 1 + 2\phi\left(\frac{X_t^i}{K_t^i} - \varphi^i\right), \tag{4}$$

$$\frac{C_{t+1}^i}{N_{t+1}^i} = \frac{C_t^i}{N_t^i}\frac{\beta}{q_t^i}[q_{t+1}^i(1 - \delta_{t+1}^i) + MPK_t^i], \tag{5}$$

$$\frac{C_{t+1}^i}{N_{t+1}^i} = \frac{C_t^i}{N_t^i}\beta\{1 + r_{t+1}^B\}, \tag{6}$$

$$I_t^i = X_t^i + \phi K_t^i\left(\frac{X_t^i}{K_t^i} - \varphi^i\right)^2, \tag{7}$$

$$I_t^i = A_t^i(K_t^i)^\theta(H_t)^{1-\theta} - C_t^i - G_t^i - (B_{t+1}^i - (1 + r_t^B)B_t^i), \tag{8}$$

where q_t^i is Tobin's q for country i and $MPK_t^i = (1 - \tau_{k,t+1}^i)(\theta A_{t+1}^i(K_{t+1}^i)^{\theta-1}(H_{t+1}^i)^{1-\theta} - \delta_{t+1}^i) + \delta_{t+1}^i - \phi(X_{t+1}^i/K_{t+1}^i - \varphi^i)^2 + 2\phi(X_{t+1}^i/K_{t+1}^i)(X_{t+1}^i/K_{t+1}^i - \varphi^i)$.

2.2. Numerical solution

An important equilibrium condition is the detrended international bond market clearing equation,

$$\tilde{b}_{t+1}^1 = -\tilde{b}_{t+1}^2 s_{t+1}, \tag{9}$$

where, following McGrattan and Prescott (2009), $s_{t+1} = (A_{t+1}^2/A_{t+1}^1)^{1/(1-\theta)}N_{t+1}^2/N_{t+1}^1$ is the relative size of country 2. The entire sequence of s_{t+1} can be recursively obtained using $s_{t+1} = s_t(g_{t+1}^2/g_{t+1}^1)^{1/(1-\theta)}(n_{t+1}^2/n_{t+1}^1)$, given s_0 and the sequence $\{g_t^i, n_t^i\}_{t=0}^\infty$.

Algorithm to compute the transition path and the steady-state: Steady state values of other variables can be obtained given the steady state net foreign asset distribution $\{\tilde{b}^1, \tilde{b}^2\}$. However, this distribution in turn depends on its transition path and the initial asset distribution. Therefore both the steady-state and the transition path have to be solved simultaneously.

It is assumed that the economy reaches a steady state at some future date T. Then starting from some initial asset distribution $\{\tilde{k}_0^1, \tilde{k}_0^2, \tilde{b}_0^1, \tilde{b}_0^2\}$, the entire path of $\{\tilde{c}_t^1, \tilde{c}_t^2, r_t^B, \tilde{k}_{t+1}^1, \tilde{k}_{t+1}^2, \tilde{b}_{t+1}^1, \tilde{b}_{t+1}^2, h_t^1, h_t^2\}_{t=0}^T$ can be solved for using the system of nonlinear equations given in the Appendix.

2.3. Measurement and calibration

Our analysis on a number of countries for which there are consistent estimates of several exogenous variables, in particular, the TFP growth rate. Consequently, attention is restricted to the CA balance between the U.S. and the following group of OECD countries: Austria, Canada, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. For simplicity these OECD countries are referred as the ROW.[6] TFP growth rates for the ROW are obtained using data from Groningen Total Economy Database. For the ROW, aggregate output, capital, and hours are the weighted sum of each individual country's output, capital and hours, weighted by each individual country's output share.[7] Then, aggregate TFP for the ROW is obtained using the Solow decomposition. The TFP computed in this way differs very little from the TFP computed as the weighted average of TFP of individual countries, weighted by each country's output share. The average population growth rate of the ROW is computed using the same weighting method. TFP for the U.S. is calculated based on NIPA data where the capital share θ is set to 0.4, and the capital stock is inclusive of stock of consumer durables and government capital. The details of the calibration are presented in the Appendix. None of the results are significantly altered by different measurements of TFP.

Saving and investment rates are measured using

$$sav_t^i = \frac{Y_t^i + r_t^B B_t^i - G_t^i - C_t^i - \delta_t^i K_t^i}{NNP_t^i}$$

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[6] Data on U.S. current account balance against various regions come from International Economic Accounts of the Bureau of Economic Analysis. The U.S. current account balances against our sample of OECD countries are the sum of the U.S. current account balances against Western Europe, Canada and Japan. After 1998 we use the U.S. current account balance against EU-15 to substitute for the U.S. current account balance against Western Europe.

