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The Impact of Bretton Woods International Capital Controls on the Global Economy and the Value of Geopolitical Stability: A General Equilibrium Analysis

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ABSTRACT

This paper quantifies the positive and normative impact of Bretton Woods capital controls on global and regional economic activity. A three-region DSGE capital flows accounting framework consisting of the U.S., Western Europe, and the Rest of the World (ROW) is developed to quantify capital controls and evaluate their impact on the world economy. We find these controls had large effects. Counterfactual analysis show world output would have been 0:5 percent higher had there been perfect capital mobility, with substantial capital flowing from the ROW to the U.S. Bretton Woods capital controls raised welfare substantially in the ROW, but at the expense of much lower U.S. welfare. Given the U.S.'s goal of keeping capital within these countries to preserve their stability during this period, we interpret lower U.S. welfare due to Bretton Woods as the implicit value the U.S. placed on preserving geopolitical stability in ally countries during the Cold War.

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A data appendix is available at http://www.nber.org/data-appendix/w31595

1 Introduction

This paper quantitatively evaluates the positive and normative impacts of capital controls on the world economy under the Bretton Woods international financial system. Bretton Woods was the most significant modern policy experiment to simultaneously manage international payments, international capital flows, and international currency values. Because of the uniqueness of Bretton Woods, there are thousands of studies of this system, with almost all focusing on *monetary* aspects, particularly fixed exchange rates and the consequences of shifting to flexible rates (see Baxter and Stockman (1989), Bordo (1993, 2018), Obstfeld and Rogoff (2000), Mussa (1986), and many others).

In contrast, this paper analyzes an important real aspect of the Bretton Woods system: *capital controls*. The fact that international net capital flows were so small during Bretton Woods (nearly zero between the U.S. and Western Europe, and between the U.S. and the Rest of the World), particularly after 20 years of severe economic dislocations from the Great Depression through World War II, suggests that capital controls may have substantially impeded the flow of global capital and that postwar global economic activity might have been very different in their absence.

This paper evaluates three related questions about Bretton Woods capital controls: (i) How much did Bretton Woods capital controls affect the international flow of capital? (ii) Where would capital have flowed in the absence of those controls? And (iii) what were the impacts of these controls on the world economy and on welfare?

Addressing these questions is challenging along several dimensions. Obstfeld, Shambaugh, and Taylor (2004) describe how the complex nature of capital controls makes them difficult to quantify. Moreover, the simultaneous use of various types of controls further complicates measurement, and the *de facto* application of controls may have differed considerably from their *de jure* specification.

Given these measurement difficulties, this paper develops an open economy, general equilibrium capital flows accounting framework that provides a model-based alternative to measuring effective (*de facto*) capital controls. We use the model to quantify the effects of Bretton Woods capital controls on the world economy, which is divided into three regions: the two major regions within the Bretton Woods agreement, (1) the U.S. and (2) Western and Northern Europe, and (3) the Rest of the World (ROW). The modeling approach is an accounting framework that captures the observed levels of consumption, labor, investment, output, and capital flows in each of these three regions with a relatively small number of identified distortions that are measured based on the model's first-order conditions. These include an international capital markets distortion that is a tax on international financial transactions between regions. This distortion captures capital controls, as it affects region-specific capital flows and net exports, as developed in Ohanian, Restrepo-Echavarria, and Wright (2018).

We conduct a counterfactual experiment that eliminates the identified distortions affecting inter-

national borrowing and lending to evaluate what would have happened if international capital markets had been much more open, such as the global system in place during the "Golden Age" of capital flows in the late 19th and early 20th centuries, when world capital flows were very high and when capital controls were largely absent in international financial markets (see Ohanian and Wright (2010)).

We find that model-inferred capital controls substantially impeded the flow of capital across countries and that the allocation of economic activity across countries would have been very different in their absence. Moreover, we find that substantial amounts of capital would have flowed out of the ROW and into the U.S. during the Bretton Woods period in the absence of controls, and that world output would have nearly 0.5 percent higher. The model-inferred capital controls line up consistently with actual capital controls implemented over time and across countries, which leads us to conclude that the model is reasonably capturing these controls.

These controls have large welfare effects, with a perpetual consumption-equivalent welfare benefit of about 5.55 percent for the ROW; in contrast, we find that U.S. welfare was about 2.78 percent lower, and Europe's was 1.27 percent lower due to impediments to international capital flows.

The key feature of the data driving lower U.S. welfare under Bretton Woods capital controls is an observed nearly 40 percent drop in U.S. consumption, relative to ROW consumption, during the Bretton Woods period. This declining relative consumption pattern is strongly at variance with standard consumption-smoothing motives, and suggests large barriers to international capital mobility during this period.

The finding that capital controls substantially reduced U.S. welfare raises the question of why the U.S.,as the principal architect of Bretton Woods, had so strongly promoted controls in the first place. To address this question, we distill the historical literature that describes how the U.S. viewed capital controls as being critically important for keeping capital within ally and developing countries to preserve their economic and political stability.

We therefore interpret the high welfare cost of Bretton-Woods capital controls to the U.S. as an estimate of the implicit value of promoting stability in foreign countries whose governments were friendly to the U.S.

More broadly, our findings suggest that Bretton Woods capital controls can be interpreted as an investment supporting the U.S. foreign policy objective of preventing the spread of communism and fascism during a period that included the Korean War, the Vietnam War, and the Cold War.

The paper is organized as follows. Section 2 describes how the paper is related to the literature. Section 3 presents the capital flows accounting framework. Section 4 discusses its implementation. Section 5 presents the identified distortions, including a comparison with actual changes in capital control policies. Section 6 shows the counterfactual analyses and the welfare calculations. Section 7 presents a political economy discussion regarding why the U.S. wanted capital controls as part of

Bretton Woods. We describe the U.S. concerns that substantial capital would have flowed out of ally countries and into the U.S. in the absence of capital controls and that the U.S. worried that such flows would be politically and economically destabilizing to U.S. ally countries. Section 8 concludes, interpreting the cost of capital controls within the model as a measure of the implicit value of promoting economic and political stability within ally countries.

2 Relationship to the Literature

Our paper is related to four different strands of the literature. It contributes to the literature on the Bretton Woods agreement, but from a very different perspective. Much of the existing literature focuses on monetary issues, particularly regarding fixed exchange rates and the relationship between real and nominal exchange rates during and after Bretton Woods. Bordo (1993) offers an overview of Bretton Woods from a historical perspective and compares its performance to other international monetary policy regimes. Eichengreen (2019) offers an account of the past one hundred and fifty years of international monetary and financial history including the Bretton Woods period. Bordo (2018) studies the relationship between inflation and the collapse of the Bretton Woods system. Mussa (1986) documents what is known today as the Mussa puzzle: a sharp and simultaneous increase in the volatility of the nominal and real exchange rates after the end of the Bretton Woods system. In a more recent paper, Itskhoki and Mukhin (2021) revisit the Mussa puzzle and argue that financial segmentation is the key to understanding the behavior of both the nominal and the real exchange rate after the end of Bretton Woods and not price stickiness as has been previously argued. Ayres, Hevia, and Nicolini (2020) show how commodities can help explain the Mussa puzzle as well as the low correlation between real exchange rates and consumption ratios (the Backus-Smith puzzle). Instead we focus on analyzing the positive and normative effects of Bretton Woods' impediments to international capital mobility on the world economy as opposed to the role of exchange rates, which have been widely studied and moved very little during the Bretton Woods era.

Our paper also contributes to the literature that tries to identify distortions to factor markets both at the domestic and the international level. The existing literature computes indices of distortions by examining legal restrictions on the operation of markets and then counting up the number of different types of restrictions, providing a qualitative measure of de jure controls or distortions. Examples of this approach in international capital markets include the large number of studies based on the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions, including Chinn and Ito (2008), Quinn (1997), Fernandez et al. (2016), and Ghosh and Qureshi (2016). Unlike these previously mentioned papers, we use data on equilibrium quantities to construct quantitative measures of the impact of de facto controls/distortions on domestic and international capital markets, and focus on the quantitative significance of such controls on macroeconomic variables.

Because de jure measures are not always implemented, we argue that our methodology is important as it allows us to measure de facto or effective capital controls. However, we show in Section 5 of the paper that our *de facto* measures line up remarkably well with those *de jure* measures from the existing literature.

We build on the literature on business cycle accounting in closed economies following Cole and Ohanian (2002) and Chari, Kehoe, and McGrattan (2007). Unlike these papers, we examine open economies and focus on medium- and longer-term movements in economic variables, which play a larger role in determining the level of consumption, and hence also savings and international capital flows, than do fluctuations at business cycle frequencies. Our paper is also related to the literature on business cycle accounting in small open economies (see Lama (2011) and Rahmati and Rothert (2014)). In contrast to their partial equilibrium (small open economy) approach with incomplete markets, we show how to apply a general equilibrium complete markets model to data on the world economy constituted from multiple countries. Finally Cheremukhin et al. (2017) study the structural transformation of Russia over 1885-1940 using an accounting approach, to identify the frictions driving such transformation. They use a perfect foresight approach while we incorporate uncertainty.

