Reassessing Dynamic Efficiency*

[Preliminary and incomplete]

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Abstract

In a seminal paper, Abel et al. (1989) argue that the United States and 6 other major advanced economies are dynamically efficient. Updating data on mixed income and land rents, I find in contrast that the criterion for dynamic efficiency is not verified for any advanced economy ; and that Japan and South Korea have unambiguously over-accumulated capital. This world "savings glut" can potentially explain otherwise hard-to-understand macroeconomic stylized facts (low interest rates, cash holding by firms, financial bubbles). Subject to some caveats, an increase of public debt, or a generalization of pay-as-you-go systems could therefore be Pareto-improving.

Keywords: Dynamic efficiency, saving and investment, intergenerational income distribution.
JEL classification: E21, E22, E24

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Introduction

Dynamic efficiency is an important macroeconomic issue. The presumption that increasing investment is always good for the economy relies on the fact that more investment leads to more output in the long run, and that more output helps achieve higher consumption. Government debt is similarly often criticized as having crowding-out effect on capital accumulation, because decreasing investment is assumed to be detrimental to economic growth. But this need not be the case. A competitive equilibrium with optimizing agents, market clearing, price taking and rational expectations can fail to be Pareto-optimal when interest rates are low in the competitive equilibrium, even without assuming any type of inefficiency (externalities, information asymmetries, or price stickiness): all that is needed is that the economy is expected to run forever, which is ruled out in the canonical Arrow-Debreu model.[1] Samuelson (1958) and Diamond (1965) showed that the government can in this case make every agent better off by borrowing.[2] [3]

For example, in a Diamond (1965) overlapping-generations capital accumulation model without uncertainty, the capital stock can be too large in the competitive steady-state: in that case, the interest rate r is lower than the rate of growth of the economy g. The economy is *dynamically inefficient*. To the contrary, the economy is dynamically efficient if the interest rate is high: $r > g$. When $r = g$, the economy is said to be at the Golden Rule level of capital accumulation.[4]. This result is not as counterintuitive as it might seem at first glance. Sure, more investment always leads to higher output. But if agents care about consumption, and not output, a social planner might realize that maintaining the capital/output ratio requires more in investment each year (gK) than the economy actually produces in capital income (rK). Intuitively, a capital sector that is on net producing more output than it is using for new investment is contributing to consumption, whereas one that is using more in resources than it is producing is a sink for scarce

[1] Technically, the failure of the first welfare theorem relies on the double infinity of agents (new agents are born in each period $t = 1, 2, ..., \infty$) and goods (if the consumption good is perishable, then there is at least one good in each period $t = 1, 2, ..., \infty$), as explained in Shell (1971). In order to prove the first welfare theorem, one needs that the sum of endowment values are summable at the equilibrium price vector, and hence that interest rates are not too low. The first welfare theorem extends to cases in which there are an infinite number of agents or of goods, but not when there are both an infinite number of agents and goods. What is interesting is that the usual suspects for inefficiencies are here absent : there are no externalities, no information asymmetries, and all markets are assumed to be clearing (no price stickiness in particular). As Geanakoplos (2008) remarks: "On the whole, it seems at least as realistic to suppose that everyone believes the world is immortal as to suppose that everyone believes in a definite date by which it will end. (In fact, it is enough that people believe, for every T, that there is positive probability the world lasts past T.)"

[2] The government can just as well run other types of Ponzi-schemes: social security, money, etc.

[3] Of course, unbacked public debt is akin to a rational bubble, and its uncertain refinancing can introduce additional uncertainty in the economy. But the government can introduce a broad spectrum of measures to ensure coordination on this rational bubble rather than on others, ranging from accepting Treasuries in open-market operations to outright financial repression. About rational bubbles, see Tirole (1985) and Santos and Woodford (1997). Hellwig and Lorenzoni (2009) deals with rational bubbles in international debt: it shows that it can only be sustained is the economy is dynamically inefficient, so that the gain from defaulting is not too high.

[4] On the Golden-Rule level of capital, see Ramsey (1928), Phelps (1961), Phelps (1965), Cass (1965), Diamond (1965)

resources.

The idea that the economy has accumulated enough capital may seem counterintuitive, to say the least, to many. With an ageing population, shouldn't the old generation care more about the less numerous young generation and help reduce public debt, rather than the other way around? But the idea behind dynamic inefficiency (and in the OLG model) is that capital might actually do a poor job at transferring resources ; it might well be more efficient to have the young work for the old in each period (a pay-as-you-go system), rather than having every individual save for retirement through its own retirement account, because capital is not so efficient at producing fruits needed at retirement. More importantly, this analysis is not only normative but also positive. For if the economy is in a dynamically inefficient state then rational bubbles can appear[5], and transfer resources from young to old agents though in a more unpredictable way.[6] Still on the positive front, dynamically inefficient economies have many of the properties of Keynesian economies as discussed by Geanakoplos (2008): in particular, they are isomorphic to Arrow-Debreu economies where markets do not clear at infinity. They therefore leave room for "animal spirits" to determine prices and drive business cycles.

But the real world provides the empiricist with multiple interest rates r to choose from. Should he use the safe interest rates on government bonds, in which case he would conclude that the economy is strongly inefficient?[7] Or should he use returns on equities, which almost always exceed the rate of growth?[8] Abel et al. (1989) extend the overlapping-generations capital accumulation model to account for more general production functions, in particular stochastic, with risk-varying interest rates. They conclude that the following sufficient criterion should be looked at: if capital income always exceeds investment, then the economy is in a dynamically efficient state. If investment to the contrary always exceeds capital income, then the economy is dynamically inefficient.[9] Empirically, Abel et al. (1989) find that this sufficient criterion for dynamic efficiency is satisfied by a wide margin for the United States ($1929 - 1985$) and 6 other advanced economies ($1960 - 1985$).

[5]This is because bubbles can in that case grow at a rate higher than the rate of interest, even with a constant fraction of optimists in the population: their wealth grows at rate g, while the interest rate is $r < g$. Dynamic inefficiency thus provides a strong rationale for buying overvalued assets and chasing capital gains rather than dividends.

[6]For example, when the young buy overvalued houses from the old, it is effectively a transfer of wealth from the young to the old. Note that the bailing out of the financial sector also amounts to such a transfer that the private sector had been achieving on its own until the housing bubble collapsed.

[7]Interest rates on 10-year US Treasury Inflation Protected Securities (TIPS) are now negative.

[8]However, calculating returns on equity from stock market returns is a contaminated test of dynamic efficiency because dynamic inefficiency creates the potential for rational bubbles, which increase the rate of return to capital through capital gains. In particular, Fama and French (2002) note that the income return on book equity is much lower than the average stock return. More on this below.

[9]This criterion is actually not so different from the $g > r$ criterion. In steady-state, investment required to maintain the capital-over-output ratio is gK, while income coming from capital is $r_a K$ on average, with r_a being the average r_a obtained from investment. Hence, condition $gK > r_a K$ in all periods implies $g > r_a$. What Abel et al. (1989) therefore teach us is that one should look at the *average* interest rate in the economy, rather that at the *safe* interest rate.

In contrast, I find that sufficient conditions for dynamic efficiency are verified for none of the advanced economies. To the contrary, Japan and South Korea verify the criterion for dynamic inefficiency.[10] And so do most advanced economies, including the United States, across a reasonable range of parameter estimates - in particular if one assumes that average Tobin's q is in the range of 1.5, an underestimation according to most analyses into this issue. For Australia and Canada, dynamic inefficiency is confirmed if Tobin's q is just a bit higher than 1. To the least, even taking a very conservative value of 1 for Tobin's q, that is assuming that monopoly rents and decreasing returns are nowhere present, dynamic inefficiency cannot be rejected using Abel et al. (1989)'s criterion. Moreover, taking the dynamic inefficiency of Japan as given (see Figure 1, which shows that investment has always been higher than capital income), an arbitrage argument suggests that other economies with which Japan has opened its capital account are dynamically inefficient too. Wouldn't capital otherwise flow out of Japan even more than it does?

Dynamic inefficiency could help explain a number of macroeconomic and financial stylized facts. A microeconomic counterpart to macroeconomic dynamic inefficiency is the claim in Fama and French (2002) and Campbell (2003), that firms seem to sink resources, since they get lower returns on dividends than is implied by their own measured cost of capital[11] (note that dynamic inefficiency, strictly speaking, arises when returns from dividends are lower than the rate of growth, which is usually more restrictive than the previous condition). It can explain financial instability, as with dynamic inefficiency, asset prices are no longer pinned down.[12] Linked to the possibility of rational bubbles, equity prices can command an equity premium over finitely-lived assets, if an inception of rational bubbles has increased their rate of return by higher-than-r returns from capital gains. Finally, among other examples (see Section 4), dynamic inefficiency can help shed a new light on the Japanese "lost decade", during which investment was substantially scaled down but consumption did not go down so much.[13]

The main reason for the difference between my results and Abel et al. (1989)'s results is new data from a recent release of a harmonized system of national accounts by the OECD, in

[10] While one could argue that South Korea still is in a capital accumulation phase, it is certainly not the case for Japan.

[11] Fama and French (2002): "Most important, the average stock return for 1951 to 2000 is much greater than the average income return on book equity. Taken at face value, this says that investment during the period is on average unprofitable: its expected return is less than the cost of capital. In contrast, the lower estimates of the expected stock return from the dividend and earnings growth models are less than the income return on investment, so the message is that investment is on average profitable." ; and Campbell (2003): "if one uses average returns as an estimate of the true cost of capital, one is forced to the implausible conclusion that corporations destroyed stockholder value by retaining and reinvesting earnings rather than paying them out."

[12] The recursive equation $p_t = p_{t+1}/(1+r) + d_t$ admits an infinity of solutions depending on expectations at infinity. With dynamic efficiency, uniqueness is guaranteed through a transversality condition. Dynamic efficiency therefore comes naturally from optimization of an infinitely-lived agent, and dynamic inefficiency arises in overlapping-generations economies.

[13] Note that in an overlapping-generations model, GDP is no good measure for welfare, as more investment can lead to lower consumption always, and yet higher GDP.

particular with a different treatment of mixed income.[14] I also use more detailed data concerning land rents, which differs quite substantially from the one used in Abel et al. (1989). By means of an example, Abel et al. (1989) estimate land rents in Japan to be roughly equal to 5% of GDP, while they were according to both OECD and Goldsmith (1985)'s estimates, rather in the 17% of GDP range.

Related literature. To the best of my knowledge, no paper has reassessed dynamic efficiency since Abel et al. (1989) so far. The breadth of the literature which this paper speaks to is potentially very large, given the importance of dynamic efficiency for intergenerational transfers. From a methodological standpoint, there has been a renewed interest in national accounts data recently, in particular since the release of harmonized national accounts by the OECD. This has led to reassessing many common wisdoms. Gollin (2002) shows that labor income shares are not so variable across countries than economists once thought, and this paper tries to share the care he gives to the treatment of capital income. Caselli and Feyrer (2007) revisit Lucas' puzzle, showing that marginal product of capital is equalized across countries, once one accounts in particular for the effect of land and other non-reproducible resources. Piketty and Zucman (2012) use new balance sheet data to investigate the long run evolutions of wealth-income ratios over the courses of the nineteenth and twentieth centuries. From a substantive standpoint, this paper provides some support for Bernanke (2005)'s view that there indeed is a "savings glut" at the world level. It relates to a broad literature on the lack of safe assets, for example Caballero and Krishnamurthy (2006), Caballero et al. (2008) or Krishnamurthy and Vissing-Jorgensen (2012). The claim of this paper that the world does not so much lack safe assets, but lacks assets per say.[15]

The rest of the paper proceeds as follows. In section 1, I review very briefly Abel et al. (1989)'s sufficient conditions for dynamic efficiency. In Section 2.1, I reassess dynamic efficiency for the United States, using the same primary dataset as Abel et al. (1989) did use - that is, the National Income and Product Accounts - in order to highlight what differs in my calculations and leads me to a different conclusion. I then review dynamic efficiency in other advanced economies (15 additional countries) in Section 2.2. These two sections will lead to the conclusion that Japan and South Korea are dynamically inefficient, while dynamic inefficiency cannot be rejected for any advanced economy. Section 3 tries to go further at the cost of more assumptions; I let the reader make his mind about dynamic inefficiency of the other 12 advanced economies. Finally, I review in section 4 some stylized facts consistent with dynamic inefficiency, and I discuss some potential caveats to this study.

[14] National Income and Product Accounts (NIPA) used by Abel et al. (1989) do not account for income of unincorporated enterprises, which include labor income.

[15] However, the two theories have a lot in common. With dynamic inefficiency, there is a shortage of assets and so rational bubbles can form naturally as discussed above. These bubbles increase the supply of assets but as they are subject to a coordination problem, this supply is not "safe". Agents therefore would ideally need assets that they perceive as safe, even though they are valued above their fundamental values. In Krishnamurthy and Vissing-Jorgensen (2012), US Treasuries play this role.

1 Sufficient conditions for dynamic efficiency

I here briefly review Abel et al. (1989)'s result that one should compare aggregate capital income and investment to assess dynamic efficiency. The setup generalizes Diamond (1965) to an economy with uncertainty, and a very general production technology.