[7] The data on the capital stock are not available from Groningen Total Economy Database. To compute the real capital stock that is consistent with real GDP in constant 1990 dollars (converted at Geary Khamis PPPs), real total capital stock as a percentage of real GDP between 1960 and 2001 from the Kiel Institute database is used. This ratio is then multiplied with real GDP from Groningen Total Economy Database to obtain real capital stock for each country. The real capital stock after 2001 is imputed by multiplying the real total capital stock as a percentage of real GDP at 2001 and the real GDP in each of the last three years.

Table 1
Parameter values for 2005 and beyond.

		U.S.	ROW
$g_t - 1$	TFP growth rate	0.011	0.011
$n_t - 1$	Population growth rate	0.01	0.01
ψ_t	Government purchases to GDP ratio	0.16	0.18
δ_t	Depreciation rate	0.05	0.05
TR_t/GDP_t	Transfers to GDP ratio	0.08	0.08
$\tau_{k,t}$	Capital income tax rate	0.42	0.34
$\tau_{h,t}$	Labor income tax rate	0.29	0.38

and

$$inv_t^i = \frac{Y_t^i + r_t^B B_t^i - G_t^i - C_t^i - \delta_t^i K_t^i - (B_{t+1}^i - B_t^i)}{NNP_t^i},$$

where $NNP_t^i = Y_t^i + r_t^B B_t^i - \delta_t^i K_t^i$ is the net national product in country i at time t. The current account deficit as a percentage of GNP is computed as

$$ca_t^i = \frac{B_{t+1}^i - B_t^i}{Y_t^i + r_t^B B_t^i}.$$

Constant parameters: There are four parameters that are time and country invariant throughout the analysis. The capital share parameter, θ, is set to 0.4. The capital adjustment cost parameter, ϕ, is set to 0.6, which is well within the range of values used in the literature.[8] The subjective discount factor, β, is set to 0.9702 so that the capital–output ratio is 3.2 at the final steady state in the U.S. The share of leisure in the utility function, α, is set to 1.45 to match an average workweek of 35 h in the U.S.

Calibration of the initial conditions: The initial capital–output ratio for the U.S. in 1960, 3.5, is used to pin down the initial capital stock for the home country. The initial capital stock for the ROW is set equal to 1.55 times that in the U.S., the actual ratio of capital stocks between ROW and the U.S. in 1960. The initial foreign asset holdings, $\tilde{b}_{1960}^1$ and $\tilde{b}_{1960}^2$, are both set to zero.

A crucial parameter for the results is the initial size of the ROW relative to the U.S. in 1960. This relative size determines the importance of the U.S. in shaping the world prices relative to the ROW.[9] If the ROW is too small to impact the world prices then the model converges to the closed economy case with a zero current account balance for the U.S. In the benchmark calibration, the *initial* relative size is chosen such that the current account deficit generated by the model in 1960 is equal to its counterpart in the data which is equal to 0.0269.[10] After the initial size is pinned down, the actual TFP and population growth rates determine the evolution of the relative size over time.

Calibration of the 1960–2004 *period*: In the benchmark simulation, the actual time series data for the U.S. and the ROW between 1960 and 2004 for TFP growth rates, $g_t - 1$, population growth rates, $n_t - 1$, shares of government purchases in GDP, ψ_t, and capital and labor income tax rates, $\tau_{k,t}, \tau_{h,t}$ are used.[11] The tax rate data for the U.S. and the ROW are from updated calculations of Mendoza et al. (1994) up to 1996. For years after 1996 tax rates are set equal to their 1996 values. For the ROW the depreciation rates δ_t, and the shares of government transfers in GDP, TR_t/GDP_t, are set equal to the values in the U.S. All the data used in the paper are provided in the Appendix.

Calibration of 2005 *and beyond*: In the benchmark model, the tax rates, ψ_t and TR_t/GDP_t are set equal to their steady state values starting in 2005. The population growth rate for the U.S. and the ROW after 2004 and at the steady state is set equal to 1%. The depreciation rates for the U.S. and the ROW are assumed to be 5% for year 2005 and beyond. Future TFP growth rates are calculated using a 5th order moving average process until year 2013, after which U.S. and the ROW are assumed to have the same steady state growth rate of 1.1%. We check the sensitivity of the results to different assumptions about the calibration of most of the variables for the period 2005 and beyond. Table 1 summarizes the parameter values for 2005 and beyond, including the steady state which is assumed to be reached in 2070.

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[8] See, for example, Baxter and Crucini (1993, 1995) and Fogli and Perri (2006).

[9] An alternative is to introduce an openness index as in McGrattan and Prescott (2009) that would impact the role of the U.S. in shaping the world prices.

[10] As the initial relative size changes to make the ROW matter more and more in 1960, the model generated current account surpluses for the U.S. in the 1960s and current account deficits in 2004 get implausibly large. Sensitivity analysis to this parameter is presented in the Appendix.