Finally, our paper is also related to the literature on capital flows and its determinants. Feldstein and Horioka (1980) examine the correlation between domestic savings and investment rates, and subsequent papers like Bayoumi and Rose (1993), Tesar (1991), and many others, interpret their analyses as "tests" of international capital market efficiency. In response to the failure of these tests, the literature has developed models of international financial frictions ranging from limited commitment (Wright (2001), Kehoe and Perri (2002), and Restrepo-Echavarria (2019)) and default risk (Eaton and Gersovitz (1981), Arellano (2008), Aguiar and Gopinath (2006), Tomz and Wright (2013), and many others) to exogenous market incompleteness (Arellano, et al. (2012)) and asymmetric information (Atkeson (1991)). A problem with these "tests" of capital mobility is that they typically rely on strong assumptions about the existence and source of gains from trade, and hence they have low power against plausible alternatives as to the nature of the gains from trade. Our approach complements this literature on international financial market inefficiency by evaluating these frictions using a different framework. Our framework uses data on a wider set of macroeconomic variables to simultaneously identify the sources of gains from international trade in capital and to back out the potential role of distortions in limiting that trade. Our emphasis on measuring the gains from trade and on exploring the role of frictions outside of capital markets is shared by a number of other recent studies of international capital flows. Caselli and Feyrer (2007) directly estimate the marginal product of capital for many countries and find that these estimates have converged over time, once the marginal products are adjusted for the share of non-reproducible capital, such as land and natural resources. Obstfeld and Rogoff (2000), Reyes-Heroles (2016), Eaton, Kortum, and Neiman (2016), and others explore the role of trade costs in explaining a number of facts about international flows. In Ohanian, Restrepo-

Echavarria, and Wright (2018) we argue that our approach is complementary in that it provides evidence that can be used to test for the role of trade costs. We follow in the footsteps of Alfaro, Kalemli-Ozcan, and Volosovych (2008), who study the role of institutions in driving the incentive to reallocate capital around the world. Unlike them, we focus on how capital controls divert these flows and the geopolitical stability motivation.

3 A Multi-Region Model Economy

This section develops a general equilibrium model as in Ohanian, Restrepo-Echavarria, and Wright (2018) to construct the international capital market distortion and the domestic labor and capital market distortions for the U.S., Western and Northern Europe, and the ROW.

3.1 Model Economy

Households The world economy has three "regions" indexed by j, where $j = U$ stands for "United States," $j = E$ stands for "Europe," and $j = R$ stands for the "rest of the world." Time is discrete and is indexed by $t = 0, 1, ...$, so that N_{jt} denotes the population of country j at time t. There is a single traded good. There is a representative agent in each country with preferences over consumption C_{jt} and per capita hours worked h_{jt}, ordered by

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t \left\{ \ln \left(\frac{C_{jt}}{N_{jt}} \right) - \frac{\varphi}{1+\gamma} h_{jt}^{1+\gamma} \right\} N_{jt} \right].$$

The parameters governing preferences—the discount factor β, the preference for leisure φ, and the Frisch elasticity of labor supply $1/\gamma$—are common across countries. The representative household of country j chooses a state-contingent stream of consumption C_{jt}, hours worked h_{jt}, purchases of capital to be rented out the following period K_{jt+1}, and a portfolio of state-contingent international bond holdings B_{jt+1} subject to a sequence of flow budget constraints for each state and date:

$$\begin{aligned} C_{jt} + P_{jt}^K K_{jt+1} + E_t \left[q_{t+1} B_{jt+1} \right] \quad \leq \quad & \left(1 - \tau_{jt}^h\right) W_{jt} h_{jt} N_{jt} + \left(1 - \tau_{jt}^K\right) \left(r_{jt}^K + P_{jt}^{*K}\right) K_{jt} \\ & + \left(1 - \tau_{jt}^B + \Psi_{jt}\right) B_{jt} + T_{jt} + \Pi_{jt}, \end{aligned}$$

where initial capital K_{j0} and bonds B_{j0} are given. Final output is produced by a representative firm using labor and capital, such that W_{jt} is the wage per hour worked, r_{jt}^K the rental rate of capital, P_{jt}^K the price of new capital goods, and P_{jt}^{*K} the price of existing capital goods, which will differ from the price of new capital goods due to adjustment costs. In this complete markets environment, the prices of state-contingent international bonds at time t that pay off in one state at $t+1$ are composed

of a risk-adjusted world price q_{t+1} multiplied by the probability of the state occurring, which allows us to write the expected value of the risk-adjusted expenditures on securities on the left-hand side of the flow budget constraint. Households also receive profits Π_{jt} from their ownership of domestic firms.

The τ's represent country-specific distortions that are isomorphic to taxes on factor payments and investment income. Specifically, τ^h is a distortion on domestic labor markets, τ^K is a distortion on domestic capital markets, while τ^B is a distortion on international capital markets. Note that a positive value of τ^B is a tax on capital inflows and a negative value of τ^B is a tax on capital outflows.

The revenue from these taxes net of the level of government spending G_{jt} is rebated as lump-sum transfers to/from households each period as T_{jt},

$$T_{jt} = \tau_{jt}^h W_{jt} h_{jt} N_{jt} + \tau_{jt}^B B_{jt} + \tau_{jt}^K \left(r_{jt}^K + P_{jt}^{*K}\right) K_{jt} - G_{jt}. \tag{1}$$

This implies that there is no government borrowing. Since Ricardian equivalence holds, this is without loss of generality.

Finally, Ψ_{jt} is an international portfolio adjustment cost that ensures long-run consumption stationarity. Even though there are complete markets, the introduction of a time-varying distortion on international capital markets means that consumption can no longer be identified out of relative shares. We discuss this issue in detail in Subsection 3.3.

Firms Each country is populated by two types of competitive representative firms. The first hires labor and capital to produce the tradable consumption good using a standard Cobb-Douglas technology of the form $A_{jt} K_{jt}^{\alpha} \left(h_{jt} N_{jt}\right)^{1-\alpha}$, where A_{jt} is the level of aggregate productivity in the economy and α is the output elasticity of capital. This yields expressions for the equilibrium wage rate per hour and the rental rate on capital:

$$W_{jt} = (1-\alpha) \frac{Y_{jt}}{h_{jt} N_{jt}}, \tag{2}$$

and

$$r_{jt}^K = \alpha \frac{Y_{jt}}{K_{jt}}. \tag{3}$$

The second firm produces new capital goods K_{jt+1} using I_{jt} units of investment and K_{jt} units of the existing capital good. They maximize profits $P_{jt}^K K_{jt+1} - I_{jt} - P_{jt}^{*K} K_{jt}$ subject to the capital accumulation equation with convex adjustment costs ϕ of the form

$$K_{jt+1} = (1-\delta) K_{jt} + I_{jt} - \phi\left(\frac{I_{jt}}{K_{jt}}\right) K_{jt}.$$

Although the capital good K_{jt+1} is used for production in period $t+1$, it is produced and sold in

period t at price P_{jt}^K. This yields the following first-order conditions:

$$P_{jt}^K = \frac{1}{1-\phi'\left(\frac{I_{jt}}{K_{jt}}\right)}, \tag{4}$$

$$P_{jt}^{*K} = P_{jt}^K\left(1-\delta-\phi\left(\frac{I_{jt}}{K_{jt}}\right)+\phi'\left(\frac{I_{jt}}{K_{jt}}\right)\frac{I_{jt}}{K_{jt}}\right), \tag{5}$$

We specify quadratic adjustment costs, which is common in the literature:

$$\phi\left(\frac{I_{jt}}{K_{jt}}\right) = \frac{\nu}{2}\left(\frac{I_{jt}}{K_{jt}}-\kappa\right)^2.$$

All production parameters—the output elasticity of capital α, the depreciation rate δ, and those governing adjustment costs ν and κ—are constant and identical across countries.

3.2 Growth and Uncertainty

The world economy has grown substantially over the period under study. However, this growth has changed considerably across regions and over time. While the U.S. has had fairly stable growth since World War II, growth in Europe and the ROW has been more volatile. Both of these regions initially grew faster than the U.S. after World War II, but growth slowed considerably, particularly in the ROW, around the 1970s. To capture these region- and country-specific growth dynamics, we adopt a specification for the growth of the population and productivity levels with country-specific parameters as in Ohanian, Restrepo-Echavarria, and Wright (2018).