There are overlapping generations of agents living for 2 periods: they are young then old. Time is discrete $t = 0, 1, 2, ...$ Agents have a Von-Neumann Morgentern utility function. There are L_t agents in each cohort. Young supply 1 unit of labor inelastically, get wage w_t, buy shares s_t of market portfolio V_t, and sell shares to young when old. Utility is additively separable across time for simplicity. Individual born in t solves :

$$\max_{s_t}\{u(c_t^y) + \mathbb{E}_t v(c_{t+1}^o)\}$$

$$\text{s.t.} \quad c_t^y = w_t - V_t s_t$$

$$\text{s.t.} \quad c_{t+1}^o = (D_{t+1} + V_{t+1})s_t$$

The standard first-order condition for this maximization problem is:

$$\mathbb{E}_t\left[\frac{v'(c_{t+1}^o)}{u'(c_t^y)}\frac{V_{t+1}+D_{t+1}}{V_t}\right] = 1.$$

Total consumption at date t is given by:

$$C_t = L_t c_t^y + L_{t-1} c_t^o.$$

Asset market clearing implies that $L_t s_t = 1$.

Defining profit: $\pi_t = Y_t - \frac{\partial F}{\partial L_t} L_t$, and investment I_t as being consumption's complement in output, Abel et al. (1989) prove the following proposition:

Proposition 1 (Abel et al. (1989))**.** *A sufficient condition for dynamic inefficiency is* $\exists \epsilon > 0, \forall t \in \mathbb{N}, \pi_t - I_t \leq -\epsilon V_t$. *A sufficient condition for dynamic efficiency is:* $\exists \epsilon > 0, \forall t, \pi_t - I_t \geq \epsilon V_t$.

The intuition is pretty straightforward: the economy is dynamically inefficient if it is always investing more than it is getting from capital income, or sinking resources each period (at the steady state growth path). To the contrary, it is efficient if it is always investing less than it is getting out. The next section looks at this criterion again for the US economy first, and at other economies next; because the data sources are not the same for the two (the US has its own national accounting system, the NIPA, which Abel et al. (1989) use).

2 Reassessing dynamic efficiency

2.1 In the United States

In this section, I investigate dynamic efficiency in the United States assuming that Tobin's q is equal to 1. Since there are monopoly rents and decreasing returns to scale in the real world, this leads me to be too sanguine about dynamic efficiency (see Section 3.1 for different assumptions about Tobin q); yet the conclusion here will be that even with $q = 1$, dynamic inefficiency cannot be rejected in the United States. In order to pinpoint how my assessment differs from the seminal Abel et al. (1989), I follow them in using the National Income of Product Accounts , even though these are not the harmonized national accounts from OECD I use later.

I use the NIPA data maintained by the Bureau of Economic Analysis (BEA) to compare Gross Private Domestic Investment on the one hand, and Gross Capital Income on the other hand. While investment is available as a series, Gross Capital Income has to be calculated. Again, I follow their methodology in adding profit (including taxes on profit), rental income, interest income, capital income of proprietors, and private Capital Consumption Allowances (which are the difference of total and government Capital Consumption Allowances). On Figure 2 I compare data obtained from their Tables with data I calculate from today's series of the NIPA. I do not systematically over or understate capital income in any way, and the fit is good.

As these results are often remembered, capital income is about 25% of GDP, while investment is 15% of GDP. Therefore, dynamic efficiency seems to be satisfied by a wide margin for the United States. Yet there are 2 ways in which these calculations are being too sanguine about dynamic efficiency of the US economy. The first is that entrepreneurial income is not properly accounted for, as unincorporated enterprises are not taken into account in the NIPA, unlike in OECD mixed income. Second, because land rents are a bit higher than 5% of GDP as revealed by land values. I make both adjustments in turn:

- **Entrepreneurial income.** Quoting Mead et al. (2004), "Some aggregates exist in one system but not in the other. For example, NIPA corporate profits and personal income do not have precise counterparts in the SNA, and the SNA concept of "mixed income" - that is, the residual business income of unincorporated corporations that is attributable to labor and to capital has not been implemented in the NIPAs, pending a review of the sectoring of unincorporated businesses." NIPA only accounts for the income of proprietors, while OECD notion of mixed income includes also that of unincorporated enterprises. In other words, NIPA misses part of mixed income. How should I attribute mixed income between capital and labor income? This is extensively discussed in Gollin (2002), who goes as far as attributing the entirety of mixed income to labor. For robustness, I do not take such an extreme stand here: I only impute 2/3 of mixed income to labor. One should however bear in mind that this estimate is very conservative in many ways. First, this imputation is traditionally used since the work of Christensen (1971). At the time, proprietors' income was mostly that of farmers working in agriculture, where wages were relatively low; today, unincorporated enterprises use more skilled labor. in particular, doctors, lawyers operate in such structures. Furthermore, in most countries there exists a tax incentive to create an incorporated enterprise if the business is capital intensive; this is because unincorporated enterprise (e.g. LLC in the US) tax capital as personal income.[16] And finally, the share of

[16]More generally, there is an incentive to treat labor income as capital income for tax reasons. Capital income is thus always more likely to be overestimated than the contrary.

capital in aggregate output is closer to 3/4 than 2/3. Figure 5 should really be seen as a higher bound on capital income excluding mixed income coming from labor.

- **Land rents, non-reproducible assets.** Land is a fixed non-reproducible factor, its return should therefore not be included to assess whether investment is on average productive or not.[17] Abel et al. (1989) use data from Rhee (1991).[18] They settle for 5% of GDP for the US, because it is consistent with an estimate of the aggregate value of land at 2/3 of GDP and a return of 8%.[19] Data on land rents is not directly available, as it is tied to residential structures, and both often trade as a bundle. I use two sources for calculating land rents in the United States: Goldsmith (1985) estimates a replacement cost of structure and attributes the remainder to land., which leads him to impute 25% of total assets to land (this is consistent with Davis and Heathcote (2007)).[20] Imputing land rents in this way leads to the results in Figure 6. Note that land is not the only non-reproducible asset: natural resources are another one. For the sake of conservativeness, I will however not make an attempt at substracting them from capital income.

2.2 In other countries

As in section 2.1, I hereby assume that Tobin's q is equal to 1, which goes against the conclusions of this paper. I compare capital income and investment for 15 additional countries (those for which OECD releases Gross Investment and Capital Income series): Australia, Belgium, Canada, Denmark, France, Germany, Hungary, Italy, Japan, Norway, Russia, South Korea, Sweden, Switzerland, United Kingdom.[21]

Reproducing. Abel et al. (1989) investigate dynamic efficiency in England, France, Germany, Italy, Canada, Japan. Their results are in Table 3 to the paper, which are plotted on Figure 9 as the difference between gross profit and gross investment. But they do not account for mixed income and land, which together account for about 9% of GDP. Note that with the Abel et al. (1989) data, Japan and Germany could already not be confirmed as being dynamically efficient, since investment is not lower than capital income over the whole period.

Updating. Land rents and mixed income do vary a lot across countries. OECD provides estimates of both for many countries. In contrast, Abel et al. (1989) used 5% of GDP for every

[17] In agricultural societies, one could argue that land needed to be somewhat maintained in order to remain productive. Today, land rents overwhelmingly consist of urban land, which has value because of economic geography considerations. For example, in the Alonso-Muth-Mills monocentric city model, higher land rents in the core are the exact counterpart of lower transportation cost.

[18] Rhee (1991) is using Denison (1962), itself updating Goldsmith(1959).

[19] Notwithstanding the very low assumed aggregate value of land in total assets, calculating land rents using returns is precisely what assessing dynamic efficiency is about, which is a bit circular. Instead, I will impute factor returns using their proportion in total assets.

[20] See Appendix C for a discussion on land data.

[21] I drop Mexico from the sample, because it has relative income to the US (in purchasing-power parity) significantly lower then the rest of my papers: about 30% on average. Dynamic efficiency is a steady-state concept, and such an emerging economy has not reached its steady-state of capital accumulation.

country for lack of better data. When not available, I complement land price data with Goldsmith (1985) estimates from Comparative National Balance Sheets. Since Goldsmith (1985) does not provide data on land since 1978, I assume that land shares were constant ever since, and take the lowest of the 1973 or 1978 to be more conservative. These details are discussed more precisely in Appendix C. Moreover, I perform a number of robustness checks in Section 3.3.

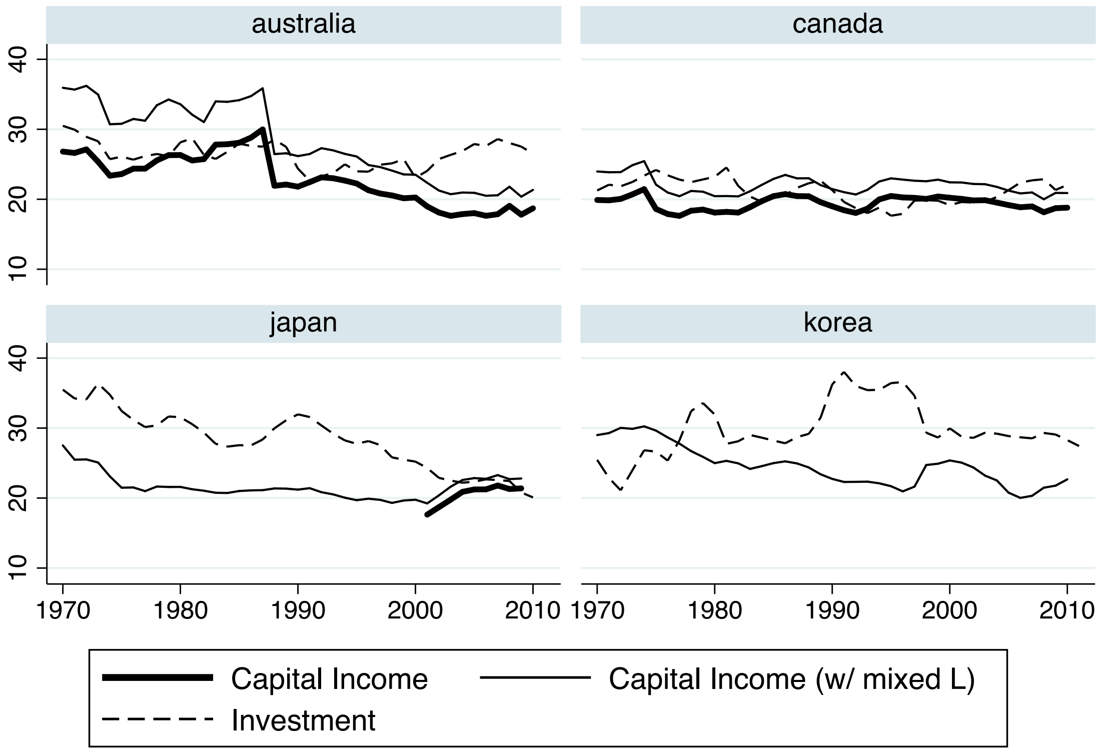
Results. I present in the main text the most inefficient economies according to OECD data: Japan and South Korea. I will not put too much of an emphasis on South Korea as it has developed only recently. The criterion for dynamic efficiency applies only at the (stochastic) steady-state, after the period of capital accumulation. Since I do not always have much data on mixed income, I present both capital income correcting for the value of mixed income and capital income containing mixed income. More precisely, capital income containing mixed income is an over-estimation of capital income coming from investment, but an under-estimation of capital income containing mixed income. This is because I calculate the value of land rents through the proportion of land in non-financial assets; so that I overestimate land rents when using capital income containing labor income from mixed income. More precisely, I use the following inequality:

$$\underbrace{\text{CapIncNolandNomixed}}_{\textbf{Capital Income}} = (\text{CapInc} - 2/3\text{mixed}) * \left(1 - \frac{\text{land}}{\text{assets}}\right) \leq \underbrace{\text{CapInc} * \left(1 - \frac{\text{land}}{\text{assets}}\right)}_{\textbf{Capital Income w/ mixed L}}$$

"Capital income with mixed Labor" is therefore a slight abuse of language in the graphs, only a fraction $1 - \text{land/assets}$ of mixed labor is actually included.

Description of the results. As can be seen on Figure 1, OECD does not provide data on mixed income for Japan before 2001. But the continuous thin line is always a higher bound on the thick line (capital income). Data from the OECD therefore suggests that Japan is inefficient. This contrasts starkly with Abel et al. (1989)'s results. The reason is that Japan has much higher land rents than the United States, because land is far more scarce. Therefore, by assuming that the United States have 5% of GDP in land revenues, Abel et al. (1989) strongly underestimate Japanese land rents. Data for mixed income in South Korea unfortunately is not available, but capital income including mixed income has been lower than investment since 1980, suggesting strong inefficiency. However, as discussed earlier, South Korea might already be in a stage of capital accumulation. Finally, Australia and Canada have low capital income compared to investment (excluding a few years in the eighties for Australia, and the nineties for Canada). This is surprising as Australia and Canada are not usual suspects for capital over-accumulation. Finally, Figures 13, 14 and 15 show that dynamic inefficiency cannot be rejected for any country (France, Germany, Hungary, Italy, Russia, Norway, Sweden, Switzerland, Beigium, United Kingdom).

