ON THE SAVINGS WEDGE IN INTERNATIONAL CAPITAL FLOWS

by

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Abstract

I explore the determinants of the savings wedge in international capital flows computed for a sample of 68 developing countries in Gourinchas and Jeanne (2013). I show that size (rather than direction (allocation)) of net capital flows we observe in the data is the major driver of the negative correlation between the calibrated savings wedge and productivity growth.

1 Introduction

Gourinchas and Jeanne (2013) (GJ henceforth) explore the patterns of net capital flows in a sample of developing countries. The study was motivated by the fact that a number of fast growing developing countries (China, Hong-Kong, Singapore, Korea, Taiwan and Botswana) have experienced net outflows of capital. The fact is puzzling, because the workhorse small open economy growth model predicts net capital inflows to economies which are growing faster than the rest of the world.

The strongest result emphasized in the GJ paper is the negative correlation (-0.97) between the average annual productivity growth and the “savings wedge” in a large sample of 68 developing countries. The savings wedge is a reduced form distortion whose value for each country is chosen such that the benchmark neoclassical growth model generates net capital flows equal to those

*I thank Katherine Smith and Jacob Short for helpful comments and conversations. All errors are mine. The views expressed herein are my own, and do not necessarily represent the views of the Department of Defense.
in the data. Mechanically, the savings wedge acts like a tax/subsidy on savings. The strong negative correlation between such a tax and productivity growth implies that countries which have been growing slowly, tend to tax savings; countries that have been growing fast, tend to subsidize savings. Moreover, the correlation is highly robust to exclusion of outliers such as the Asian tigers. GJ conclude that understanding that negative correlation is key to understanding the “allocation puzzle”.

This note explores the extent to which the strong negative correlation between the calibrated savings wedge and productivity growth is driven by the sheer size of net capital flows that we observe in the data (rather than direction, or “allocation”). The answer is surprising: if we exogenously limit the maximum size of net foreign asset position to empirically plausible levels, we can account on average for more than 50% of the savings wedge. The intuition behind the result is the following. According to a neoclassical model, faster growing economies should borrow (a lot). For example, during the period 1980-2000, Cyprus’ productivity grew at an average rate of 5%. During that period of time, the cumulated sum of net capital inflows equaled 50% of the country’s GDP from 1980. When the same country is studied through the lens of the one-sector small open neoclassical economy (GJ benchmark), the predicted cumulated sum of net capital inflows equals 2000% (two thousand percent) of the country’s GDP from 1980. Hence, Cyprus has borrowed much less than the benchmark model predicts. An opposite example, Venezuela, with average productivity growth of -2%, had the cumulative sum of net capital inflows equal to -25% of the country’s GDP from 1980. The neoclassical model would predict that number to be -1000%. It appears then that Venezuela (the slow growing economy) was taxing savings, while Cyprus (the fast growing economy) was subsidizing savings. The savings wedges GJ estimate are 4.06% for Venezuela and -3.74% for Cyprus.

The exercise in this note proceeds as follows. First, I reproduce GJ’s empirical findings using Penn World Table and IFS data. In particular, I explore the extent to which the negative (or zero) correlation between cumulative capital inflows and productivity growth are driven by few, albeit important, outliers. Second, given the robust negative correlation between the savings wedge and
productivity growth, and the disparity between the predicted and actual size of net capital flows, I explore the link between the savings wedge and the size (rather than direction) of net capital flows.

2 Allocation Puzzle

Gourinchas and Jeanne (2013) study the long-term dynamics of net foreign asset position in a sample of 68 developing countries. This section will present a summary of their findings and major conclusions.

2.1 Puzzling correlation

First, GJ finds a negative correlation between cumulative productivity growth and the cumulative capital inflows during the period 1980-2000. Figure 1 reproduces GJ’s main empirical findings. The left panel presents the scatterplot of net cumulative capital inflows and the cumulative catch-up in productivity against the United States \( \frac{\text{TFP}_{2000}}{\text{TFP}_{1980}} - \frac{\text{TFP}_{2000}}{\text{TFP}_{1980}} \). The correlation in the left panel is -0.4. The right panel presents the same data, but without foreign aid (also described by GJ). The correlation drops to -0.17 and is insignificant\(^1\). They conclude capital inflows are at best uncorrelated with the growth rate of productivity. The result is at odds with predictions of the theory: high productivity growth should be associated with larger capital inflows.