There is a stochastic world trend for both population and productivity based on U.S. data (for similar approaches, see Canova (1998), Fernandez-Villaverde and Rubio-Ramirez (2007), and Cheremukhin and Restrepo-Echavarria (2014)). U.S. productivity and population evolve according to

$$\begin{aligned}\ln A_{Ut+1} &= \ln A_{Ut} + \ln \pi_{ss} + \sigma_U^A \varepsilon_{Ut}^A,\\ \ln N_{Ut+1} &= \ln N_{Ut} + \ln \eta_{ss} + \sigma_U^N \varepsilon_{Ut}^N,\end{aligned}$$

where π_{ss} and η_{ss} are the growth rates in U.S. productivity and population that would occur in the deterministic steady-state of the model, such that $\pi_t = \frac{A_{Ut+1}}{A_{Ut}} = \pi_{ss}\exp\left(\sigma_U^A\varepsilon_{Ut}^A\right)$ and $\eta_t = \frac{N_{Ut+1}}{N_{Ut}} = \eta_{ss}\exp\left(\sigma_U^N\varepsilon_{Ut}^N\right)$. To achieve stationarity, we scale variables by the level of effective labor in the United States $Z_t = A_{Ut}^{1/(1-\alpha)}N_{Ut}$. Note that this specification nests a constant growth rate as a special case.

Population and productivity levels in Europe and the Rest of the World evolve relative to the U.S. trend in such a way that a non-degenerate long-run distribution of economic activity across countries is preserved. For Europe and the Rest of the World we define relative productivity $a_{jt} = A_{jt}/A_{Ut}$ and relative population $n_{jt} = N_{jt}/N_{Ut}$ and assume that both a_{jt} and n_{jt} follow first-order autoregressive processes of the form

$$\begin{aligned}\ln a_{jt+1} &= \left(1-\rho_j^a\right)\ln a_{jss} + \rho_j^a \ln a_{jt} + \sigma_j^a\varepsilon_{jt+1}^a,\\ \ln n_{jt+1} &= \left(1-\rho_j^n\right)\ln n_{jss} + \rho_j^n \ln n_{jt} + \sigma_j^n\varepsilon_{jt+1}^n.\end{aligned}$$

This allows for long-lasting deviations from the world trend. This specification of region-specific TFP with long-lasting deviations is broadly related to Aguiar and Gopinath's (2007) analysis of growth and TFP in emerging economies. We place no further restrictions on these processes, and we estimate the parameters of the processes below.

The labor, capital, and international distortions (indexed by $m = h, K$, and B) for each country also follow univariate first-order autoregressive processes of the form

$$\ln\left(1-\tau_{jt+1}^{m}\right) = \left(1-\rho_{j}^{m}\right)\ln\left(1-\tau_{jss}^{m}\right) + \rho_{j}^{m}\ln\left(1-\tau_{jt}^{m}\right) + \sigma_{j}^{m}\varepsilon_{jt+1}^{m}, \tag{6}$$

where τ_{jss}^{m} is the level the distortion would take in the deterministic steady-state of the model and ρ_{j}^{m} governs the rate of mean reversion. The evolution of the level of government spending in each country G_{jt} is specified so that the ratio of government spending to national income $g_{jt} = G_{jt}/Y_{jt}$ also follows a first-order autoregressive process:

$$\ln g_{jt+1} = \left(1-\rho_{j}^{g}\right)\ln g_{jss} + \rho_{j}^{g}\ln g_{jt} + \sigma_{j}^{g}\varepsilon_{jt+1}^{g}.$$

3.3 Stationarity and International Bond Portfolios

To our knowledge, the capital controls specification developed in Ohanian, Restrepo-Echavarria, and Wright (2018) and applied here is unique within the open economy literature in terms of modeling taxes/subsidies on inflows and outflows with a large set of assets. Notable papers that analyze capital controls within general equilibrium models include Bianchi (2011), who studies a small open economy with a single asset that yields a constant (world) return, and Farhi and Werning (2014), who model capital controls using a tax/subsidy specification, but who study a deterministic environment and a single asset. We view the complete markets specification in this model as a natural and interesting benchmark for two reasons. One is that there are many ways in which markets can be incomplete; so analyzing complete markets provides a baseline that is informative in its own right and provides context for assessing a broad array of incomplete markets models. Another reason is that complete markets capture the spirit of the very complex asset trades observed in actual economies, and can handle many more assets than can be accommodated in a tractable incomplete markets model.

A significant challenge with complete markets, however, is that the continuous state-space formulation we specify means each country has an infinite dimensional portfolio decision to solve each period. In the next subsection we show how the solution to a particular pseudo-social planner's problem corresponds to the competitive equilibrium of our complete markets economy, which makes computation of the equilibrium tractable.

Stationarity is achieved by scaling all growing variables with the stochastic world trend Z_{t-1} to obtain an intensive form version of the model.

The large number of state variables (23) leads us to use perturbation methods, which requires

a unique non-degenerate deterministic steady-state. We therefore make some assumptions to ensure that this holds. We begin with the Euler equations for state-contingent assets, which imply:

$$\left(\frac{C_{jt+1}/N_{jt+1}}{C_{Rt+1}/N_{Rt+1}}\right)\left(\frac{C_{Rt}/N_{Rt}}{C_{jt}/N_{jt}}\right)=\frac{1-\tau^B_{jt+1}+\Psi_{jt+1}}{1-\tau^B_{Rt+1}+\Psi_{Rt+1}}=\zeta^B_{jt+1}. \tag{7}$$

Since the ratio of the international distortions of two regions appears on the right-hand side of the equation, we normalize the international distortion for the ROW to one such that

$$\left(\frac{C_{jt+1}/N_{jt+1}}{C_{Rt+1}/N_{Rt+1}}\right)\left(\frac{C_{Rt}/N_{Rt}}{C_{jt}/N_{jt}}\right)=1-\tau^B_{jt+1}+\Psi_{jt+1}=\zeta^B_{jt+1}. \tag{8}$$

This means that the distortions for the U.S. and Europe are identified relative to that in the ROW.

The equation also shows that if the steady-state of τ^B_{jt+1}, is not equal to zero, then there is a long-run trend in relative aggregate consumption levels so that the deterministic steady-state distribution of consumption is degenerate (one country's share of consumption must converge to zero). Moreover, assuming that $\tau^B_{jss}=0$ for all j does not pin down a *unique* steady-state relative consumption level. Intuitively, the impediments to international capital mobility out of steady-state affect the accumulation of international assets, which in turn affects long-run consumption levels. In terms of equation (8), the *growth rate* of relative consumption is a first-order autoregressive process that converges to zero in the deterministic steady-state; the long-run *level* of relative consumption depends upon the entire sequence of realizations of the international distortion.

Analogous issues arise in multi-agent models with heterogeneous rates of time preference (see the conjecture of Ramsey (1928), the proof of Becker (1980), and the resolution of Uzawa (1968)) and in small open economy incomplete markets models. In the latter context, a suite of alternative resolutions of this issue have been proposed (see Schmitt-Grohe and Uribe (2003) for a survey and discussion). We use a variant of the portfolio adjustment cost approach, adapted to our general equilibrium complete markets setting. Specifically, for Europe and the United States, we specify an international distortion that can be decomposed into a term that represents capital controls τ^B_{jt} and an adjustment cost term Ψ_{jt}, both of which the country takes as given:

$$\zeta^B_{jt}=1-\tau^B_{jt}+\Psi_{jt}.$$

The exogenous variable τ^B follows a first-order autoregressive process with the steady-state assumed to be zero:

$$\ln\left(1-\tau^B_{jt+1}\right)=\rho^B_j\ln\left(1-\tau^B_{jt}\right)+\sigma^B_j\varepsilon^B_{jt+1}. \tag{9}$$

The adjustment cost term can be positive or negative, and satisfies the following:

$$\Psi_{jt}=\left(1-\tau^B_{jt}\right)\left[\left(\frac{C_{jt}/N_{jt}}{C_{Rt}/N_{Rt}}\frac{1}{\psi_{j0}}\right)^{-\psi_{j1}}-1\right]. \tag{10}$$

This ensures that, in the deterministic steady-state, relative consumption levels are pinned down by ψ_{j0}, with mean reversion in relative consumption levels controlled by ψ_{jt} as

$$\ln \frac{C_{jt+1}/N_{jt+1}}{C_{Rt+1}/N_{Rt+1}} = \frac{\psi_{j1}}{1+\psi_{j1}} \ln \psi_{j0} + \frac{1}{1+\psi_{j1}} \ln \frac{C_{jt}/N_{jt}}{C_{Rt}/N_{Rt}} + \frac{1}{1+\psi_{j1}} \ln \left(1 - \tau^B_{jt+1}\right). \tag{11}$$

The portfolio adjustment cost can be positive or negative because in the steady-state, relative consumption levels map one-for-one into net foreign asset positions. These parameters are identified from the data by estimating the long-run net foreign asset position of each country from the data.