Figure 1: ASSESSING DYNAMIC EFFICIENCY IN AUSTRALIA, CANADA, JAPAN, SOUTH KOREA



Source: OECD, Kuznets (1985), and author's calculations

Notes: The dotted line represents Gross Capital Formation as a % of GDP. The thick continuous line is Capital Income as a % of GDP (including Capital Consumption Allowances), excluding land rents and mixed income coming from labor. Those two are to be compared to assess dynamic efficiency. Because data on mixed income is not always available, I also plot as a thin continuous line Capital Income excluding land rents but including labor income in mixed income (thus overstating "economic" Capital Income). "Korea" is South Korea. Data comes from OECD.

3 Further calculations

From the upper left hand graph of Figure 1, one could boldly conclude that every advanced economy having an open financial account with Japan is dynamically inefficient. The reasoning is the following. In the absence of financial frictions, any dynamically efficient country could borrow from Japan and invest at a higher rate than Japan.[22] Therefore, a simple arbitrage argument would have all countries be inefficient if one of them is. But why is it then that investment is not always higher than capital income in other advanced economies as well? This section is about discussing other factors influencing the calculation of capital income, without necessarily being able to take a quantitative stance on these factors. In subsection 3.1, I argue that Tobin's average q is significantly higher than 1, which has led me to be too sanguine about dynamic efficiency. In subsection 3.2, I review other reasons which might have led me to be too sanguine about dynamic efficiency. In subsection 3.3 I do the opposite and examine the

[22]In practice, Japan has a current account surplus but it still is inefficient, perhaps less so today.

robustness of my calculations to other assumptions, notably about government investment.

3.1 Taking into account Tobin's q

3.1.1 Extension of the Abel et al. (1989) model to decreasing returns

This model differs with Abel et al. (1989) in the production function $Y_t = F(I_{t-n}^{t-1}, L_t, \theta_t)$,, which has decreasing returns. ($I_{t-n}^{t-1} = (I_{t-1}, ..., I_{t-n})$) Defining profit: $\pi_t = Y_t - \frac{\partial F}{\partial L_t} L_t$, and pure profit:

$$\pi_t^p = Y_t - \frac{\partial F}{\partial L_t} L_t - \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} I_{t-i}.$$

Proposition 2. ***(Decreasing returns.)*** *With decreasing returns to scale, a sufficient condition for dynamic inefficiency is* $\exists \epsilon > 0, \forall t \in \mathbb{N}, \pi_t - \pi_t^p - I_t \leq -\epsilon V_t$. *Moreover,* $\exists \epsilon > 0, \forall t, \pi - I_t \geq \epsilon V_t$ *is not sufficient for dynamic efficiency. A sufficient condition for dynamic efficiency is:* $\exists \epsilon > 0, \forall t, \pi_t - \pi_t^p - I_t \geq \epsilon V_t$.

Proof. See Appendix A.1. □

3.1.2 Extension of the Abel et al. (1989) model to monopolistic competition

The setup is essentially the same as in the previous section, except that the consumption good is now a constant-elasticity of substitution aggregator of different varieties, and each firm produces one variety monopolistically. More precisely, both young and old consumption goods now are a CES of different varieties $\omega \in [0, 1]$, such that:

$$c_t^y = \left[\int_0^1 c_t^y(\omega)^{\frac{\theta-1}{\theta}} d\omega\right]^{\frac{\theta}{\theta-1}}, \quad c_t^o = \left[\int_0^1 c_t^o(\omega)^{\frac{\theta-1}{\theta}} d\omega\right]^{\frac{\theta}{\theta-1}}, \quad \theta > 1.$$

Dropping generation subscripts (everything is symmetric for old and young), the demand function for a generic good and the welfare-based price index are :

$$c_t(\omega) = \left(\frac{p_t(\omega)}{p_t}\right)^{-\theta} c_t.$$

$$p_t = \left[\int_0^1 p_t(\omega)^{1-\theta} d\omega\right]^{\frac{1}{1-\theta}}$$

The model also differs from that of the previous section in that the environment is no longer competitive, but that of monopolistic competition. That is, every variety is produced by a monopolist with a constant-returns-to-scale[23] production function, defining as previously $I_{t-n}^{t-1}(\omega) = (I_{t-1}(\omega), ..., I_{t-n}(\omega))$:

$$y_t(\omega) = F(I_{t-n}^{t-1}(\omega), L_t(\omega), \theta_t).$$

[23] Here again, I could generalize to decreasing returns to scale, adding a "pure rent" component in addition to the "monopoly rents" profits, but this would only complicate the exposition.

Note that θ_t is a productivity shock affecting all corporations equally. Denote the value function of minimizing the labor cost for an individual monopolistic firm ω:

$$\Lambda_t(y_t(\omega)) = \min_{L_t(\omega)} \left\{ w_t L_t(\omega) \text{ s.t. } y_t(\omega) = F(I_{t-n}^{t-1}(\omega), L_t(\omega), \theta_t) \right\}.$$

Again defining aggregate profit as:

$$\pi_t = \int_0^1 \left(\frac{\theta}{\theta - 1} \Lambda_t'(y_t(\omega)) y_t(\omega) - \Lambda_t(y_t(\omega)) \right) d\omega,$$

and monopoly profit as:

$$\pi_t^m = \int_0^1 \left(\frac{\theta}{\theta - 1} \Lambda_t'(y_t(\omega)) y_t(\omega) - \Lambda_t(y_t(\omega)) \right) d\omega - \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} I_{t-i},$$

allows to state the following proposition:

Proposition 3. ***(Monopoly power.)*** *With monopolistic competition, a sufficient condition for dynamic inefficiency is* $\exists \epsilon > 0, \forall t \in \mathbb{N}, \pi_t - \pi_t^m - I_t \leq -\epsilon V_t$. *Moreover,* $\exists \epsilon > 0, \forall t, \pi - I_t \geq \epsilon V_t$ *is not sufficient for dynamic efficiency. A sufficient condition for dynamic efficiency is:* $\exists \epsilon > 0, \forall t, \pi_t - \pi_t^m - I_t \geq \epsilon V_t$.

Proof. See Appendix A.2. □

3.1.3 Discussion of Tobin's q for the United States

Based on Figure 11 from Hall (2001) (updated by Philippon (2009)), one can notice that Tobin's q departs significantly from 1. Unfortunately, Tobin's q captures adjustment costs as well as potential monopoly rents and decreasing returns to scale.[24] Given Hall (2001)'s methodology, the starting value for Tobin's q is assumed to be 1. Moreover, given Hall (2001) adjustment cost model, which by construction minimizes the distance between Tobin's q and 1 (subject to constraints), average q is likely to be underestimated.

Note that in any case, Tobin's q cannot be lower than 1 for my purposes - that is, irreversibility of investment which potentially drives Tobin's q below 1 is of no interest. Decreasing returns to scale or monopoly power cannot be negative.

The discussion about Tobin's q, and why it can so persistently depart from 1, would lead us too far for the purpose of this paper. What is important is that while Hall (2001) work in the zero-rent framework, he repeatedly cites monopoly power as a potential microfundation for adjustment costs. Tobin's q might as well capture investment in intangibles that is not taken into account in official investment data - marketing costs are expensed for example, but they bring revenues in the future. In that case, it would be wrong to interpret the entirety of Tobin's q as consequential to the presence of rents. However, if investment was abnormally high in the 1990s and early 2000s as some have suggested to explain the "dotcom bubble", then most capital income would have materialized later, which would have dramatically increased the probability of

[24] Although adjustment costs can be microfounded by patent rights. (Hall (2001))

dynamic inefficiency, at least in these years. Bond and Cummins (2000) question the importance of the intangible channel and instead point to irrational valuations from the part of investment. I believe there is more to the latter story than to the former, therefore I will never consider Tobin's q on the order of 3.[25]

3.1.4 Robustness to Tobin's q

Because of the difficulties outlined above, I do not want to take an affirmative stand on the value of Tobin's q. Given that Japan already provides us with the presumption that advanced economies may well be inefficient, I perform a sensitivity analysis using different parameters of Tobin's q.

The results for the United States are on Figure 16, for Japan, Anstralia and Canada on Figure 17. On Figure 12, I plot the fraction of years in which investment exceeds capital income. Graphically, dynamic inefficiency can be rejected for Tobin $q = 1$ in countries for which the line begins from the x axis. However, note that I here only use the thick line from previous graphs, which means I am missing many years for which those countries were actually inefficient, as suggested by the extrapolated thin line. Dynamic inefficiency cannot be rejected for Tobin $q = 1$ in countries for which the line begins from the y axis.

3.2 Other causes for overstatement of capital income

Capital income is likely to be overestimated for multiple other reasons not mentioned above because they are hard to quantify. However, some evidence suggests that some of them might be of first order significance. To get an idea of the orders of magnitudes involved, overstating capital income by 3% of GDP for the US leads to satisfy the sufficient condition for dynamic inefficiency assuming Tobin Q is equal to 1.

Incidence of corporate taxation. In the calculations above, taxes on profit are assumed to fall entirely on capital. Hence the revenue they raise is treated as capital income. If instead taxes on profit are borne by workers or consumers, as at least then taxes on profit are not capital income. Given the order of magnitude involved ($\simeq 2.3\%$ of GDP), tax incidence is not a detail. In fact, if taxes on profit do not fall at all on capital income, then the sufficient condition for dynamic inefficiency is verified in the United States with Tobin q equal to 1.

Household production in financial services. Individual investors search for stocks, and put some effort in portfolio management. There is a cost to managing one's wealth, that is not recorded in the national accounts when it is not done professionally. Some individuals indeed spend a lot of time monitoring their financial intermediaries and finding more performing ones, doing their investment in stocks, etc. Other rent their real-estate assets, and provide the labor services of choosing tenants and collecting rents. All this implies that pure capital income tends

[25] Note however that the presence of rational bubbles is possible only with dynamic inefficiency. One could make the following reasoning: either rational bubbles exist and dynamic inefficiency is guaranteed, or they do not and Tobin's q should be taken at face value.

to be over-estimated. As Piketty and Saez (2011) put it, these efforts should be viewed as informal financial services that are directly supplied and consumed by households; they estimate these financial services to be of the order of **2%-3% of GDP** at the very most.

Favorable tax treatment of capital income. As pointed out previously, it is very hard to measure the share of labor in mixed income. This is all the more true that capital income is less heavily taxed than labor income in most tax systems, so that entrepreneurs have a strong incentive to make their labor revenues appear as capital revenues. Hence, revenues from LBOs are usually treated as capital gains, or as revenue accruing to investment, while it usually employs a very qualified workforce to pick these investments and "beat the market".[26] In other words, management fees often understate the return to labor - part of financiers' wages are earned through capital gains. The public finance literature has only begun to investigate this issue (for example Piketty (2011) and Piketty and Saez (2011)).

Public debt and rational bubbles. Needless to say, advanced economies have very high levels of debt. To the extent that Ricardian equivalence does not hold in an overlapping generations model, private savings do not perfectly offset these public dissavings. Hence, dynamic inefficiency would likely even be more severe absent our extraordinary levels of public debt. Rational bubbles can similarly crowd out private savings and raise consumption. To the extent that they are a feature of the real world, rational bubbles lessen the severity of dynamic inefficiency.

Other rents. Only land rents have been taken out of capital income. But there are other physical rents, of which the World Bank maintains a data series (extensively used by Caselli and Feyrer (2007)). However, it might well be that countries have not reached a steady-state of their resource-extraction path (for example, US oil), so that excluding these rents would actually lead to an underestimation of capital income. For the sake of robustness, I do not attempt at such a calculation here, which would only strengthen my conclusions.

3.3 Robustness

Government investment. In Appendix H, I take out government investment from Investment series, when available. I also take out Public Capital Consumption Allowances from Capital Income. Note however that such a calculation leads to be too sanguine about dynamic efficiency, as government investment mostly yields private benefits in the form of private capital income. Figures 21, 22, 23 and 24 give the results.

Data on land. One might worry that the "asset approach" yields to overstate the importance of land in value added, especially if land is subject to overvaluation due to animal spirits. This potential limitation applies only to 6 countries for which I use recent OECD data. I perform a number of robustness checks in this direction. In particular I assume that land shares stayed constant after 2000 - when the run-up in house prices began in most advanced economies.

[26] Very often, changing the corporate finance structure of the company and loading it with debt helps benefit from the tax deductibility of debt interest.

4 Discussion

4.1 Consistent stylized facts

Feldstein and Horioka (1980) puzzle. A puzzle in international finance is that investment and savings are highly correlated in the cross section of countries. This puzzle has been named the Feldstein-Horioka puzzle: investment opportunities have no reason to be present where savings rate are also higher. Current accounts should make up for the differences, but they are relatively small compared to the differences in savings and investment rates across countries. All this theoretical analysis however assumes that capital is relatively scarce. With dynamic inefficiency, asset supply is in any case too low relative to asset demand, and so even an arbitrarily small amount of home bias translates into so high level of savings-investment correlation.