2.1.1 Six drivers of the puzzling correlation?

A closer look at the right panel of Figure 1 reveals the lack of positive correlation in the data without foreign aid is primarily driven by six (albeit important) outliers: China, Korea, Taiwan, Botswana, Hong-Kong and Singapore. If we remove these outliers and restrict the attention to remaining 63 countries, the correlation becomes positive (30%) and significant (see Figure 2).

\(^1\)Aguiar and Amador (2011) show the correlation reported in GJ is largely driven by public flows.
capital inflows 1980-2000 / initial output

Figure 1: Allocation puzzle - redux

capital inflows without foreign aid / initial output

Figure 2: Net capital flows without foreign aid and without outliers
2.2 Savings wedge

Second, GJ introduces a savings wedge into the standard neoclassical growth model. They calibrate it for each country by making sure the model generates the same change in external debt as we observe in the data (i.e. for each country they match its position in the left panel of Figure 1).

**Neoclassical model with wedges** The planner’s problem in the model with wedges is as follows:

\[
\max_{t=1}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma} N_t
\]

s.t.

\[
C_t + K_{t+1} \leq (1 - \tau_s)(R_t((1 - \tau_k)K_t - R^*D_t) + D_{t+1} + N_t(w_t + z_t)
\]

where \(z_t = \tau_k R_t k_t + \tau_s R^*(k_t - d_t)\). The inter-temporal Euler condition for this economy is:

\[
\left(\frac{c_{t+1}}{c_t}\right)^{\sigma} = \beta R^*(1 - \tau_s)
\]

If \(\tau_s > 0\) then \(\left(\frac{c_{t+1}}{c_t}\right)^{\sigma} < \beta R^*\) (which will be the case for slow-growing economies). If \(\tau_s < 0\) then \(\left(\frac{c_{t+1}}{c_t}\right)^{\sigma} > \beta R^*\) (which will be the case for fast-growing economies). The investment wedge \(\tau_k\) is calibrated for each country by matching average investment/GDP ratio. The savings wedge \(\tau_S\) is calibrated to exactly match the change in net external debt. Figure 3 presents the relationship between the calibrated savings wedge and productivity catch-up. The result is quite striking: strong and robust negative correlation of -0.97.

3 Understanding the savings wedge: size matters

The lack of positive correlation between capital flows and productivity catch-up is largely driven by the six outliers. The negative correlation between the savings wedge and productivity growth is definitely not. That correlation is -0.97 and is probably the strongest result in Gourinchas and Jeanne (2013): “the allocation puzzle is the savings puzzle”.\(^2\) This section explores the extent to which the small net size of capital flows in the data accounts for such strong correlation.

\(^2\)Gourinchas and Jeanne (2013), page 21.
First I show that GJ’s model with a savings wedge described in Section 2.2 is isomorphic to a neoclassical growth model with time varying borrowing and savings requirements. Second, I evaluate what fraction of the savings wedge reported by GJ can be accounted for simply by restricting the size of net capital flows. I consider a model with fixed restrictions on international borrowing and savings. For each economy, I simulate capital flows predicted by such model. Then, I treat these predicted flows as the data and look at them through the lens of the GJ framework.