Given these assumptions, there is a unique non-degenerate deterministic steady-state. We take a first-order log-linear approximation of the pseudo-social planner's problem around this point.

3.4 Pseudo-Social Planning Problem

To compute the allocations of the competitive equilibrium model, we employ a *pseudo-social planning problem* that maps into the competitive equilibrium. We call it a pseudo-social planning problem because mapping it into the competitive equilibrium requires modifying some of the equations of the standard planner's problem, as shown below. Hereafter, we refer to this as the "planning problem."

The planning problem facilitates computation substantially because it allows us to construct the equilibrium allocations while sidestepping the solution of the continuous-choice, infinite dimensional portfolio of securities for the three regions that otherwise would be required every period. The planner's first-order conditions also provide intuition for understanding how the model works, so we present a simple version of the problem here. The full mapping can be found in the Online Appendix.

The planner chooses state-, date-, and country-contingent sequences of consumption, capital, and hours worked to maximize:

$$E_0 \left[\sum_j \sum_{t=0}^{\infty} \chi^C_{jt} \beta^t \left\{ \ln \left(\frac{C_{jt}}{N_{jt}} \right) - \chi^I_{jt} \chi^H_{jt} \frac{\psi}{1+\gamma} h_{jt}^{1+\gamma} \right\} N_{jt} \right],$$

subject to a global resource constraint for each state and date:

$$\sum_j \left\{ C_{jt} + \chi^I_{jt} X_{jt} + G_{jt} \right\} = \sum_j \chi^I_{jt} A_{jt} K^{\alpha}_{jt} \left(h_{jt} N_{jt} \right)^{1-\alpha}$$

and region-specific capital evolution equations of the form:

$$K_{jt+1} = (1-\delta) K_{jt} + X_{jt} - \phi \left(\frac{X_{jt}}{K_{jt}} \right) K_{jt}.$$

The planning problem features time-varying planner weights, χ^C_{jt}. They vary over time because relative consumption across the regions will vary over time, and this time variation in the planner weights provides intuition about the international capital market distortions in the competitive equilibrium.

To capture the equilibrium model's time allocation distortion, the planner's objective function includes the term χ_{jt}^H. The planner's first-order condition maps into the competitive equilibrium first-order condition with $\chi_{jt}^H = 1/(1-\tau_{jt}^h)$.

The competitive equilibrium domestic capital allocation distortion is captured in the planner's problem with the term χ_{jt}^I. The intertemporal nature of this distortion in the equilibrium problem requires that this term appear in several places in the planner's problem. This allows us to create the equivalence between the planner's and the equilibrium's first-order conditions for investment in each region, and ensures that the time allocation first-order condition mapping is preserved:

$$1-\tau_{jt+1}^K = \frac{\chi_{jt+1}^C}{\chi_{jt}^C}\frac{\chi_{jt+1}^I}{\chi_{jt}^I}.$$

We now turn to the mapping between the international capital market distortion in the equilibrium model and the analogous objects in the planner's problem. As is well known (see Backus, Kehoe, and Kydland (1992) for an example without any distortions), separable, time-invariant utility functions and frictionless markets imply that the equilibrium allocations coincide with the planner's allocations with constant planner weights across regions.

However, when international capital markets experience time-varying τ^B, then relative consumption will change over time in the equilibrium problem, since these time-varying τ^B distort the incentives for regions to engage in international trade and asset accumulation over time. The planner's problem captures this time variation in relative consumption with time-varying planner weights, such that:

$$\frac{C_{jt}/N_{jt}}{C_{Rt}/N_{Rt}} = \frac{\chi_{jt}^C}{\chi_{Rt}^C}.$$

The equivalence between the equilibrium problem with time-varying τ^B and the planner's problem (see Online Appendix for details) implies:

$$\ln\frac{C_{jt+1}/N_{jt+1}}{C_{Rt+1}/N_{Rt+1}} = \frac{\psi_{j1}}{1+\psi_{j1}}\ln\psi_{j0} + \frac{1}{1+\psi_{j1}}\ln\frac{C_{jt}/N_{jt}}{C_{Rt}/N_{Rt}} + \varepsilon_{jt+1}^C,$$

which is the same equation (11) from the competitive equilibrium problem with $\varepsilon_{jt+1}^C = \ln\left(1-\tau_{jt+1}^B\right)$.

Thus, the mapping between the equilibrium and the planner's problem relates the international capital market distortion in the equilibrium problem to the time-variation in the planner's weights. This provides context for understanding the counterfactual experiments we conduct below. Specifically, an increase in relative consumption growth for region j, which occurs with a declining τ^B, implies an increase in the planner's weight. This in turn implies that changes in τ^B will redistribute wealth between regions in the equilibrium. Note that while eliminating the international distortion for a region means that its consumption growth will rise *relative* to the ROW, the absolute levels of consumption growth across regions will be determined as part of the entire equilibrium.

4 Implementation

The model described in the previous section has been designed to replicate data from the national income and product accounts' expenditure aggregates. This means the model can be used as an accounting framework for the observed data. This section describes how the model uses these data to identify the different distortions. It also summarizes the sources of the data, with a detailed data discussion in the Online Appendix.

A small number of structural parameters governing preferences and production are calibrated. Some distortions can be recovered, and the parameters governing their evolution estimated, without solving the model. The remaining parameters are estimated using maximum likelihood.

4.1 Using the Data and Model to Measure Distortions

Realizations of the domestic labor and capital distortions, as well as international capital market distortions, can all be measured by feeding data from the national income and product accounts' expenditure aggregates through the equilibrium of the model. Realizations of the domestic labor and international distortions are computed directly from first-order conditions without needing the general equilibrium solution of the model. The domestic capital market distortion, on the other hand, requires computing expectations of future capital returns and hence requires both estimating and solving the model.

To see this, note that under our assumption of complete markets, the overall international distortion, ζ^B_{jt+1}, can be recovered from the growth in relative consumption levels, as shown in equation (8). Estimation of equation (11) serves to both decompose ζ^B_{jt+1} into τ^B_{jt+1} and the portfolio adjustment cost Ψ_{jt+1} and estimate the parameters governing the evolution of both. Note that under the assumptions of our model, the residual in this equation—the international distortion—follows an autoregressive process and relative consumption follows an ARMA(1,1) process. Nonetheless, all that is needed to estimate the process governing the international distortion and the parameters of the portfolio adjustment cost is data on the growth in relative consumption levels. This can be done without solving the model.

The domestic labor market distortion can also be recovered and the parameters of its stochastic process can be estimated outside of the model. Specifically, using the first-order labor supply condition for the household and the optimal employment decision of the firm (2), we obtain

$$1 - \tau^h_{jt} = \frac{\varphi}{1-\alpha} h^{\gamma}_{jt} \frac{h_{jt} N_{jt}}{Y_{jt}} \frac{C_{jt}}{N_{jt}}. \tag{12}$$

Specifically, given data on consumption, population, hours worked, and output, and given values for the production and preference parameters, realizations of the labor distortion are recovered and used to estimate its stochastic process. Note that it is not possible to separately identify the level of the

labor distortion from the preference for leisure parameter φ, which in principle could also vary across countries. Hence, we normalize the leisure parameter to 1 for all countries, and we focus on changes in the levels of these distortions over time.

Lastly, the domestic capital distortion is determined from the Euler equation for the household, the optimal capital decision of the consumer good firm (3), and the optimality conditions of the capital goods firm (4) and (5). Denoting by $i_{jt+1} = I_{jt+1}/K_{jt+1}$ the ratio of investment to the capital stock, we obtain the domestic capital distortion from

$$1 = E_t \left[\beta \frac{C_{jt+1}/N_{jt+1}}{C_{jt}/N_{jt}} \left(1 - \tau^K_{jt+1}\right) \frac{\alpha \frac{Y_{jt+1}}{K_{jt+1}} + \frac{1-\delta-\phi(i_{jt+1})+\phi'(i_{jt+1})i_{jt+1}}{1-\phi'(i_{jt+1})}}{\frac{1}{1-\phi'(i_{jt})}} \right]. \tag{13}$$

Note that we can't separately identify the level of the domestic capital distortion from the level of the discount factor. We therefore focus on changes in the levels of these distortions. Unlike the labor and international distortions, this requires computing an expectation, which in turn requires the solution of the model and estimation of the processes governing the evolution of all exogenous variables. We also estimate the initial capital stock of each country.

4.2 Data, Model Solution, and Model Estimation

Recovering the wedges requires national accounts data, including output Y_{jt}, consumption C_{jt}, investment I_{jt}, and net exports NX_{jt}, and requires data on population N_{jt} and hours worked h_{jt}, for each of the three regions. We use the dataset constructed in Ohanian, Restrepo-Echavarria, and Wright (2018).