Crises. The severity of dynamic inefficiency seems to be strongly correlated with key macroeconomic events, like banking crises. For example, as the second and third quadrants of Figure 14 show, Norway and Sweden had a dynamic efficiency problem before their banking crises in $1991-1993$. Japan was the most severely inefficient of all countries in the 80s, and the "lost decade" corresponds to a period of declining investment and increasing consumption.[27]

4.2 Potential caveats

Externalities to capital accumulation. An important factor for the validity of this analysis that there be no externalities, or that those are negligible. In a capital accumulation model with externalities (e.g. Saint-Paul (1992)), capital income could understate returns to capital, and increasing public debt in case of dynamic inefficiency could lower consumption. Note however that capital externalities are usually a feature of human capital rather than physical capital.

Conclusion

"Search for yield", "scarcity of assets", "abundant liquidity", all these phrases point to the fact that there might well be too many savings chasing too few assets in the world. Because of high levels of public debt, older people are usually accused of not caring enough about their children. In contrast, this paper suggests that they still save too much, relative to the relatively few investment opportunities present in our economies.

Series from the Bureau of Economic Analysis start in 1929, just before the Great Depression; before that, national accounting was very rudimentary. But the difference between capital income and investment was similar in 1929 than it is today. Was capital also overaccumulated at the eve of the Great Depression, after the long period of capital accumulation in the nineteenth century documented in particular by Piketty (2011)?

In any case, dynamic inefficiency invites us to revisit many policy questions. In a world of too much capital accumulation, capital taxation, which is often thought of as a deterrent to

[27] Note that going from an above-Golden rule steady state growth path to a Golden-Rule one mechanically decreases output and leads to a recession, even though consumption increases.

capital accumulation, is perhaps not a bad idea after all.[28] At the same time, future capital taxes decrease the value of assets today, and so increase the problem of asset scarcity. Dynamic inefficiency also makes rational bubbles possible (Tirole (1985), Santos and Woodford (1997)): when assets are scarce, any real, financial or even monetary asset can become a locus for bubbles. Other social contracts such as pay-as-you-go systems to replace funded systems can also be Pareto-improving.

Solving the problem of dynamic efficiency is certainly not as straightforward as Diamond (1965) suggested. In practice, the market may have a hard time coordinating on so high implied levels of debt. This is all the more true that this debt is not an infinitely lived asset, and has to be refinanced from time to time. Moreover, it always is subject to the risk of default, even if Hellwig and Lorenzoni (2009) show that the costs of defaulting (being further excluded from the financial markets) far exceeds the benefits with dynamic inefficiency. Moreover, I suspect that markets can very well coordinate on other rational bubbles that are equally fragile; and that public debt does not have a special status in this respect. I leave this very important issue for future research.

[28]However note that Piketty and Saez (2011) recommend in their Appendix to use public debt for dealing with dynamic inefficiency, to restore the Golden Rule level of capital accumulation; and use capital taxes for redistribution motives. There is a dichotomy with 2 instruments and 2 objectives.

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A Proofs

A.1 Proof of Proposition 1

I will go over the sufficient condition for dynamic inefficiency in detail, since the condition is less restrictive as in Abel et al. (1989). The proof for the sufficient condition for dynamic efficiency is very similar.

Proof. Assume that : $\exists \epsilon > 0, \forall t \in \mathbb{N}, \pi_t - \pi_t^p - I_t \leq -\epsilon V_t$. Then by definition

$$\exists \epsilon > 0, \forall t \in \mathbb{N}, \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} I_{t-i} - I_t \leq -\epsilon V_t \leq -\epsilon I_t$$

Therefore:

$$\exists \epsilon > 0, \forall t \in \mathbb{N}, \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \frac{I_{t-i}}{I_t} \leq 1 - \epsilon.$$

Let us consider now an increase in consumption financed by a decrease in investment (so that it is resource-feasible), and the size of this increase be $\delta > 0$, $dc_0 = \delta$ small $\Rightarrow dC_0 = \delta L_0, dI_0 = -\delta L_0$. To make this change Pareto-improving, one has to make up for the decrease in output in the following periods by reducing investment as well. From the production function, production in period 1 decreases by $dY_1 = \frac{\partial F}{\partial I_0} dI_0$, and so for unchanged consumption $dC_1 = 0$, $dI_1 = \frac{\partial F}{\partial I_0} dI_0$. More generally, today's output will be reduced by the n previous reductions in investment of all vintages. The general formula is:

$$dI_t = \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} dI_{t-i}$$

$$\Rightarrow \frac{dI_t}{I_t} = \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \frac{I_{t-i}}{I_t} \frac{dI_{t-i}}{I_{t-i}}.$$

Of course, there is a limit to how much one can reduce investment in each period, since there is a non-negativity constraint on investment. Since $\forall t \in \mathbb{N}, \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \frac{I_{t-i}}{I_t} \leq 1 - \epsilon$, such a change is feasible for $\delta > 0$ sufficiently low. $\square$

Once can similarly extend Abel et al. (1989) to sufficient conditions for efficiency, redefining profit in an adequate manner.

A.2 Proof of Proposition 2

Again, I will only go over the proof for dynamic inefficiency.

Proof. Let us first calculate each firm's profit. Facing demand for its product as:

$$y_t(\omega) = \left(\frac{p_t(\omega)}{p_t} \right)^{-\theta} y_t,$$

a monopolistic firm chooses $p_t(\omega)$ so as to maximize its profit, that is:

$$\max_{p_t(\omega)} \left\{ p_t(\omega) \left(\frac{p_t(\omega)}{p_t} \right)^{-\theta} y_t - \Lambda \left(\left(\frac{p_t(\omega)}{p_t} \right)^{-\theta} y_t \right) - \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} I_{t-i}(\omega) \right\}.$$

The firm charges a markup over marginal labor cost:

$$p_t(\omega) = \frac{\theta}{\theta - 1}\Lambda_t'(Y_t(\omega)).$$

Monopoly profits for a single firm are therefore:

$$\pi_t^m(\omega) = \frac{\theta}{\theta - 1}\Lambda_t'(y_t(\omega))y_t(\omega) - \Lambda_t(y_t(\omega)) - \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} I_{t-i}(\omega).$$

Total profits for a monopolistic firm, including returns to capital are:

$$\pi_t(\omega) = \frac{\theta}{\theta - 1}\Lambda_t'(y_t(\omega))y_t(\omega) - \Lambda_t(y_t(\omega)).$$

Using that the returns on capital for each firm are equalized because it is supplied competitively, I can sum over ω to find:

$$\pi_t^m = \int_0^1 \pi_t^m(\omega)d\omega = \int_0^1 \left(\frac{\theta}{\theta - 1}\Lambda_t'(y_t(\omega))y_t(\omega) - \Lambda_t(y_t(\omega)) \right) d\omega - \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} I_{t-i}.$$

Now as in the previous proof, assume that : $\exists \epsilon > 0, \forall t \in \mathbb{N}, \pi_t - \pi_t^m - I_t \leq -\epsilon V_t$. Therefore:

$$\exists \epsilon > 0, \forall t \in \mathbb{N}, \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \frac{I_{t-i}}{I_t} \leq 1 - \epsilon.$$

Let us consider now an increase in consumption financed by a decrease in investment in each monopolistic firm (so that it is resource-feasible), and the size of this increase be $\delta > 0$, $dc_0 = \delta$ (per-capita consumption) small $\Rightarrow$ $dC_0 = \delta L_0$, so that the aggregate decrease in investment must be $dI_0 = -\delta L_0$. Let us split this decrease in investment equally among firms so that $dI_0 = \int_0^1 dI_0(\omega)d\omega$. To make this change Pareto-improving, one has to make up for the decrease in output in each firm in the following periods by reducing investment as well. From the production function, production in period 1 decreases by $dY_1(\omega) = \frac{\partial F}{\partial I_0} dI_0(\omega)$ in each firm, and so for unchanged consumption $dC_1 = 0$, $dI_1(\omega) = \frac{\partial F}{\partial I_0} dI_0(\omega)$ in order to maintain the same level of production in each firm. More generally, today's output will be reduced by the n previous reductions in investment of all vintages. The general formula is:

$$\forall \omega \in [0, 1], dI_t(\omega) = \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} dI_{t-i}(\omega).$$

Summing, and because marginal returns to capital are equalized across firms:

$$dI_t = \int_0^1 dI_t(\omega)d\omega = \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \int_0^1 dI_{t-i}(\omega)d\omega = \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} dI_{t-i}$$

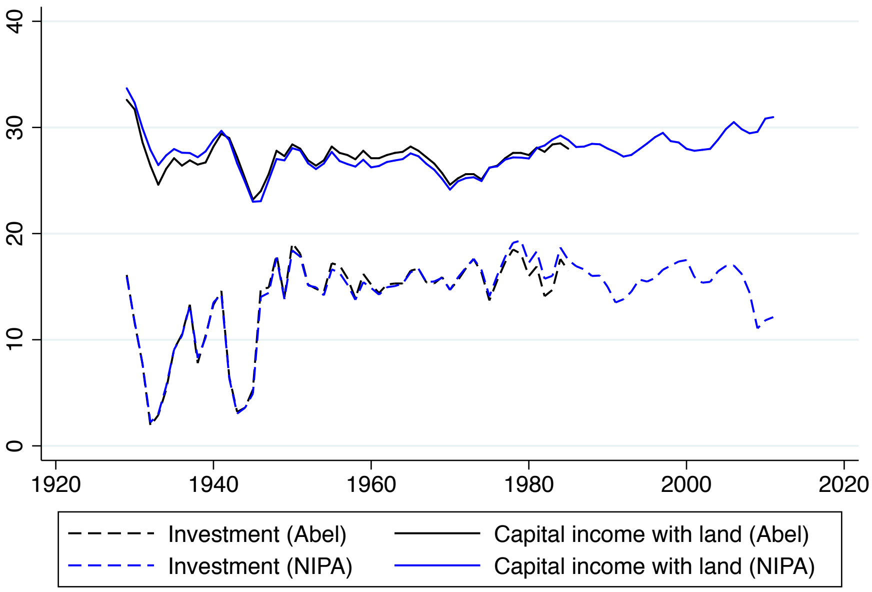
$$\Rightarrow \frac{dI_t}{I_t} = \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \frac{I_{t-i}}{I_t} \frac{dI_{t-i}}{I_{t-i}}.$$

Of course, there is a limit to how much one can reduce investment in each period, since there is a non-negativity constraint on investment. Since $\forall t \in \mathbb{N}, \sum_{i=1}^{n} \frac{\partial F}{\partial I_{t-i}} \frac{I_{t-i}}{I_t} \leq 1 - \epsilon$, such a change is feasible for $\delta > 0$ sufficiently low.

$\square$

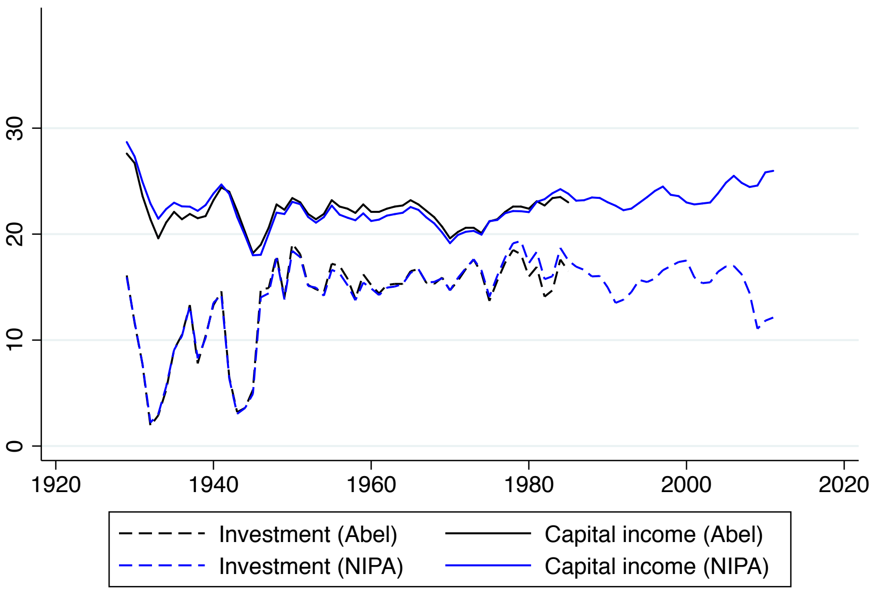
B Reproducing Abel et al. (1989) step by step for the United States

Figure 2: Reproducing and updating Abel et al. (1989)