[11] Government purchases as a percent of GDP are calculated using data on government final consumption expenditures in national currency units for each country from OECD annual national accounts. Data on transfer payments for the U.S. are obtained from NIPA tables. For OECD countries, similar data are used. Population data for individuals between 15 and 64 years old are obtained from United Nations demographic year book (1960–1969) and OECD Economic Outlook (1970–2005).
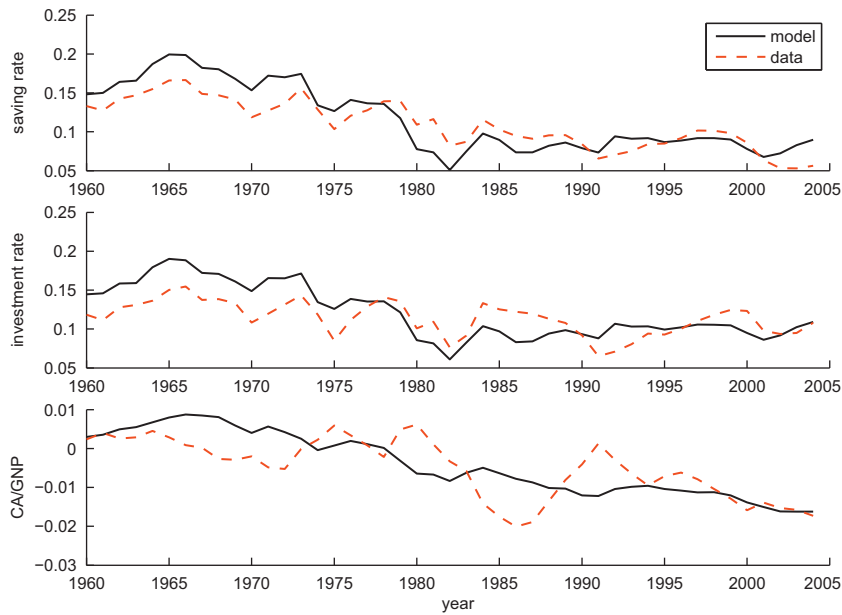
Fig. 2. Benchmark results. U.S. data versus model generated saving and investment rates and the CA balance in the benchmark economy.

3. Quantitative results

This section summarizes the key findings and then provide further numerical results to examine additional properties of the model.

3.1. Key findings

Fig. 2 displays three panels that highlight our key findings and compares the saving rate, investment rate and the current account balance series generated by the model economy and those from the U.S. national accounts.

First, the model generated CA balance captures the overall secular decline in the observed CA balance since 1960s quite well. The current account starts from a surplus of around 0.3% in 1960 and ends up with a deficit of about 2% in 2004. Second, the model accounts for most of the fluctuations and the trend decline in the observed saving and investment rates. These results indicate that it is possible to generate realistic current account deficits, as well as saving and investment rates, for the U.S. in a carefully calibrated standard neoclassical growth model driven by differences in TFP growth rates, population growth rates and factor income tax rates.

Since 1960s there have been substantial changes in these exogenous factors across time and between the U.S. and the ROW. For example, population growth rates have declined more severely in the ROW relative to the U.S. In addition, TFP growth rates have followed different paths as displayed in Fig. 3 which shows the TFP growth rates for the U.S. and the ROW between 1960 and 2004, with the linear trends indicated by the dashed lines. Notice that the ROW displays higher TFP growth rates in the 1960s relative to the U.S.[12] In our framework the international bond allows for saving to flow from the U.S. to the ROW in the 1960s, exploiting higher returns driven by higher TFP growth rates in the ROW. In addition, the trend in TFP growth rates reverses in the 1990s where U.S. TFP growth exceeds that of the ROW indicating saving in the ROW should flow to the U.S.

In order to isolate the impact of TFP growth, demographics and other variables on the secular decline in the saving and investment rates and the CA balance, two counterfactual experiments are conducted. First, differences in TFP growth rates between the U.S. and the ROW are shut down, and only differences in demographics and fiscal policies are allowed to play a role. Second, the case where the only differences between the U.S. and the ROW are differences in their TFP growth rates is examined. In both counterfactual experiments, all the exogenous variables for the U.S. are kept as in the benchmark case.

In the first experiment, differences between the U.S. and the ROW arise due to the differences in the population growth rates, GDP shares of government purchases, and tax rates. The results of this experiment are depicted in three panels in Fig. 4. The line 'counterfactual' shows the model generated saving and investment rates, and the CA balance. There are hardly any differences between the benchmark and the counterfactual series for saving and investment rates. However,