We solve the model numerically by taking a first-order log-linear approximation of the model around its deterministic steady-state, which is well defined given the portfolio tax. There are 68 model parameters. This section describes how some parameters are calibrated to standard values in the literature and others are estimated by maximum likelihood using the Kalman filter. For the welfare calculations of Section 6 we use a second-order approximation.

The empirical values of the portfolio adjustment cost are constructed using relative consumption growth rates across regions, and thus do not depend on any other model features.

The parameters governing preferences and production are constant across countries. Of these common parameters (collected in Table 1), six are calibrated to standard values, while a seventh is a normalization. Specifically, the output elasticity of capital in the Cobb-Douglas production function α is 0.36, the discount factor β is 0.96, and the depreciation rate δ is 7 percent per year. These are all standard values. The curvature for the disutility of labor γ is set to 1.5, which implies a Frisch elasticity of labor supply of two-thirds. This value strikes a balance between estimates of labor supply elasticities using micro data on the intensive margin, using micro data on the extensive margin, and using aggregate data (see the surveys by Pencavel (1987), Keane (2011), and Reichling and Whalen

Table 1: Common Parameter Values

Parameter	Notation	Value
Preferences		
Discount Factor	β	0.96
Frisch Elasticity of Labor Supply	$1/\gamma$	2/3
Preference for Leisure	φ	1
Production		
Output Elasticity of Capital	α	0.36
Depreciation Rate	δ	0.07
Adjustment Cost Size	ν	5.5
Adjustment Cost Reference Level	κ	0.09

(2012)). As is evident from equation (12), we cannot separately identify the household's preference for leisure φ from the long-run labor distortion τ^h_{jss}, so we normalize φ to 1. We therefore focus on analyzing changes in this wedge over time.

As is standard in the investment adjustment cost literature, the parameter κ is set such that adjustment costs are zero in the steady-state, or $\kappa = (\delta + z_{ss} - 1)$. The adjustment cost scale parameter ν is chosen to generate a value for the elasticity of the price of capital with respect to the investment-capital ratio, $\nu\kappa$. Bernanke, Gertler, and Gilchrist (1999) use a value of 0.25 for this elasticity for the United States and argue that the range of plausible values is from 0 to 0.5. We use 0.5 as our benchmark.

The remaining parameters govern the evolution of population, productivity, and government spending; the domestic labor, capital, and international distortions; the portfolio tax; and the initial levels of capital in each country.

The steady-state growth rate of the the world economy is 2 percent per year: $z_{ss} = \pi_{ss}^{1/(1-\alpha)}\eta_{ss} = 1.02$.

Given our detrending approach the model is estimated using the *growth rates* of the data. To ensure that the estimated model produces *levels* of hours worked, capital, and productivity that are consistent with the data, we set the steady-state labor distortion to match the sample average level of hours worked and the steady-state of the domestic capital distortion to match capital-to-output ratios from our benchmark capital series, and estimate the steady-states and persistence of the productivity processes from our benchmark productivity series. All other parameters are estimated using maximum likelihood.

The linearized equations form a state-space representation of the model. The Kalman filter computes the likelihood and generates the paths of the wedges. Table 2 presents the estimated parameters.

Table 2: Country-Specific Parameter Values

Process	Region	Steady State	Persistence	Standard Deviation
Population	United States	η_{ss} =0.84	ρ_U^n =1	σ_U^n =0.003
	Europe	n_{Ess} =0.77	ρ_E^n =0.99	σ_E^n =0.002
	Rest of World	n_{Rss} =0.82	ρ_R^n =0.98	σ_R^N =0.003
Productivity	United States	π_{ss} =1.01	ρ_π =1	σ_π =0.08
	Europe	a_{Ess} =0.74	ρ_E^a =0.99	σ_E^a =0.02
	Rest of World	a_{Rss} =0.52	ρ_R^a =0.99	σ_R^a =0.03
Government Distortion	United States	g_{Uss} =0.18	ρ_U^g =0.94	σ_U^g =0.03
	Europe	g_{Ess} =0.20	ρ_E^g =0.20	σ_E^g =0.03
	Rest of World	g_{Rss} =0.13	ρ_R^g =0.13	σ_R^g =0.10
Domestic Labor Market Distortion	United States	τ_{Uss}^h =1.93	ρ_U^h =0.99	σ_U^h =0.04
	Europe	τ_{Ess}^h =1.91	ρ_E^h =0.99	σ_E^h =0.03
	Rest of World	τ_{Rss}^h =1.79	ρ_R^h =0.99	σ_R^h =0.02
Domestic Capital Market Distortion	United States	τ_{Uss}^k =0.94	ρ_U^K =0.99	σ_U^K =0.03
	Europe	τ_{Ess}^k =0.94	ρ_U^h =0.99	σ_U^K =0.27
	Rest of World	τ_{Rss}^k =0.98	ρ_R^h =0.99	σ_R^K =0.01
International Distortion	United States	τ_{Uss}^B =0	ρ_U^B =0.93	σ_U^B =0.02
	Europe	τ_{Ess}^B =0	ρ_E^B =0.93	σ_E^B =0.01
Portfolio Tax	United States	ψ_{U0} = 1.95	$1-\psi_{U1}$ =0.94	—
	Europe	ψ_{E0} = 1.46	$1-\psi_{E1}$ =0.97	—

Notes: Appendix C contains more details on the estimation.

5 Model-Inferred Distortions

This section presents the model distortions, which pinpoint the precise margins-the allocation of time between market and non-market activities, and the allocation of resources between consumption and investment at home and abroad-that drive observed capital flows and other variables. We discuss how these model-constructed distortions align with actual policies, with a focus on capital controls and labor income and consumption taxes.

5.1 International Capital Market Distortions

We begin with Figure 1, which shows capital flows across the three regions. These data provide context for interpreting the international capital market distortions presented below.

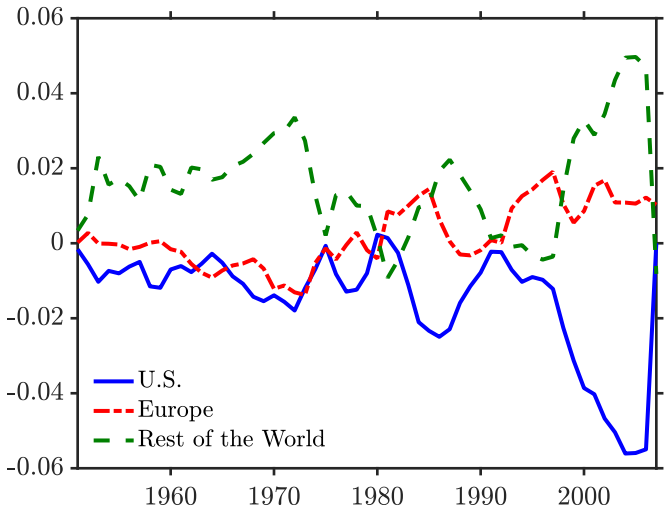
Capital flows were small during Bretton Woods, which is surprising given that much of the 1930s and 1940s was a period of limited capital mobility that coincided with the large shocks of the Great Depression and World War II. This suggests the possibility of strong accumulated incentives to move global capital after World War II. Moreover, TFP and GDP growth across these regions was very different during Bretton Woods, as Europe and the ROW grew much faster than the U.S. This suggests another factor incentivizing global capital flows during Bretton Woods.

To provide evidence on the size of capital flows that did occur during Bretton Woods, we note capital flows were much higher during the late 19th and early 20th centuries, the period known as the "Golden Age of International Finance." Capital controls were largely absent in this era and capital flows were much higher, ranging from inflows as high as nearly 8 percent of GDP per year between 1880 and 1913, and outflows that averaged nearly 5 percent of GDP per year over the same period (see Ohanian and Wright (2010)).

The model economy reproduces the small observed capital flows during Bretton Woods with significant international capital market distortions, which are measured based on relative consumption growth. The left panel of Figure 2 shows the consumption of the U.S. and Europe relative to that of the Rest of the World. Note in particular the very steep and large decline in U.S. per capita consumption relative to the ROW, which falls nearly 50 percent during Bretton Woods. This rapid and large change in relative consumption is puzzling, ceteris paribus, given standard consumption-smoothing motives. The middle panel of Figure 2 shows raw and Hodrick-Prescott-smoothed relative consumption growth for the U.S., which is negative (as it is for Europe, although not depicted in the graph) during Bretton Woods.

The right panel of Figure 2 shows raw and Hodrick-Prescott-smoothed international capital market distortions for the U.S. and Europe, constructed using their relative consumption growth rates. The main feature of the right panel is the rising distortion to importing capital in the U.S., which increases

Figure 1: Capital Flows (Net-Exports %GDP)



to nearly 2.5 percent in the smoothed data and is significant compared to the steady-state return to investment. Moreover, this distortion is a tax that applies to the entire stock of foreign assets.

The international distortion redistributes consumption across regions. Equation 8 shows that higher values of τ^B imply that both the U.S. and Europe are worse off relative to the ROW, because their consumption is growing at a slower rate due to the tax on foreign borrowing.