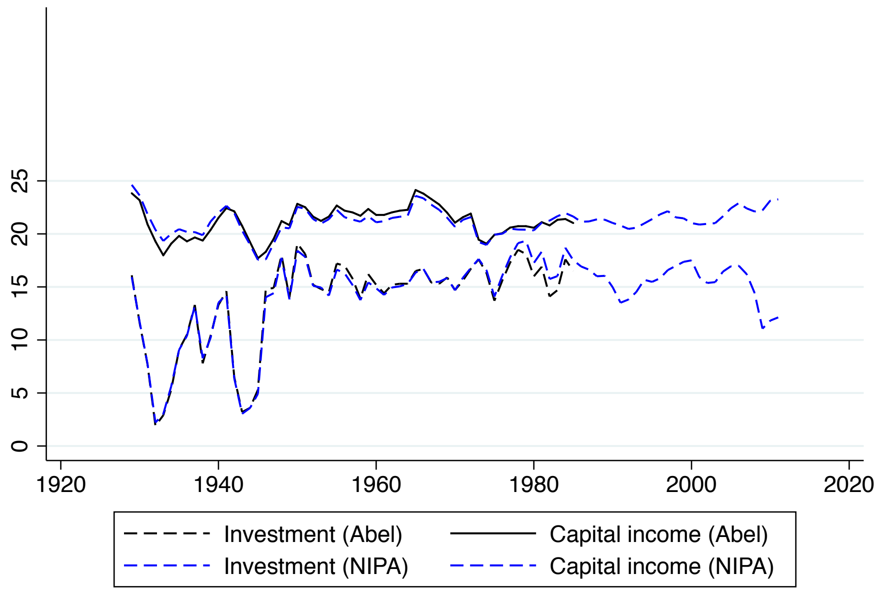
Source: National Income and Product Account (NIPA) and Abel(1989)'s calculations

Figure 3: Removing land rents at 5% of GDP



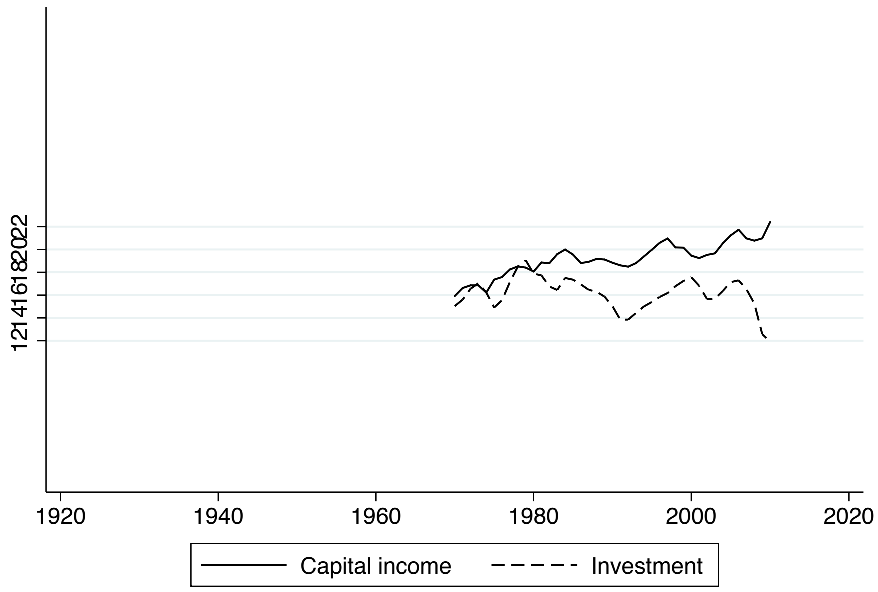
Source: National Income and Product Account (NIPA) and Abel(1989)'s calculations

Figure 4: Using OECD data for land rents



Source: NIPA, Goldsmith(1985),Abel(1989)'s and author's calculations

Figure 5: Using OECD data for mixed income



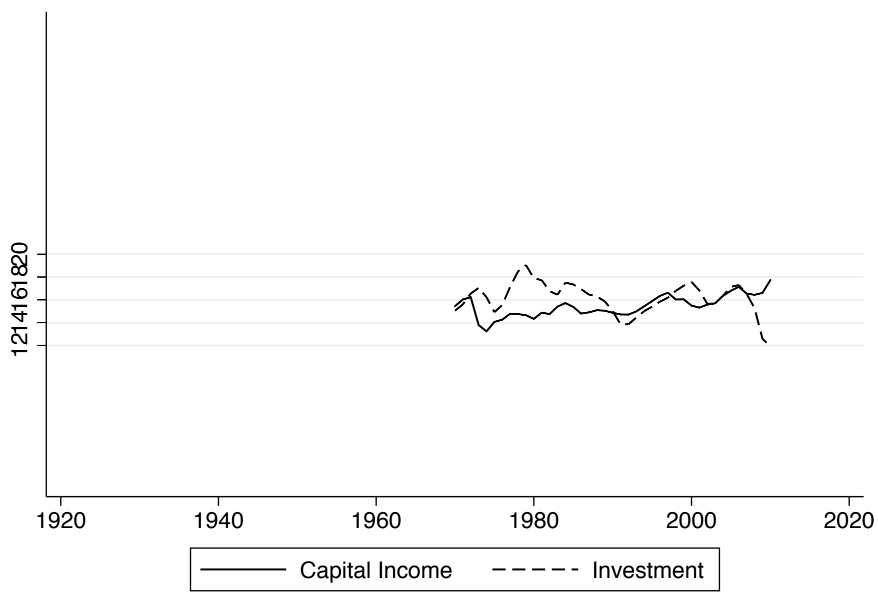
Source: NIPA, SNA, Goldsmith(1985),Abel(1989)'s and author's calculations

C Data on land

Data on land comes mainly from two sources:

- OECD for 6 countries (Australia, Canada, Czech Republic, France, Japan, Korea). Data for OECD is plotted on Figure 7.

Figure 6: Preferred specification, assuming Tobin $q = 1$



Source: NIPA, SNA, Goldsmith(1985),Abel(1989)'s and author's calculations

- Goldsmith (1985) *Comparative National Balance Sheets*, for 20 countries (with two dates 1973 and 1978).

For other countries, I take the lowest value in 1973 or 1978 from Goldsmith for all years. This is very conservative, especially for the last decade. Furthermore, Goldsmith underestimates relative to OECD (although it displays a similar evolution).

In order to impute land income, I use an asset approach. That is, I assume that assets produce revenues in proportion to their relative importance in the capital stock. As discussed in Kravis

D Reproducing Abel et al. (1989) step by step

D.1 United States

Abel et al. (1989) use data from the National Income and Products Accounts (NIPA). Raw data from Table 1 is reproduced in the upper left hand corner of Figure 8. Upper right hand corner updates this data with contemporaneous data given by the Bureau of Economic Analysis. The numbers are very similar ; this confirms that I am using the same methodology for calculating capital income. In the bottom left hand corner, I use their estimate of land rents (5% of GDP), which I substract from capital income. Finally, I use more recent data on land rents in the bottom right hand corner.

Figure 7: Land as a % of total assets

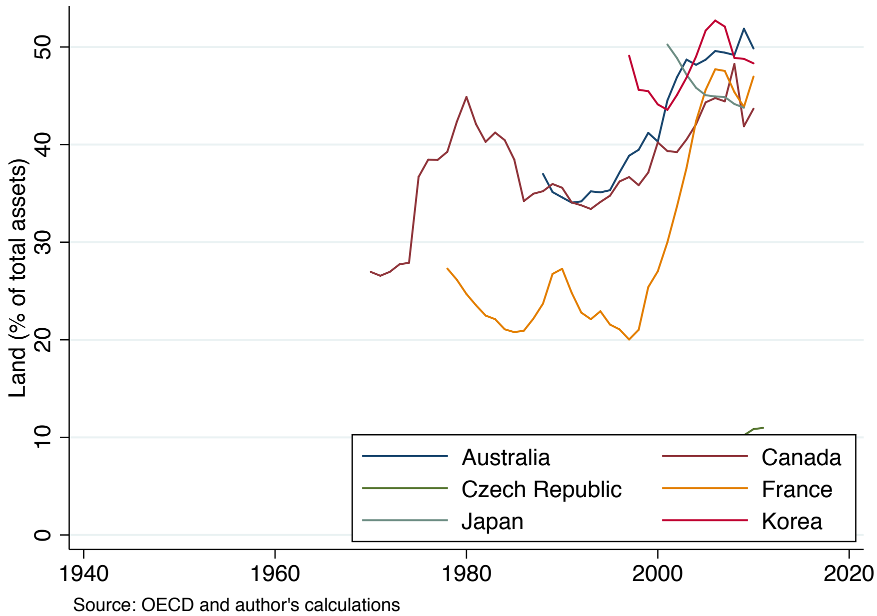
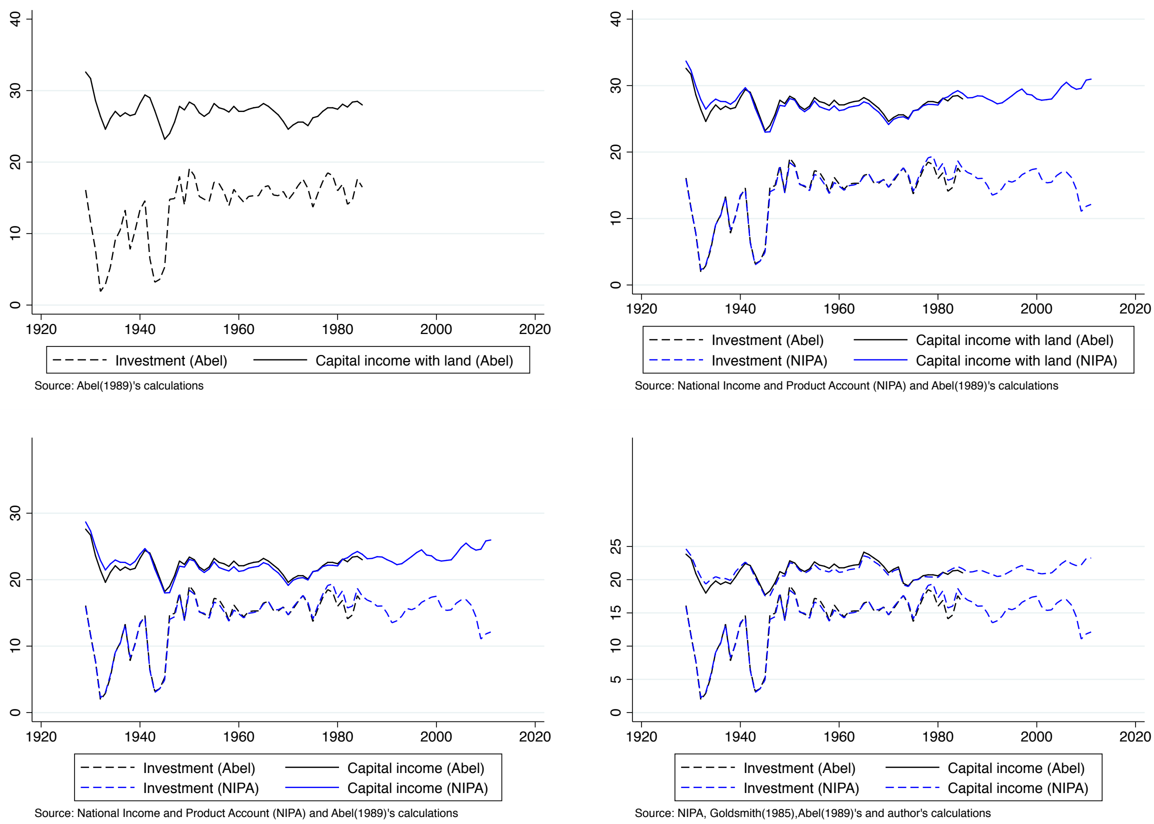


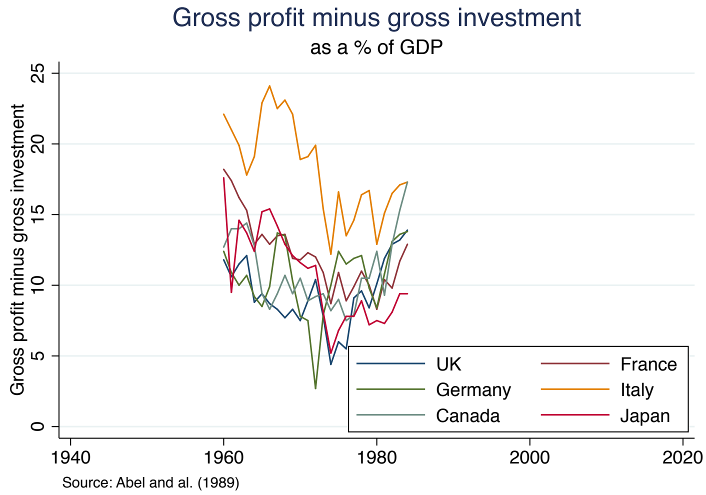
Figure 8: Modifying Abel and al. (1989), step by step



D.2 UK, France, Germany, Canada, Italy, Japan

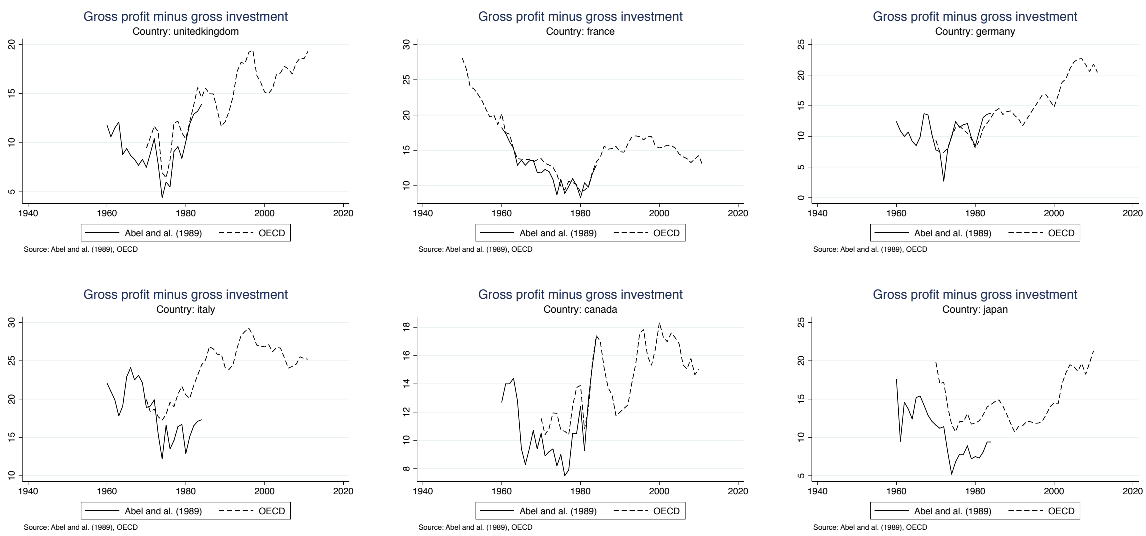
They then use gross investment and gross capital income coming from OECD database. Results from Table 3 are given in Figure 9. Note that even with their data, and taking an estimate of 5% of GDP for land rents and 4% of GDP for labor mixed income, dynamic efficiency could not be confirmed in Japan, Germany, United Kingdom, and Canada.