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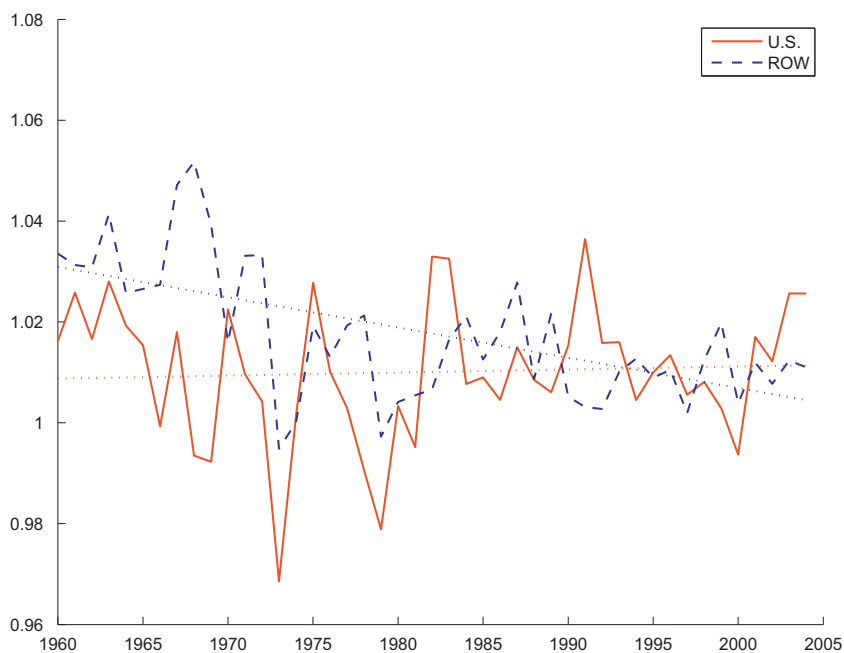[12] The country that is mostly responsible for that measurement is Japan.

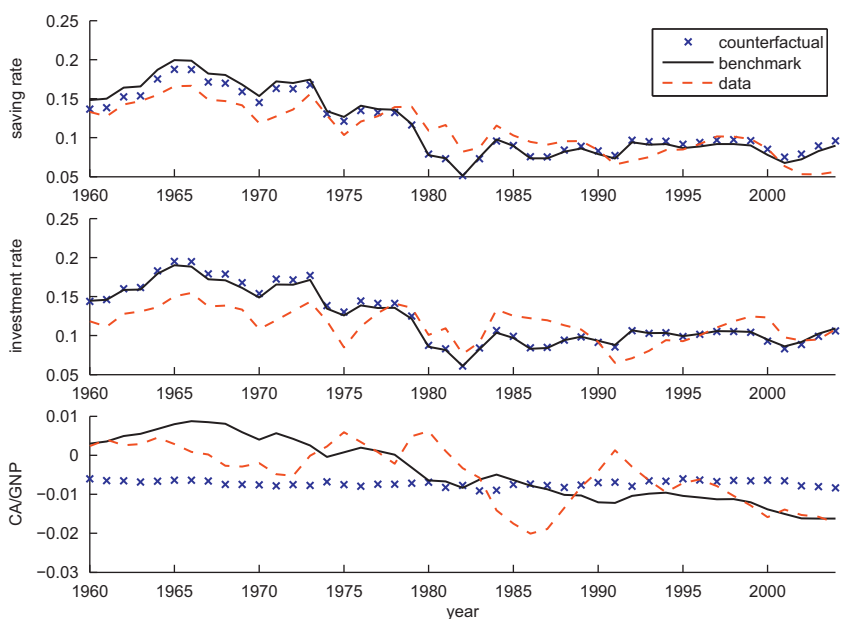**Fig. 3.** TFP growth rates. TFP growth rates for the U.S. and the ROW.

Fig. 4. Role of demographics and fiscal policy. Counterfactual experiment where TFP growth rate is identical between the U.S. and the ROW. Saving and investment rates and the CA balance generated by the benchmark and the counterfactual experiment versus the data.

under the counterfactual experiment, the trend decline in the CA totally disappears.[13] These findings suggest that the impact of the ROW in shaping the U.S. saving and investment rates is small. Moreover, differences in demographics and other variables between the U.S. and the ROW are not capable of generating the secular decline in the CA balance observed in the U.S.