The figure shows that during Bretton Woods, both the U.S. and Europe faced international capital market distortions that on average made capital inflows more expensive, while after 1973 τ_j^B declined, with capital flowing back into the U.S. (see Figure 1).

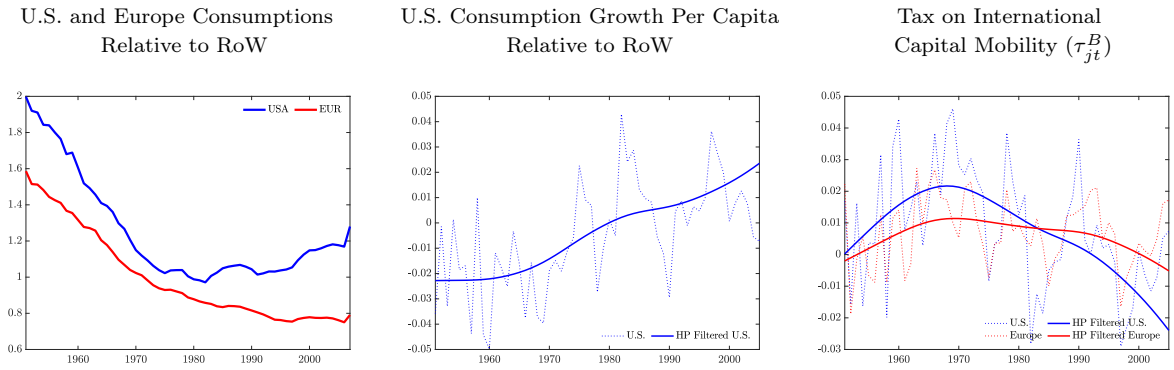
We will see that removing these distortions during Bretton Woods in a counterfactual experiment will lead to substantial capital inflows to the U.S., which is exactly what the U.S. wanted to prevent when it designed the Bretton Woods system with capital controls.

This analysis interprets the model-inferred international capital market distortions as capital control/regulatory policies that affect the incentives and/or opportunities to move capital internationally. To assess their empirical plausibility, we compare the model's measure of international capital market distortions to actual capital control policies implemented at the country level.

We proceed as follows. We first recover the τ^B for the U.S. and the three biggest Western European countries (U.K., France, and Germany), and compare them to actual changes in capital control policies (*de jure* capital controls) that were implemented to affect international capital flows. We chose these countries because of their size and because they have received considerable attention in the literature.

Next, we identified all the capital control policies in these four countries cited in the international

Figure 2: Relative Consumption and International Capital Market Distortions



capital controls literature as represented by the following set of papers: Bordo (2020), Chinn and Ito (2008), Ghosh and Qureshi (2016), Fernandez et al. (2016), and Ilzetzki, Rheinhart, and Rogoff (2019)). These studies describe 37 separate international capital control/regulatory policies across these four countries.

Then, for each country, we (i) graph its model τ^B over time, (ii) indicate each policy by name at the date of implementation marked by an arrow on the graph, and (iii) describe the intention of each policy, specifically whether it was to discourage capital inflows or to discourage capital outflows.

If the actual policy changes had quantitatively large enough effects on capital flows, then we expect to see a corresponding change in τ^B in the intended direction of the actual policy change.

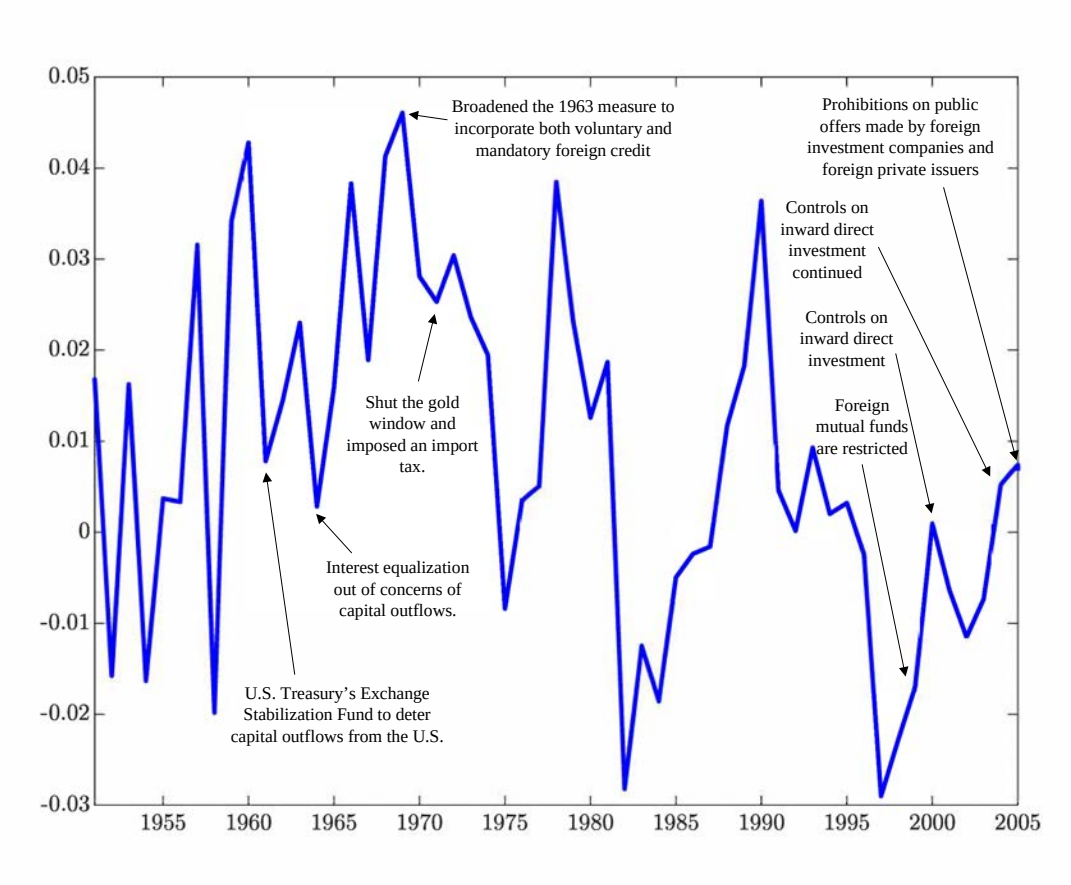
We will show that the model's measure of capital controls (τ^B) changes, often substantially, when the policies are implemented, and they almost always change in the direction of the intention of the actual policy change. A policy intended to discourage inflows will align with an increase in τ_U^B, and one intended to discourage outflows will align with a decrease in τ_U^B.

United States Figure 3 shows τ_U^B between 1950 and 2007. This corresponds to the dotted line in the right-hand panel of Figure 2. We found eight major U.S. international capital flow policies within the literature for comparison. In 1961 the U.S. Treasury's Exchange Stabilization Fund was created to deter capital outflows. The implementation of this policy coincides with a large drop in τ_U^B at that time, which represents a disincentive to capital outflows in the model. In 1963, an interest equalization policy was implemented, reflecting concerns about capital outflows, which coincides with a decline in τ_U^B.

In 1969, a policy that broadened the 1963 policy with an interest equalization measure to incorporate mandatory foreign credit restraints was implemented to discourage capital inflows. This measure coincides with an increase in τ_U^B, which is a disincentive to capital inflows. In 1971, the U.S. gold

window was closed and an import tax was imposed. This coincides with a positive (albeit lower) τ_U^B, which is a disincentive to capital inflows.

Figure 3: Estimated versus Implemented Capital Controls in the United States



In 1999 foreign mutual funds are restricted. This restriction applies to nonresident issuers that are defined as investment companies under the Investment Company Act. Also, the Johnson Act prohibits—with certain exceptions—persons within the United States from dealing in financial obligations or extending loans to foreign governments (with the exception of World Bank and IMF members) that have defaulted on payments of their obligations to the U.S. government. These policies institute controls on capital outflows and as such our measure of capital controls is negative during this period (although increasing).

In 2000, laws on inward direct investment apply to purchases in the United States by nonresidents. These are controls on capital inflows and as such our measure goes from negative to zero in that period.

These measures were reinforced in 2004, reflecting a more positive τ_U^B.

In 2005, public offers made in the United States or to U.S. residents by foreign investment companies are prohibited under the Investment Company Act, unless an order from the Securities and Exchange Commission authorizing such offers is first obtained. This constitutes a control on capital inflows and as such our τ_U^B is positive.

This shows that the intention of all of the U.S. policies identified within the capital controls literature matches up with the change or level in the U.S. τ_U^B.