Figure 9: Plotting results from Table 3



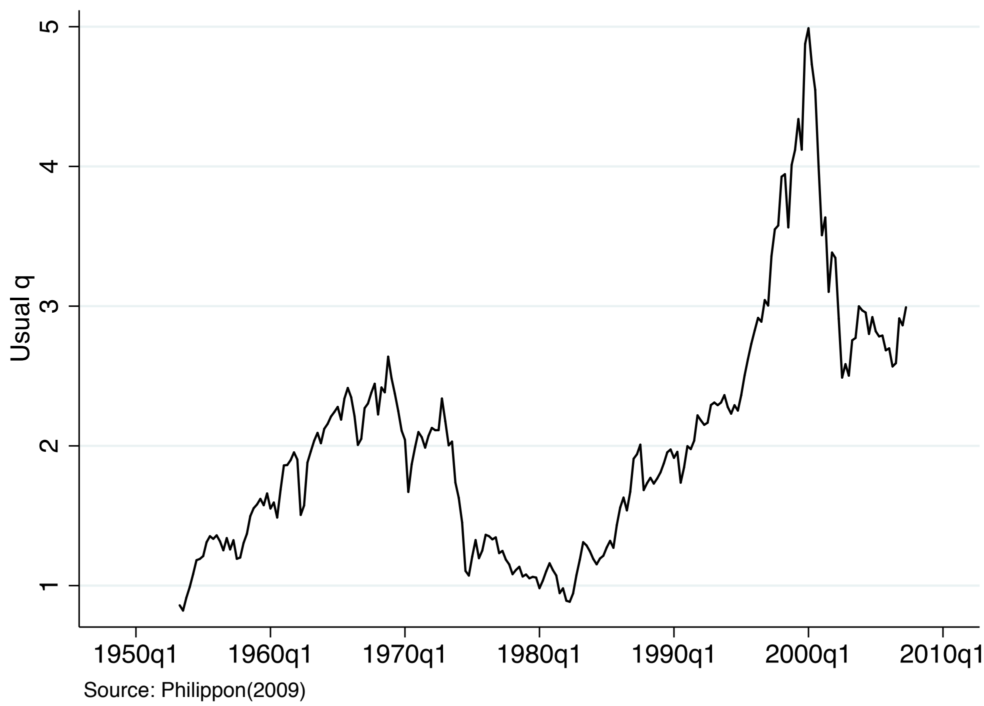
As shown on Figure 10, my estimates sometimes coincide, sometimes are higher for capital income than theirs. If anything, overstating capital income goes against the conclusions of this paper, and should only reinforce them.

Figure 10: Reproducing for 6 OECD economies



E Data on Tobin's q

Figure 11: Tobin's q, using equity values.



F Inefficiency as a function of Tobin q

This figure 12 summarizes the preceding graphs in $3D$. It plots the fraction of years for which investment exceeds capital income in the data, as a function of assumed Tobin q. When equal to 0%, the sufficient condition for efficiency is satisfied. When equal to 100%, the economy has unambiguously sinked resources into investment, and is dynamically inefficient.

G More countries

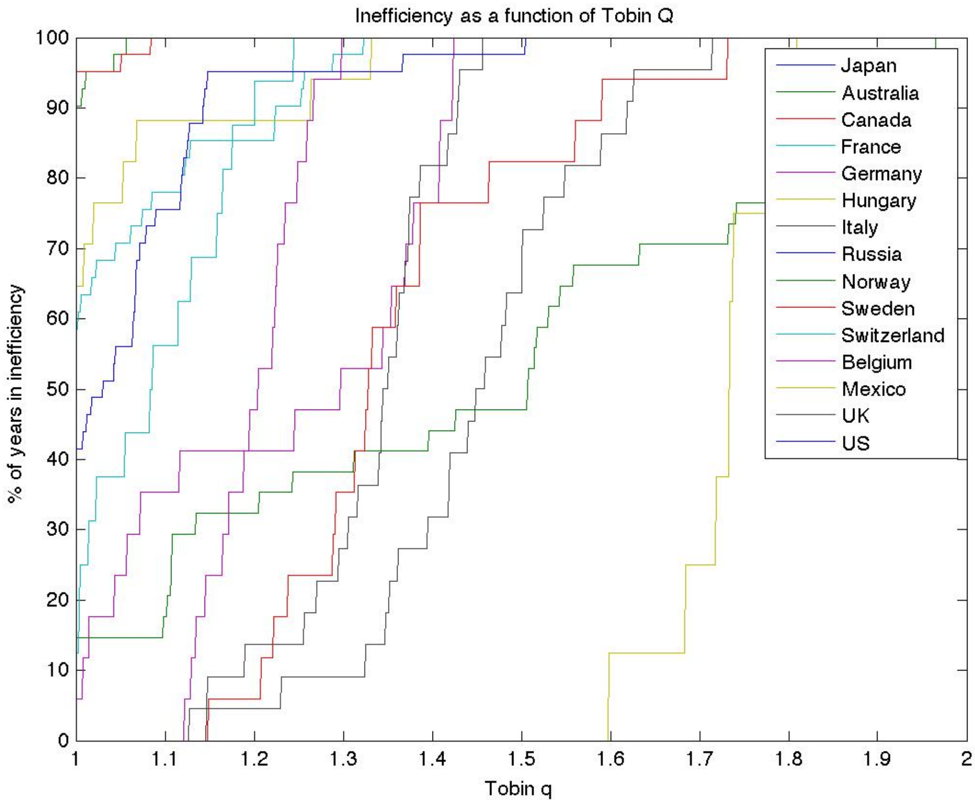
G.1 Tobin's q equal to 1

Capital income and investment in countries for which there is data are plotted in Figures 13, 14 and 15 (reminder: data for 4 inefficient economies is plotted in Figure 1).

G.2 Varying the q of Tobin

Similarly, Tobin q is allowes to vary in Figures 18, 19 and 20. Reminder: inefficient economies are plotted in Figure 17.

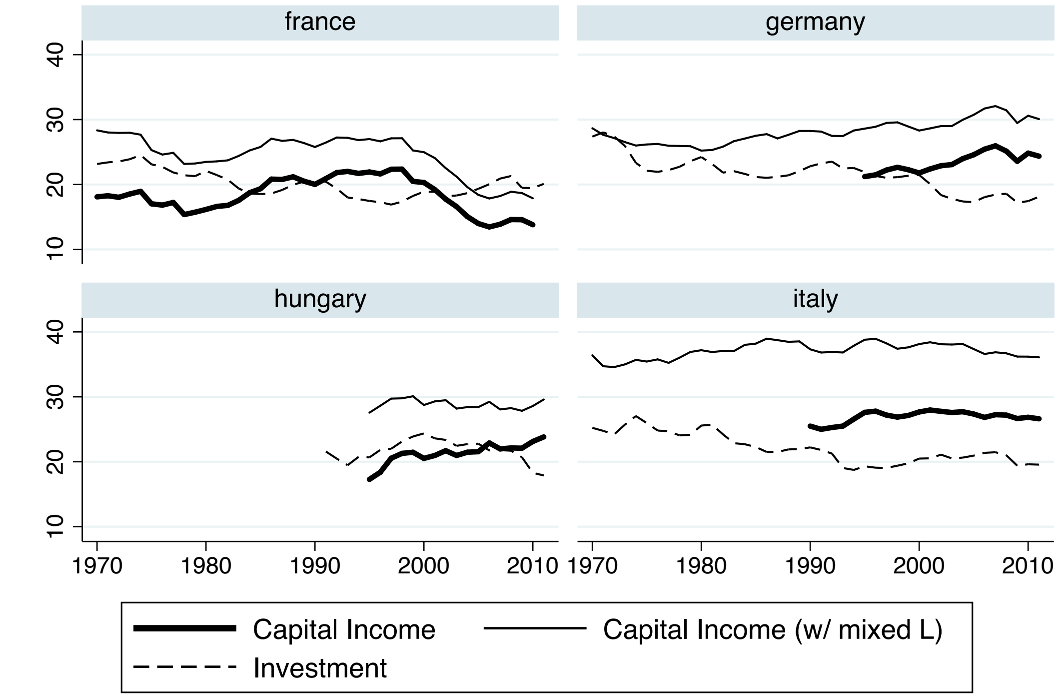
Figure 12: Fraction of years (in %) in which Investment exceeds Capital Income



H Robustness: Government investment

As Abel et al. (1989), I have used private investment when using the Bureau of Economic Analysis (NIPA) data, and investment (including private and public) when using OECD data. This is because government investment series and capital consumption expenditures for government are not always available for all countries. However, I show here that government investment isn't driving dynamic inefficiency. In other words, it is not the case that government investment is so inefficient that it explains why capital income is low compared to investment. Moreover, there are many reasons to believe that private capital income includes some returns to government investment, as firms need roads to operate, for example. Results are show in Figures 21, 22, 23 and 24.

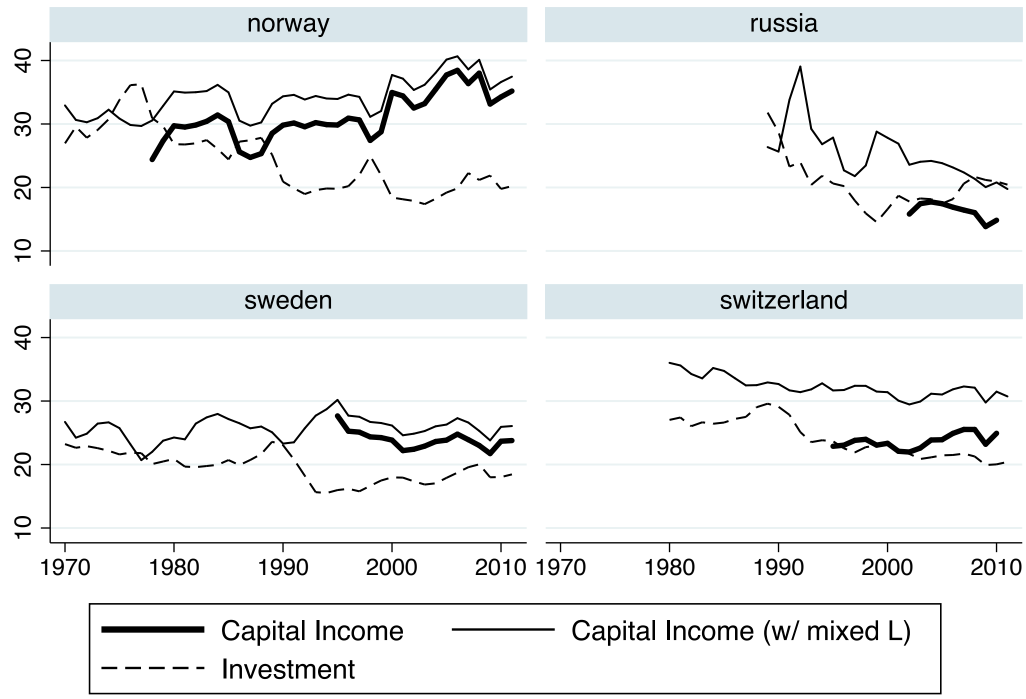
Figure 13: Assessing dynamic efficiency in France, Germany, Hungary and Italy



Source: OECD, Kuznets (1985), and author's calculations

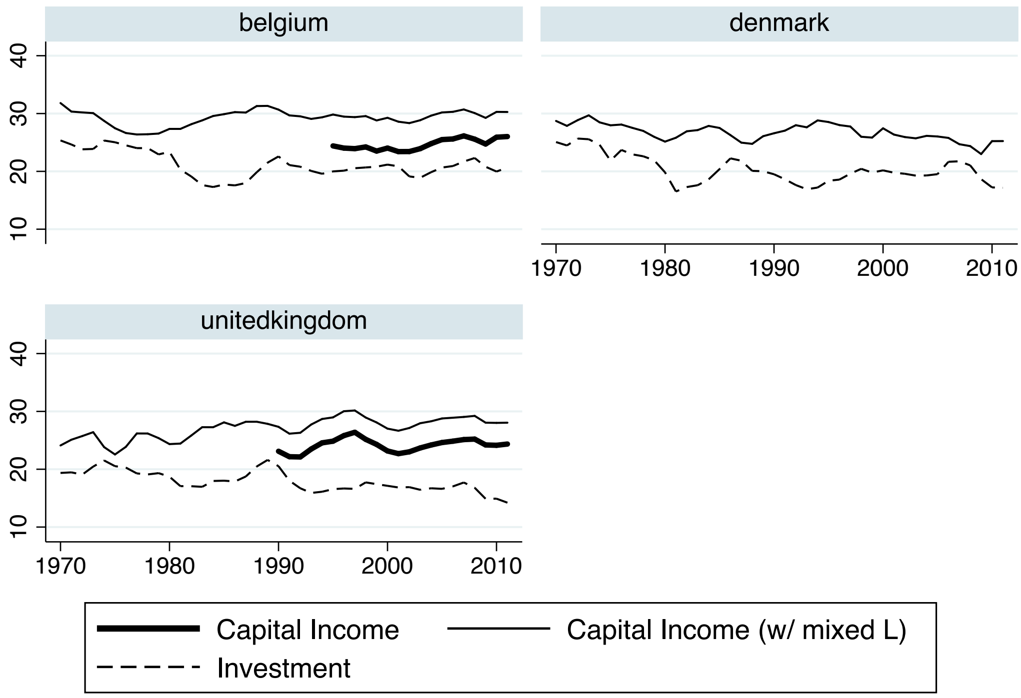
Notes: See Figure 1.