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[13] The relatively constant 0.5% CA deficit obtained in this counterfactual experiment comes mostly from the higher labor taxes in the U.S. and the differences in the level of capital stock that existed between the U.S. and the ROW in 1960.
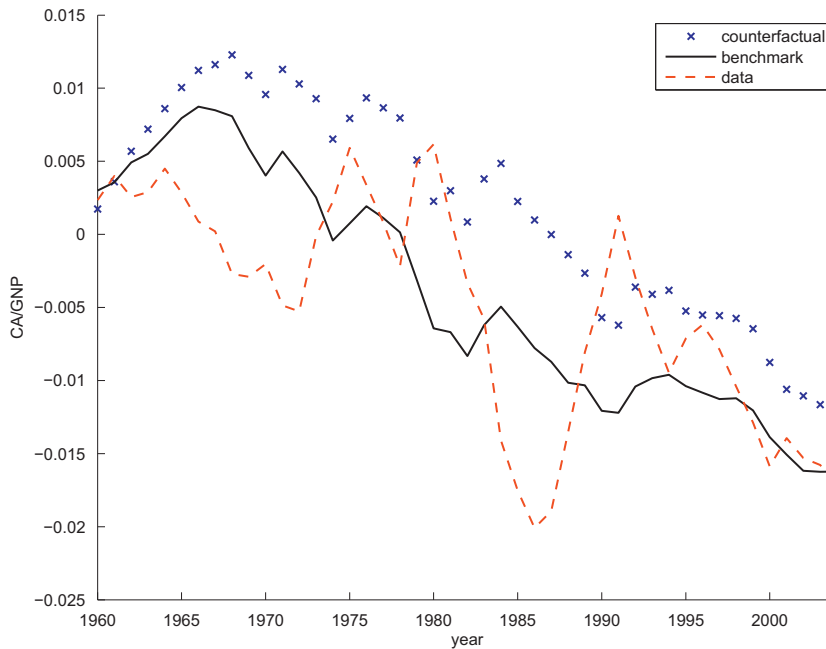
Fig. 5. Role of TFP. Counterfactual experiment where TFP growth rate is the only difference between the U.S. and the ROW. CA balance generated by the benchmark and the counterfactual experiment versus the data.

In the second counterfactual experiment, all exogenous differences between the ROW and the U.S. are shut down, except for the differences in TFP growth rates and initial conditions. The population growth rate, G/Y, and the tax rates in the ROW are set equal to the U.S. values. The only country specific exogenous variable allowed for is the TFP growth rate. The saving and investment rates in this experiment are very similar to the benchmark case since all the U.S. series are still active. Therefore only the resulting CA balance is displayed in Fig. 5, which is the series labeled as 'counterfactual'. Note that this series displays a similar trend as in the data and the benchmark series. This experiment demonstrates that the secular decline in the U.S. CA balance mainly comes from the differences in TFP growth rates between the U.S. and the ROW.[14]

The results of the two counterfactual experiments carried out above suggest that the secular decline in the U.S. CA balance is likely due to differences in the TFP growth rates between the U.S. and the ROW.

3.2. Additional results

This section explores the properties of the model economy further.

3.2.1. Decline in the national saving and domestic investment rates

The previous section presented our core findings that (i) the low frequency behavior of the U.S. CA balance seems attributable to TFP differentials between the U.S. and the ROW, and (ii) the U.S. saving and investment rates are mostly determined by the U.S. exogenous variables alone. This section examines which of the domestic factors is quantitatively more important in shaping the saving and investment rates.

Fig. 6 displays the results from setting all the U.S. series equal to their steady state values except for the population growth and depreciation rates. This experiment generates a small trend decline in the saving rate, displayed by the curve labeled 'counterfactual'. Further experimentation about this reveals that changes in the population growth rate exert a smooth and small influence on the saving rate, while the increase in the depreciation rate gives rise to a quantitatively important decline in the saving rate between 1960s and 1990s.[15]

Fig. 7 displays the findings from the second counterfactual experiment where the only time series that is active is the TFP growth rate. All other exogenous variables are set to their long run averages. Notice that changes in TFP appear to be highly related to the decline in the saving rate through the first half of the sample, but move in the wrong direction during the second half of the sample.

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[14] These results are robust to alternative measures of TFP which are discussed in the Appendix.

[15] These additional results can be obtained from the authors.
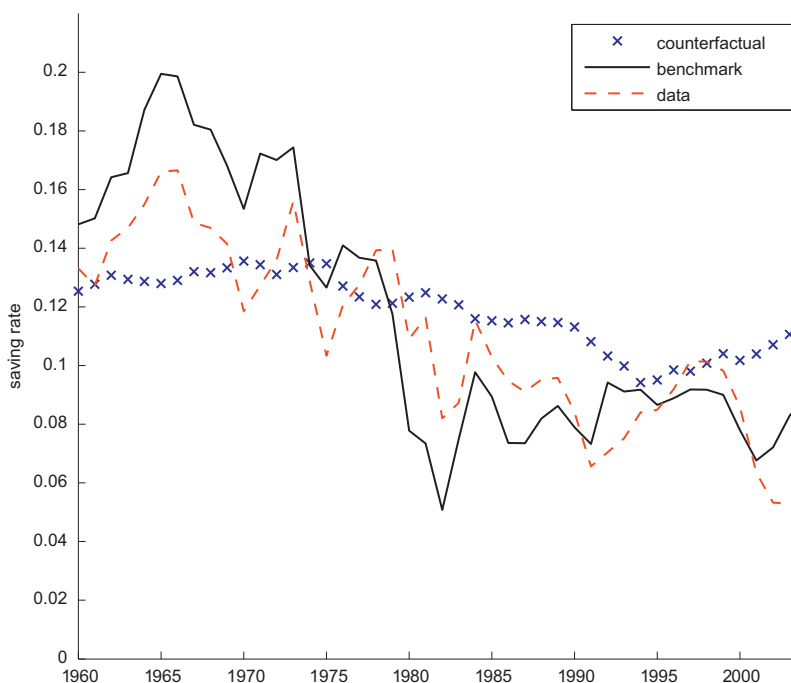
Fig. 6. Role of population growth and depreciation. Counterfactual experiment where population growth rate and the depreciation rate are the only time varying exogenous variables used in the simulation. Saving rate generated by the benchmark and the counterfactual experiment versus the data.