France Figure 4 shows the τ^B for France together with several policy changes. In 1957 France changed the method of monetary control to credit ceilings to prevent capital inflows by placing a cap on borrowing. This policy corresponds to a high value in τ_U^B for France, which disincentivizes capital inflows. In 1959 there was a return to current account convertibility, meaning that people could receive and convert into local currency resources sent from abroad. This reflects an easing of controls on capital inflows and is captured by a lower international distortion in our model. In 1962 France abolished its "devises-titres" policy, which facilitated cross-border financial transactions in order to deter capital outflows. This corresponds to a decline in τ_U^B, which disincentivizes capital outflows. In 1963 French banks stopped paying interest on all foreign deposits. This policy discouraged capital inflows and coincides with an increase in τ_U^B, which disincentivizes inflows. In 1965, France prohibited interest payments on non-resident deposits and on loans by non-residents to residents to deter capital inflows, and this policy coincides with an increase in τ_U^B.

In 1968-69, France reimposed outflow controls, which coincides with a decline in τ_U^B, which is consistent with the policy of disincentivizing outflows. In 1969, the "devises-titres" market was re-established, making cross-border financial transactions more complicated. This in principle might encourage capital outflows and discourage inflows and our model accurately captures this with an increase in τ^B.

In 1973 there was a tightening of capital controls to prevent speculative capital outflows, and this accurately lines up with a decrease in τ^B. In 1974 controls on inflows, including 100 percent reserve requirements on new non-resident franc deposits, were implemented, and there is a slight increase in τ^B, consistent with discouraging inflows in the model. In 1982 exchange rate controls were adopted to prevent devaluation of the franc, and this corresponds to a low τ_U^B, which deters capital outflows. Finally, most outflow controls were lifted in 1986 and this coincides with an increase in τ^B.

In 1999 authorization was required for investments in areas pertaining to public order and defense and the liquidation proceeds of foreign direct investment in France could be freely transferred abroad. These two policies are a tightening on capital inflows and this is reflected in an increase in τ^B.

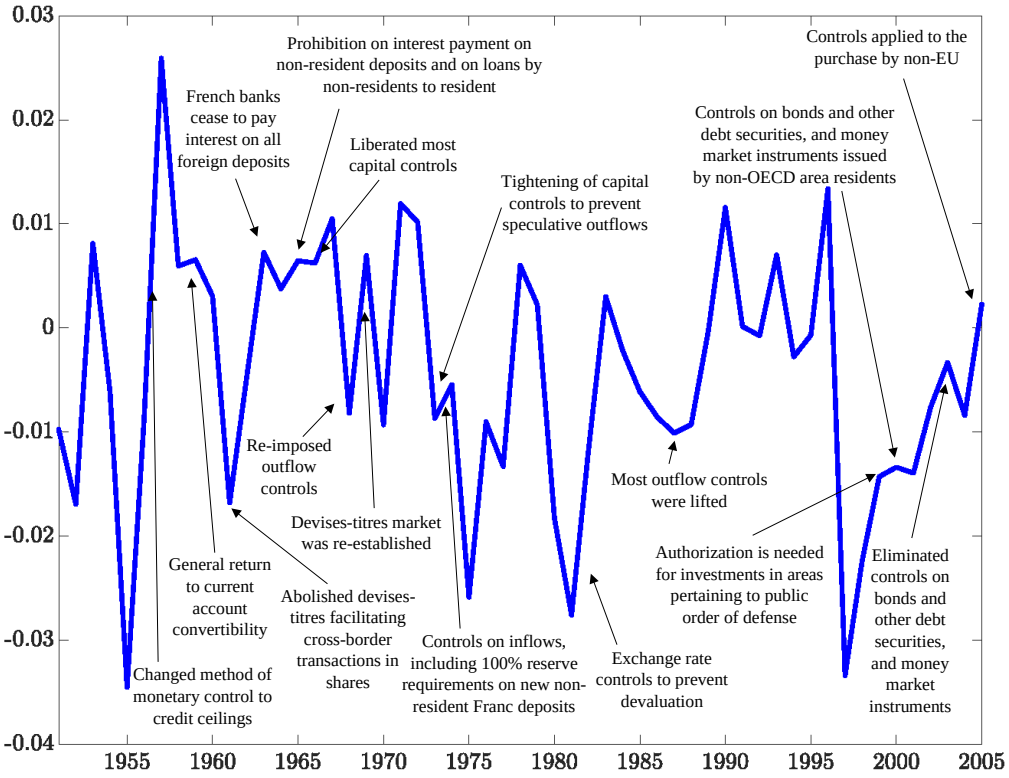
In 2000 France imposed controls on bonds and other debt securities as well as money market in-

struments issued by non-OECD area residents. These in principle reflect a control on capital outflows, and our measure of capital controls is negative, though it is slightly increasing.

In 2003, controls on shares, bonds, money market instruments, or other securities of a participating nature issued by non-OECD residents no longer applied. This is a loosening of capital controls on outflows and as such these policies are captured by an increase in our τ^B.

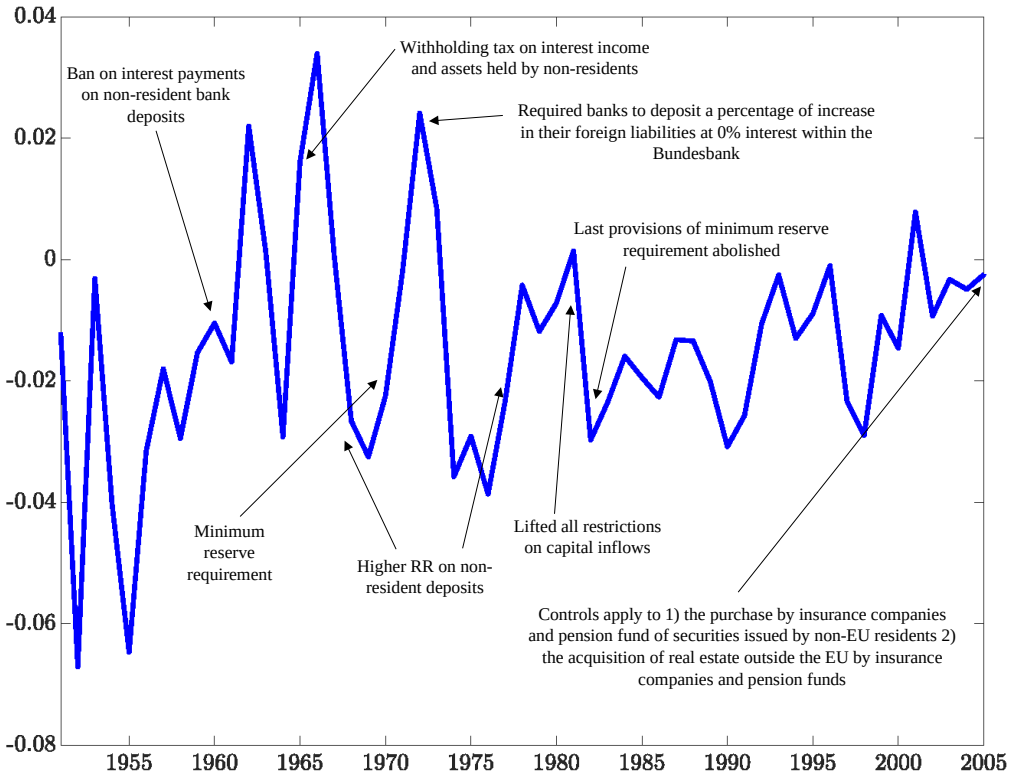
In 2005 France imposed controls on the purchase by non-EU residents of securities not quoted on a recognized securities market that may be affected by laws on inward direct investment and establishment as well as on the issuance of certificates of deposit by non-resident banks and to foreign collective investment securities. This constitutes a control on capital inflows and it is captured by an increasing and positive τ^B.

Figure 4: Estimated versus Implemented Capital Controls in France



Germany Figure 5 compares τ^B for Germany with observed German capital control policies. In 1960 Germany imposed a ban on interest payments on non-resident bank deposits, discouraging capital inflows, and this coincides with an increase in τ^B. In 1965 Germany implemented a withholding tax on interest income and assets held by non-residents, again deterring capital inflows, which corresponds to a high τ^B in the model. In 1981 Germany lifted all restrictions on capital inflows, which coincides with a peak in our τ^B.