Figure 14: Assessing dynamic efficiency in Russia, Norway, Sweden, Switzerland



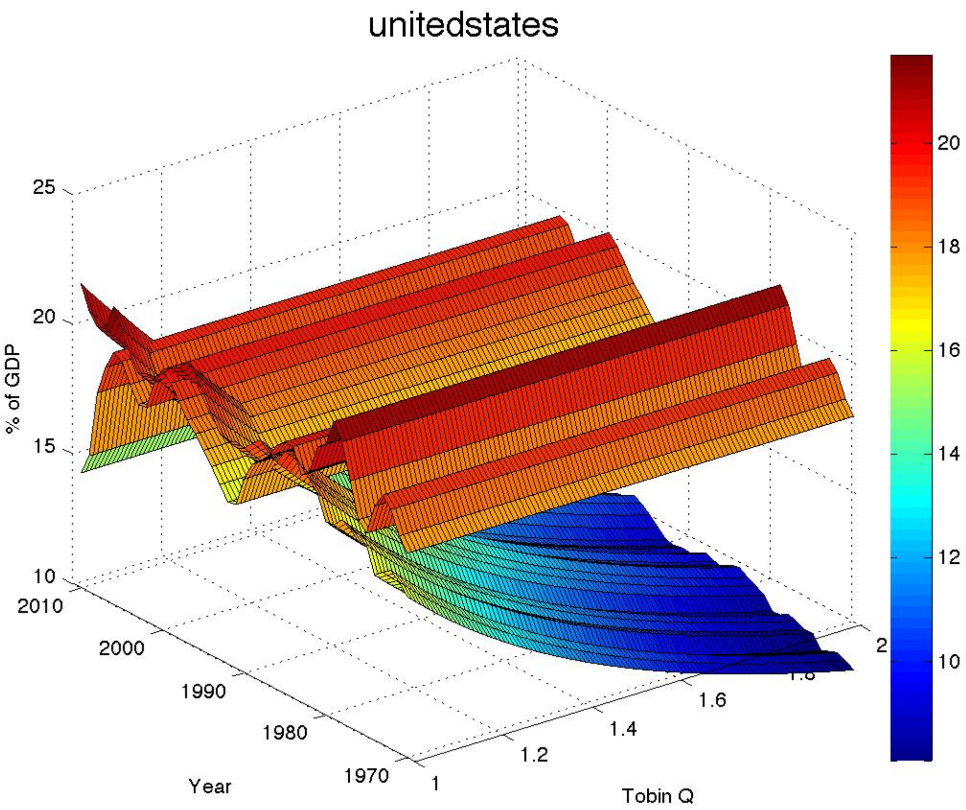
Source: OECD, Kuznets (1985), and author's calculations

Figure 15: Assessing dynamic efficiency in Belgium, Denmark, United Kingdom



Source: OECD, Kuznets (1985), and author's calculations

Figure 16: Dynamic efficiency as a function of Tobin Q in the US



Notes: This 3D graph represents capital income and investment (as a % of GDP), capital income coming from investment being an hyperbolic function of Tobin's q. If average Tobin q is superior to 1.5, then capital income is lower than investment for all years, and therefore the US economy is dynamically inefficient. The data is from OECD.

Figure 17: Dynamic efficiency as a function of Tobin Q in Japan, Australia and Canada