Fig. 7. Role of TFP for the saving rate. Counterfactual experiment where TFP growth rate and is the only time varying exogenous variable used in the simulation. Saving rate generated by the benchmark and the counterfactual experiment versus the data.
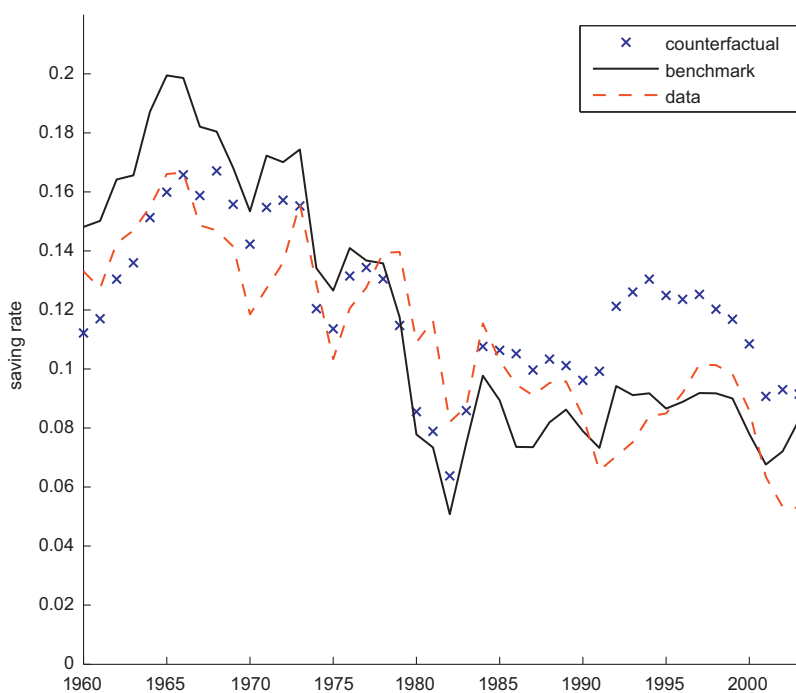
These experiments suggest that for the time series behavior of the U.S. saving rate, TFP growth rate, depreciation rate and demographics all play a role. By contrast, according to the results, the major determinant of the decline in the U.S. CA balance is the difference between the TFP growth rates in the U.S. and the ROW.
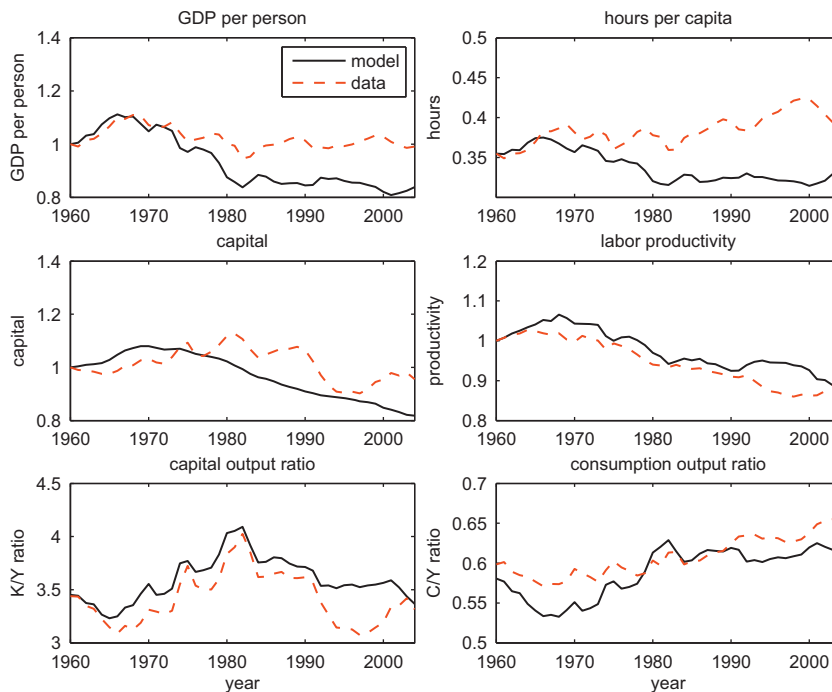
Fig. 8. Benchmark model without labor wedge. Model's predictions for per capita GDP, hours, capital, labor productivity, capital output ratio and consumption output ratio together with their counterparts in the data.