3.1 Model with exogenous borrowing and saving requirements

The planner solves the following problem:

\[
\max \sum_{t=1}^{\infty} \beta^t \frac{c_t^{1-\sigma}}{1-\sigma} N_t \\
\text{s.t.}
\]

\[
C_t + K_{t+1} = (R_t(1 - \tau_k)K_t - R^*D_t) + D_{t+1} + N_t(w_t + z_t)
\]

\[
(\lambda_t) \quad D_{t+1} \leq \bar{D}_t
\]

\[
(\lambda_t) \quad D_{t+1} \geq \underline{D}_t
\]
where $z_t = \tau_t R_t k_t$ is the lump-sum tax/subsidy. each period, there is a potentially different lower (upper) bound on net external debt: $D_t (\overline{D}_t)$, and for every $t$ we have $D_t < \overline{D}_t$; The Lagrange multipliers on the two constraints are $\overline{\lambda}_t$ and $\underline{\lambda}_t$. The Euler equation for international borrowing and lending reads:

$$\left( \frac{c_{t+1}}{c_t} \right)^\sigma = \beta R^* + \frac{\overline{\lambda}_t}{\beta^t U_{c,t+1}} - \frac{\underline{\lambda}_t}{\beta^t U_{c,t+1}}$$

(3.4)

For a fast-growing economy, only (3.2) will ever be binding (i.e. only $\overline{\lambda}_t > 0$ for some $t$). For a slow-growing economy, only (3.3) will ever be binding (i.e. only $\underline{\lambda}_t < 0$ for some $t$). Mechanically, as Table 1 shows, this is isomorphic to the model with $\tau_s < 0$ in fast-growers, and with $\tau_s > 0$ in slow-growers.

### 3.2 Quantitative Evaluation

It is not clear what fraction of the savings wedge (and its correlation with the productivity growth) we can account for by simply limiting net capital flows to the magnitudes observed in the data. This section will address that question.
The analysis is simple. I first consider a model from Section 3.1, i.e. a simple one-sector neoclassical growth model with exogenously imposed limits on the international borrowing and lending (3.2)-(3.3). The limits are common for all economies and constant over time \( \bar{D}_t = \bar{D} \) and \( \bar{D}_t = \bar{D}, \text{all } t \). Both \( \bar{D} \) and \( \bar{D} \) are calibrated so that the range of values of the Y-axis in Figure 1 predicted by the model corresponds to the range in the data (i.e. \(-4 \leq \Delta D/Y_0 \leq 3\)). I then consider the capital flows simulated by the model and treat them as the data to which I apply the procedure from GJ and compute the implied savings wedge. The final two steps are (1) to compare that savings wedge with the one in GJ and (2) to quantify the percent of the GJ savings wedge accounted for by the exogenous limits on the size of net flows.

Results are presented in Figure 4. The left panel presents a scatter-plot of the two savings wedges with a remarkable correlation of 95.3%. The right panel shows the fraction of the GJ’s savings wedge accounted for by the model with limits on borrowing and on saving. It is calculated as the ratio of two wedges - one computed using model generated flows—\( \tau_S(\text{model}) \)—and one computed using actual data—\( \tau_S(\text{data}) \)—(i.e. the wedge obtained by GJ). On average, limiting exogenously the size of net external asset position accounts for 53.4% of the savings wedge. Not surprisingly, that fraction is closest to 1 for the fastest and slowest growing countries. For countries whose growth is close to the World’s average, there is a lot of variation in that ratio, with values falling above 1 or below 0 (for those countries the standard neoclassical model predicts \( \Delta D/Y_0 \approx 0 \), and thus \( \tau_S(\text{data}) \) is close to 0).

3.3 Why are net capital flows so small?

It’s important to emphasize the goal of this note was only to evaluate the extent to which the savings wedge in GJ is driven by size of net capital flows. Understanding the reasons behind the small size of net flows requires further analysis. Small net flows can result from frictions (see e.g. Bai and Zhang (2010)), but they can also result from a large non-tradable component of both consumption and investment (see e.g. Rothert and Short (2014)).
4 Summary

The fact that some fast growing countries have accumulated large net external surpluses is puzzling. The key to this puzzle is to understand the factors that drive down autarky interest in those countries.

The negative correlation between the savings wedge and productivity is about something different - the size of net capital flows. Relative to predictions of the neoclassical growth model, net capital flows are small. The key to this puzzle is to understand the factors that reduce the interest-elasticity of countries’ savings supply and investment demand.

References