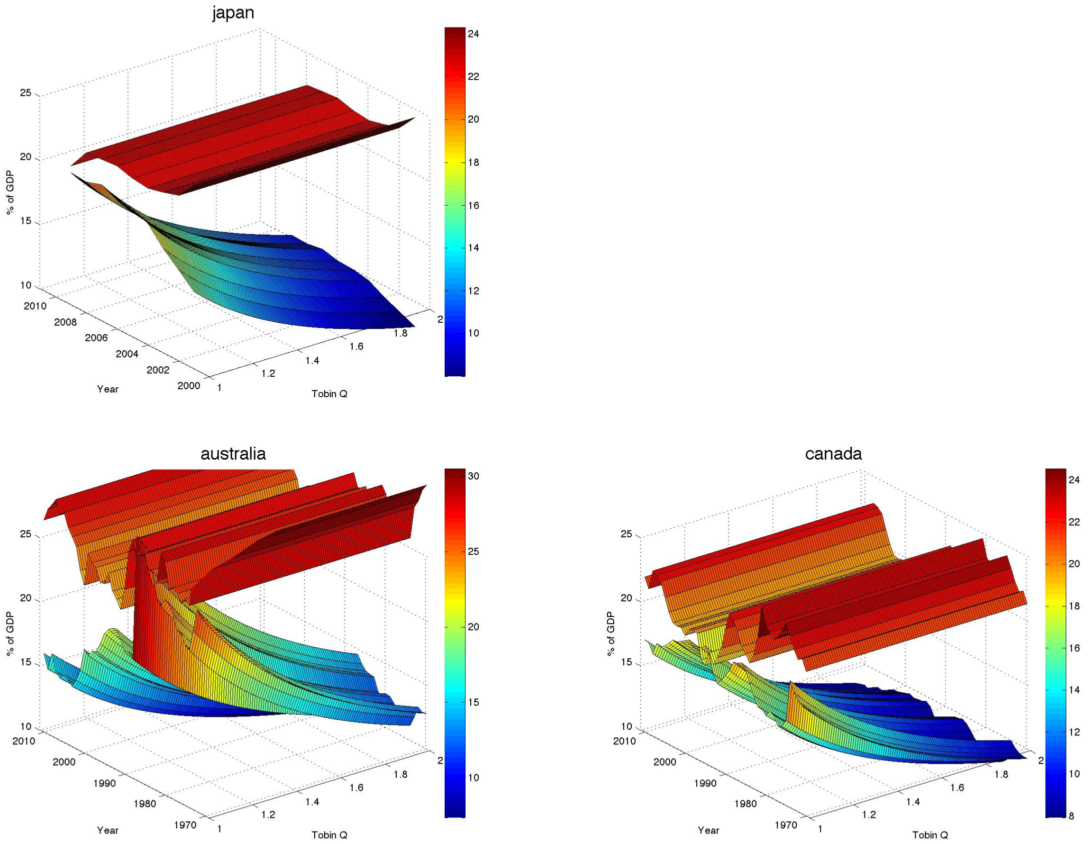


Figure 18: Assessing dynamic efficiency in France, Germany, Hungary and Italy

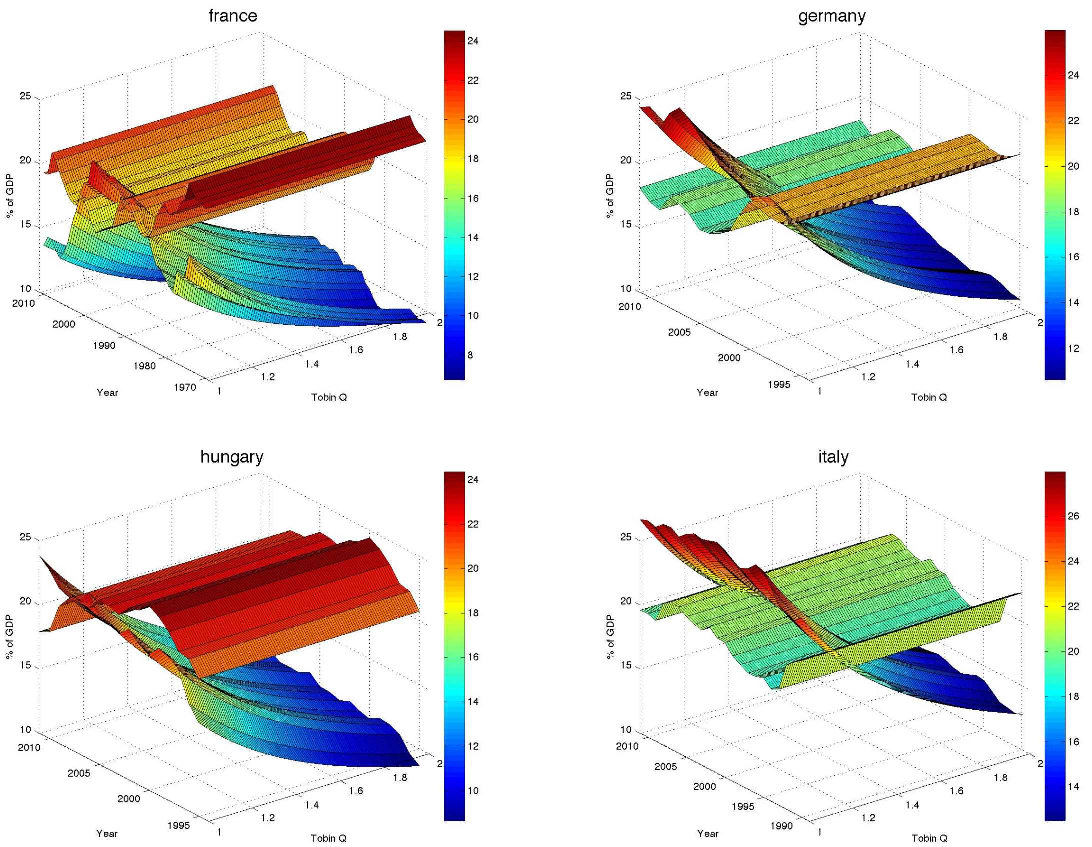


Figure 19: Assessing dynamic efficiency in Russia, Norway, Sweden, Switzerland

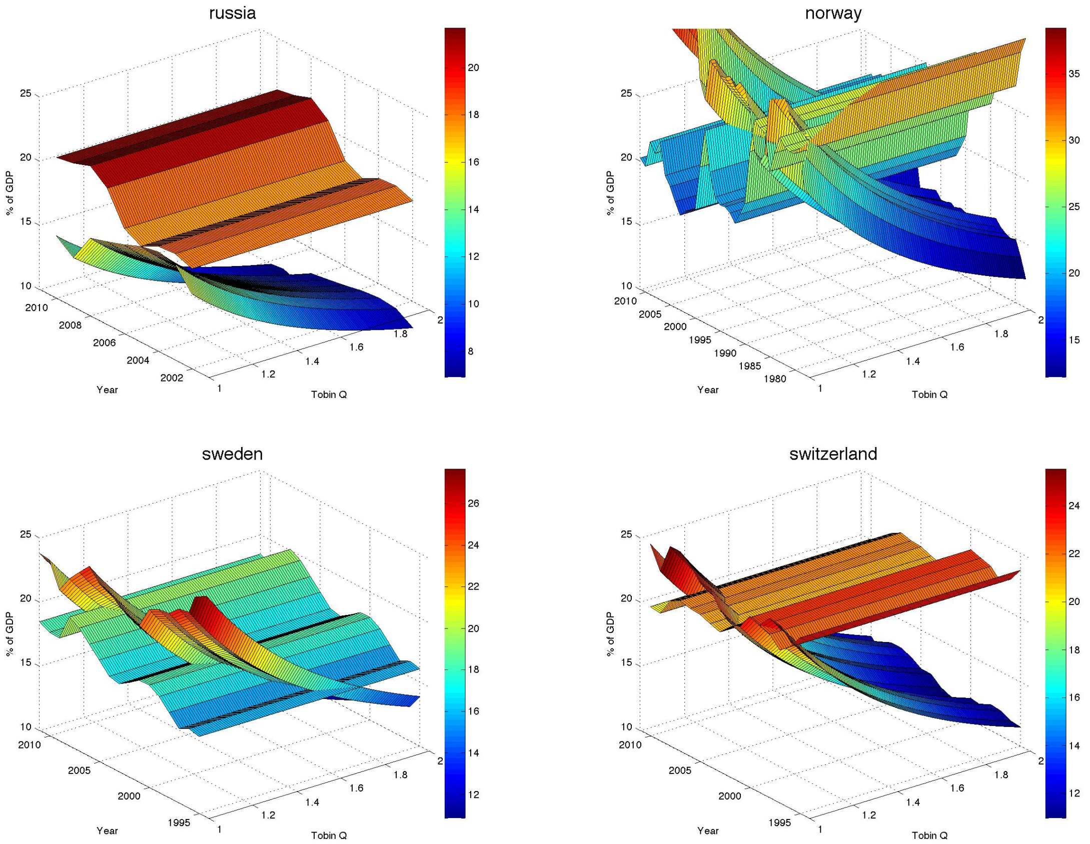


Figure 20: Assessing dynamic efficiency in Belgium, and United Kingdom

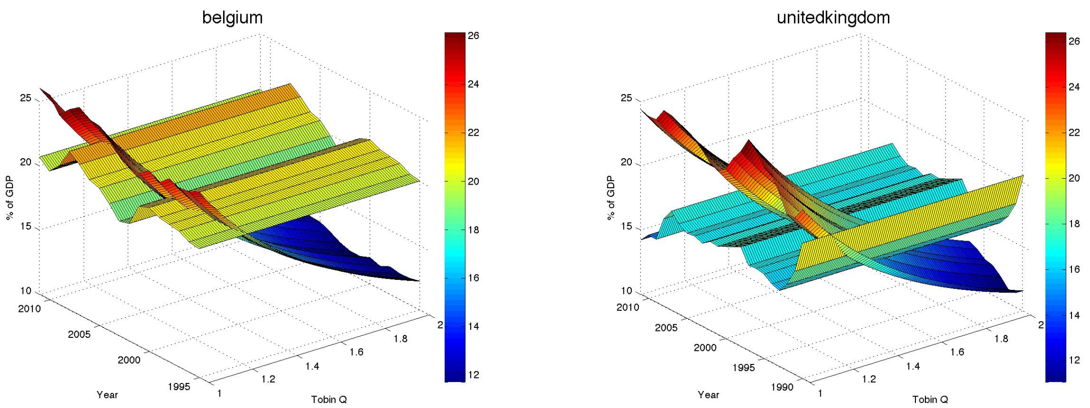
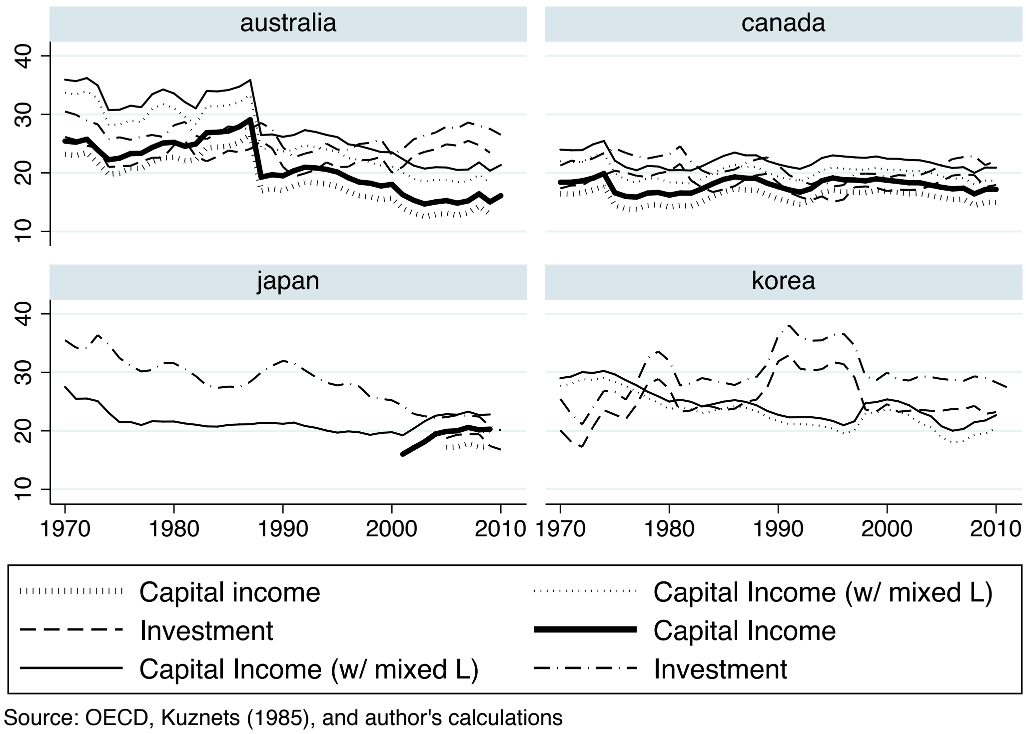
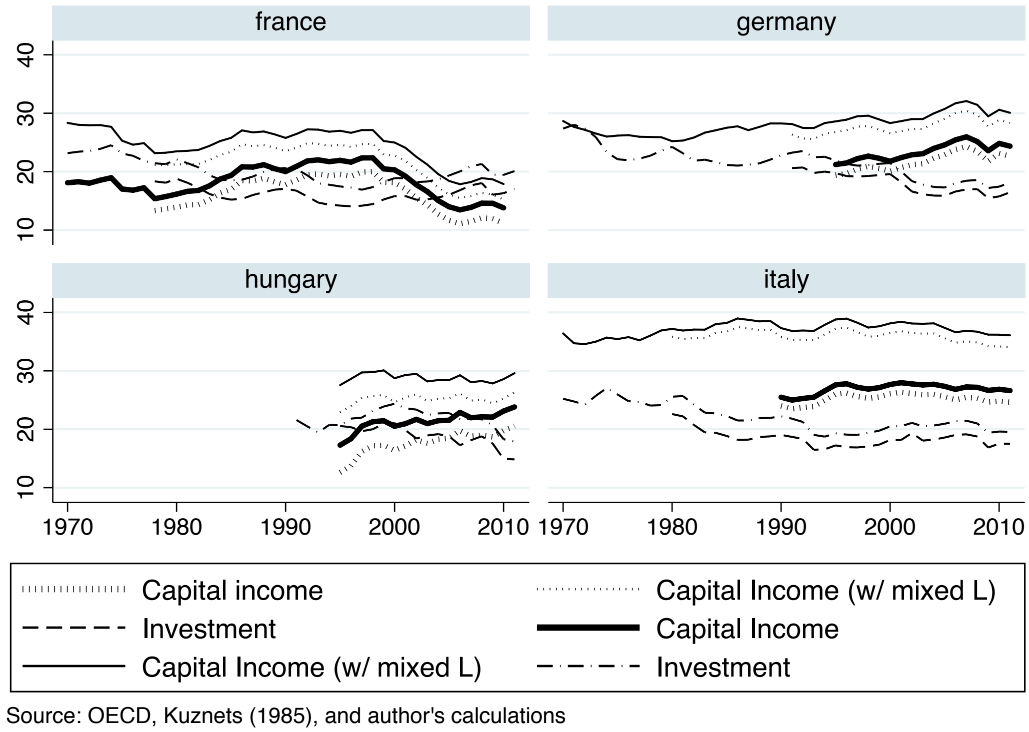


Figure 21: Assessing dynamic efficiency in Japan, South Korea, Australia, Canada



Notes: The dotted line represents Gross Capital Formation as a % of GDP. The dash-dotted line is total investment, excluding public investment. The thick continuous line is Capital Income as a % of GDP, excluding land rents and mixed income coming from labor. The thin continuous line is Capital Income excluding land rents but including labor income in mixed income "Korea" is South Korea. The thick dotted line is Capital income as a % of GDP excluding Government Consumption Allowances, and the thin line as before includes labor income in mixed income. Data comes from OECD.

Figure 22: Assessing dynamic efficiency in France, Germany, Hungary and Italy



Notes: See Figure 21.

Figure 23: Assessing dynamic efficiency in Russia, Norway, Sweden, Switzerland

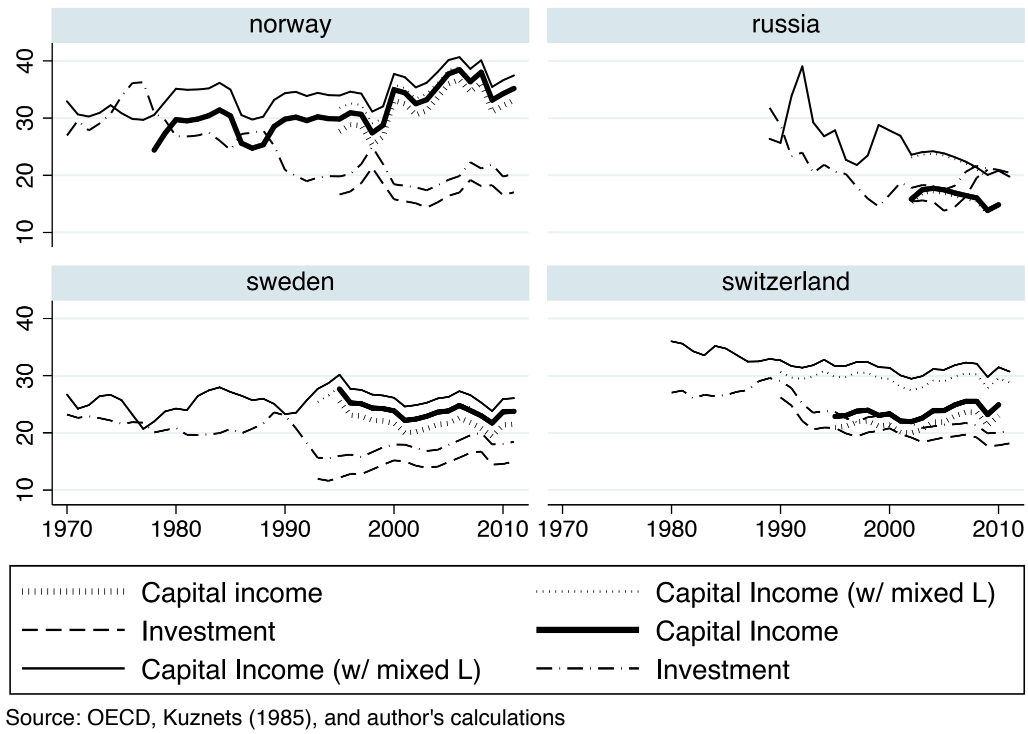
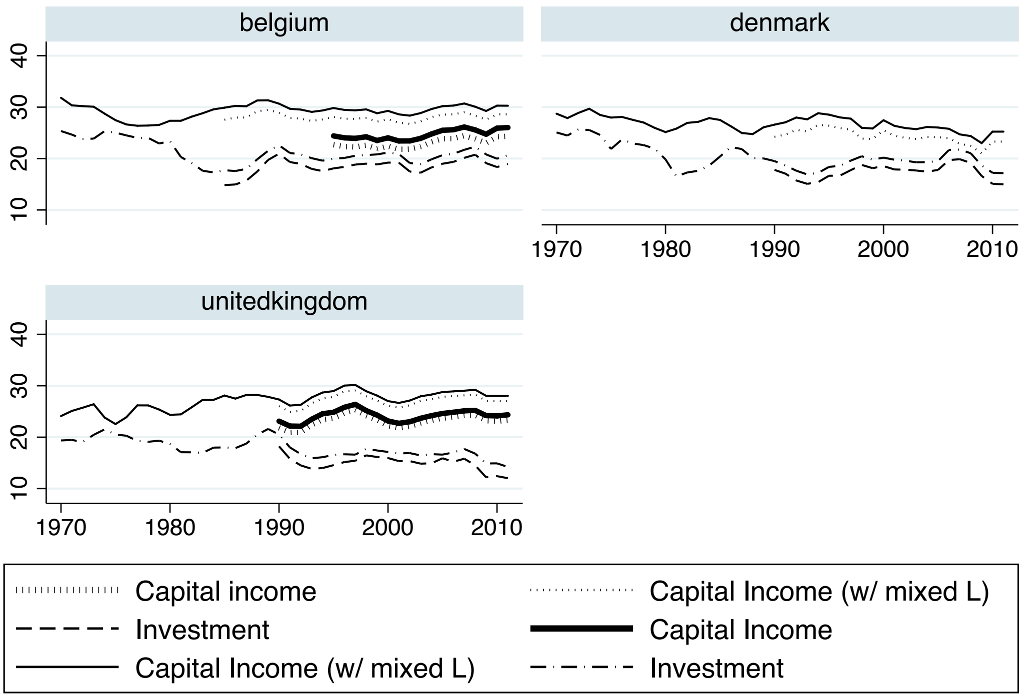


Figure 24: Assessing dynamic efficiency in Belgium, Denmark, United Kingdom



Source: OECD, Kuznets (1985), and author's calculations