Overall, we conclude that the standard growth model is able to capture the secular movements in the saving and investment rates as well as the current account reasonably well once key exogenous variables are incorporated into the analysis.

3.2.2. Model's predictions on other indicators

Fig. 8 displays the model's predictions for per capita GDP, hours, capital, labor productivity, capital output ratio and consumption output ratio together with their counterparts in the data.[16] The model generated series and the data, except for hours per capita, are all detrended by 1.018^t. The model generated per capita hours and GDP per person display large gaps from their data counterparts. In particular, simulated labor supply displays a decline while hours per capita in the data increase.[17] As a result, both average labor productivity and capital–output ratio from early 1990s diverge from their data counterparts, although the discrepancy between the model and data is relatively small before then.

The reason for the hours boom in the U.S. is not well established. One possibility is the increase in the labor force participation of women. McGrattan and Rogerson (2004) show that the increase in hours per capita observed in the U.S. is mainly due to the increase in the labor force participation rate of females. In fact, between 1950 and 2000, employment to population ratio of women increases by 87% while that of men declines by 15.7%. Between 1980 and 2000 employment to population ratio of women increases by 17%. The simple framework used in this model is not capable of mimicking these trends.[18] It is also possible that the reason for the hours boom lies elsewhere such as the intangible capital explanation advanced by Corrado et al. (2006) and McGrattan and Prescott (2007a) or the change in wage markups argued by Smets and Wouters (2007).

3.2.3. Labor wedge

In order to further understand the performance of the standard model, but without taking a stand on the main reasons behind the hours boom in the data, we introduce a labor wedge into the model. Note that a perfect match between the model and the data would be obtained if a labor wedge and an investment wedge were simultaneously introduced. In this case, the first-order condition for the consumption-leisure trade-off and the Euler equation would both be guaranteed to hold.[19] In the following experiment only the labor wedge is introduced to examine the role of labor in generating the

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[16] Hours worked is measured as hours per civilian noninstitutional population aged 16 and over.

[17] These discrepancies were also noted by Uhlig (2003) and McGrattan and Prescott (2007b), among others.

[18] Several papers investigate the rise of the female labor force participation such as Jones et al. (2003), Olivetti (2006), Akbulut (2005), and Caucutt et al. (2002).

[19] These two first order conditions are provided in the Appendix. Here, the country superscript is dropped.
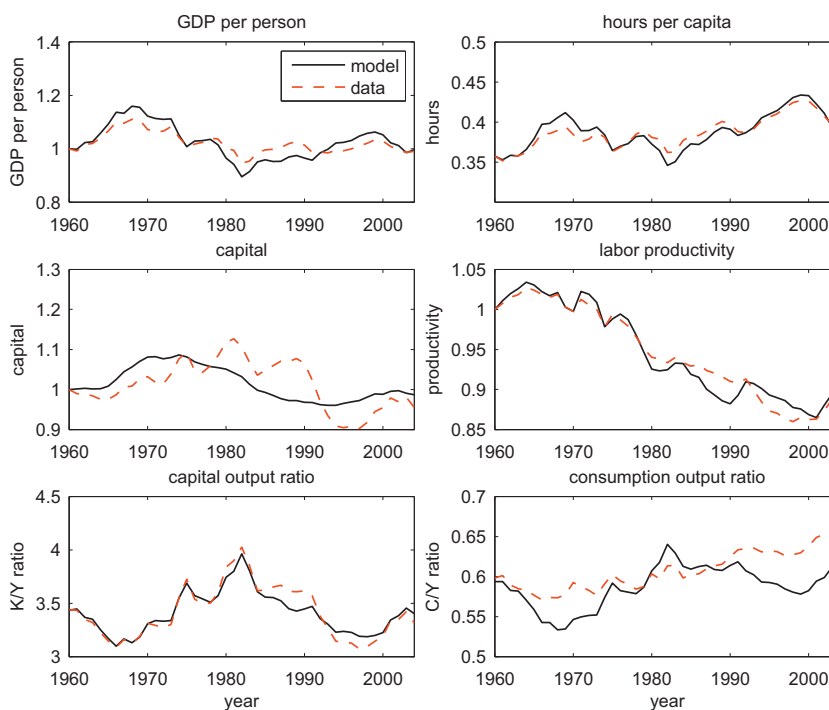
Fig. 9. Benchmark model with labor wedge. Model's predictions for per capita GDP, hours, capital, labor productivity, capital output ratio and consumption output ratio when a labor wedge is incorporated and the data.

results in Fig. 8. Specifically the labor wedge is calculated from

$$L_{wt} = \frac{\alpha h_t C_t}{(1 - h_t)(1 - \tau_{h,t})(1 - \theta)Y_t}.$$

After computing the labor wedge, $(1 - \tau_{h,t})$, in the first order condition for the consumption-leisure trade-off is replaced with $(1 - \tau_{h,t})L_{wt}$. Since there are already taxes in this model, the labor wedge would have to be a proxy for labor distortions other than taxes.

Fig. 9 displays the results of this experiment with the labor wedge. Now hours per capita and GDP per person match the data reasonably well. In particular, after the labor wedge is used to generate an hours boom in the 1990s, the model accounts for both average labor productivity and capital–output ratio well. We conjecture that extensions of the standard model which can capture the hours boom may be successful in mimicking the other aspects of the U.S. economy well.[20]

3.2.4. Investment wedge

The investment wedge is calculated as the growth rate of per capita consumption which is not accounted for by changes in the return measure in Eq. (5). In particular, the left-hand side of (5) is calculated from NIPA after reorganizing the accounts to match model accounts. The model-generated growth rate of per capita consumption is calculated using the right-hand side of Eq. (5), taking $X_t^i, X_{t+1}^i, K_t^i, K_{t+1}^i, \tau_{k,t}^i$, and δ_t^i for the U.S. from the data.

Fig. 10 plots the two sides of Eq. (5). These two measures for the growth rate of per capita consumption track each other fairly closely except for the mid-1980s and early 1990s. This suggests that the standard theory is able to capture the consumption-saving trade-off fairly well without the need to introduce additional frictions. Indeed, this has been a key motivation in our use of the standard growth model in addressing the low frequency movements in the national saving rate, domestic investment rate, and the CA balance in the U.S.

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[20] The labor wedge needed to generate these results is non-negligible especially for the 1984–2004 period. It starts at the value of 1.0 in 1960 and grows to 1.12 at the end of 1984. By 2000, it increases to 1.56. In the framework with the labor wedge, the model generated consumption–output ratio is quite low in the 1990s relative to that in the data. Consequently, the model generated saving rate in the 1990s is higher than its data counterpart, when the model is constructed to fit the hours per capita series. The remaining puzzle is to simultaneously account for the boom in hours and decline in the saving rate during this time period.
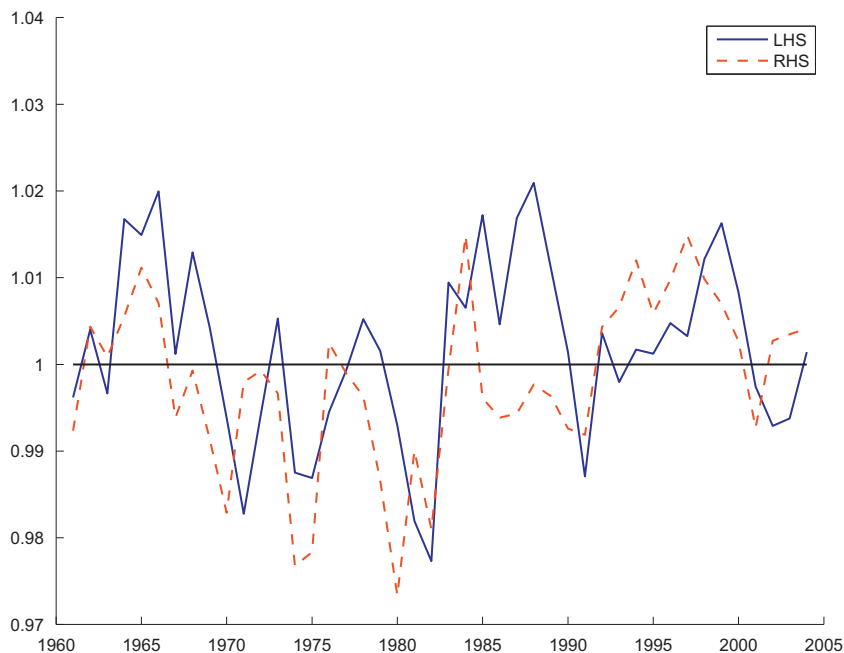
Fig. 10. Investment wedge. Growth rate of consumption per capita from the data (LHS) and the model's prediction for the same growth rate after using the data on investment–capital ratio and the real after-tax rate of return to capital (RHS).

4. Concluding remarks

This paper shows that differences in productivity growth rates across time and across countries play a major role in accounting for the low frequency changes in the U.S. current account. Our results contradict some of the findings in the literature that highlight the role of demographics leading to current account imbalances. According to the numerical results, differences in the population growth rates and fiscal policies across countries do not have a significant impact on the secular trend in the U.S. current account balance once differences in TFP growth rates are incorporated. Nevertheless, our findings indicate that domestic factors, such as the U.S. population growth rate, depreciation rate and the TFP growth rate all play a role in accounting for the trend and the fluctuations observed in the U.S. saving rate.

Appendix. Supplementary data

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jmoneco.2009.10.014.

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