Figure 5: Estimated versus Implemented Capital Controls in Germany

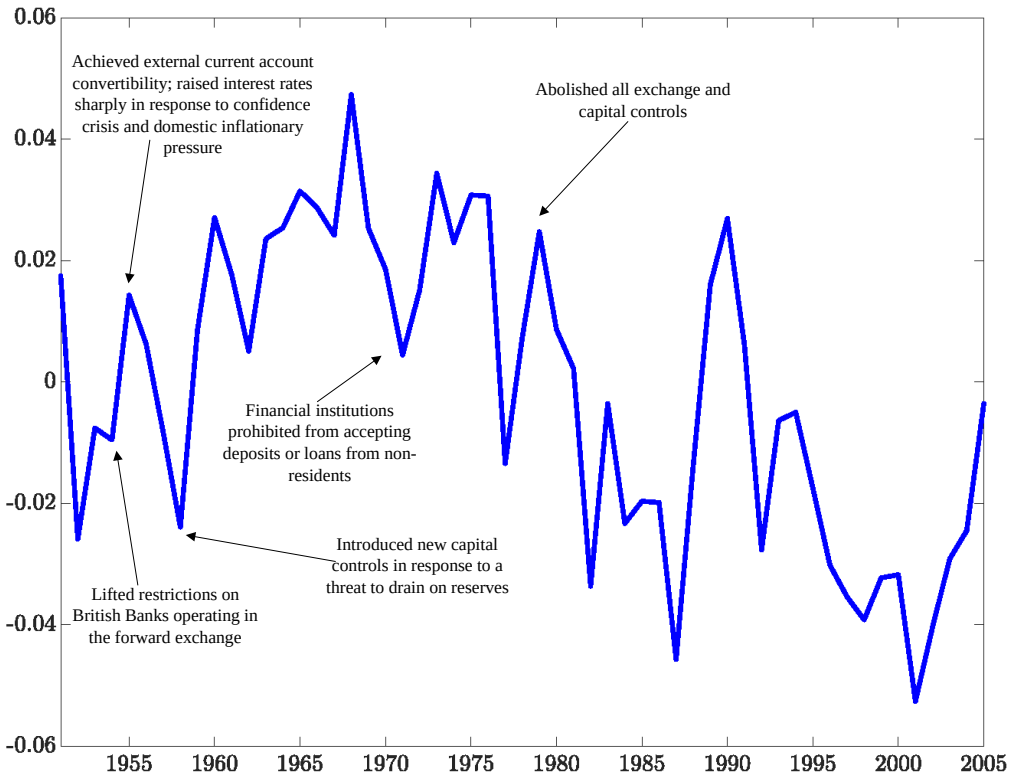


In 1969 and 1977 Germany imposed a higher reserve requirement on non-resident deposits and in 1972 it required banks to deposit a percentage of the increase in their foreign liabilities at 0 percent interest within the Bundesbank. These are all policies that deter capital inflows, and our model identified the ones of 1972 and 1977 as such, though not the 1969 policy.

At the begining of the 1980s Germany lifted restrictions on capital inflows and this is correctly reflected in a drop in τ^B.

In 2005 controls were imposed on the purchase by insurance companies and pension funds of (1) securities issued by non-EU residents if these assets are to form more than 5 percent of their guaranteed assets or more than 20 percent of their other restricted assets, and (2) shares not quoted on an EU stock exchange if these assets are to form more than 6 percent of their guaranteed assets or more than 20 percent of their other restricted assets. Also, Germany imposed controls on the acquisition of real estate outside the EU by insurance companies and pension funds if the assets in question are to form more than 5 percent of their guaranteed assets or more than 20 percent of their other restricted assets. These are controls on capital outflows, and in our model, they correspond to a negative, albeit slightly increasing τ^B.

Figure 6: Estimated versus Implemented Capital Controls in the United Kingdom



United Kingdom Figure 6 compares our empirical estimate of τ^B with the policies implemented in the United Kingdom to impede international capital mobility. In 1954 the U.K. lifted restrictions on British banks operating in the forward exchange market. In 1955 the U.K. achieved external current account convertibility and raised interest rates sharply in response to a confidence crisis and domestic inflationary pressure. In 1957 it introduced new capital controls in response to a threat to a drain on reserves, which would be aimed at preventing capital outflows, and it coincides with a low peak in our τ^B. In 1971 financial institutions are prohibited from accepting deposits or loans from non-residents. This is a direct ban on both inflows (deposits) and outflows (loans), so it is impossible to tell in which direction our empirical measure should move. This is the same as in 1979 when the U.K. abolished all exchange and capital controls: it may or may not be a wash and there is no way of knowing.

In summary, the model-inferred measures of the impediments to international capital mobility line up well with the actual policies that were implemented by the U.S., France, and Germany. In the few cases where it doesn't, it is important to keep in mind that our de facto measure of capital controls is a net measure, and it can be the case that controls on outflows are implemented to counteract controls on inflows, and vice-versa.

These findings suggest that the model-inferred τ^B's are a reasonable measure of capital controls that we will use to conduct counterfactual experiments.

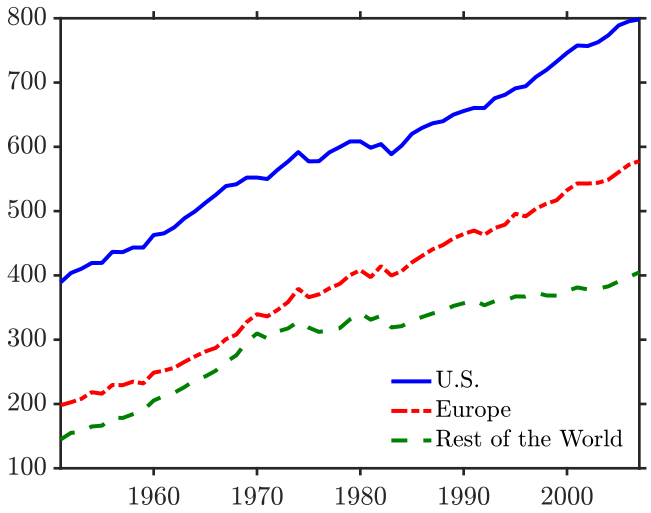
5.2 Productivity and Domestic Labor and Capital Market Distortions

Productivity and capital flows Figure 7 shows total factor productivity for the three regions (A_{jt}). The figure shows that productivity grew rapidly, particularly during the Bretton Woods era. During Bretton Woods, TFP grew 1.84 percent in the U.S.,2.7 percent in Europe, and 3.6 percent in the Rest of the World. Bretton Woods was also a period of extremely rapid real output growth, with an average annual growth rate of 3.7 percent for the United States, 4.6 percent for Europe and 7.4 percent for the Rest of the World.

These productivity and output growth patterns highlight a rapidly evolving world economy with large differences in growth rates across regions. These large differences suggest an incentive to move capital to the Rest of the World, where growth was highest. In sharp contrast, Figure 1 shows that during this period capital flows were very small and that capital moved in larger quantities to the United States, the region with the slowest growth rate.

Domestic labor market distortions Figure 8 reports the estimated labor market distortions τ^h (right panel) and per capita hours worked (left panel). Recall that a value of the labor wedge that is

Figure 7: Total Factor Productivity

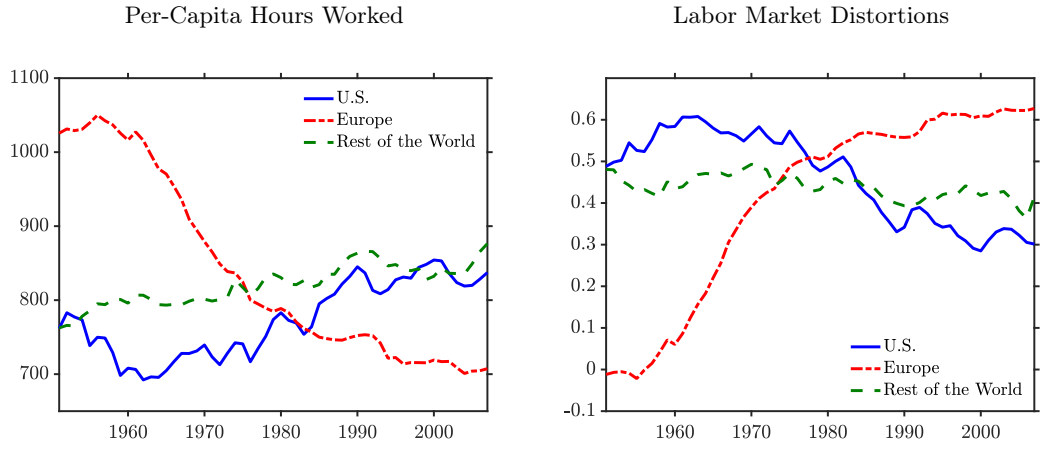


greater than zero is equivalent to a tax on labor income and coincides with employment levels lower than predicted by the model with a distortion that is equal to zero and a value less than zero coincides with relatively high employment and is interpreted as a subsidy to labor. A value of 0.4, for example, denotes a 40 percent tax rate on labor income.

To interpret this distortion, note that it reflects various factors that affect the relationship between the household's marginal rate of substitution between consumption and leisure and the marginal product of labor. These may include factors that can be affected by policy, such as labor and consumption taxes (Chari, Kehoe, and McGrattan (2007), Ohanian, Raffo, and Rogerson (2008), and Karabarbounis (2014)), employment protection laws and other restrictions on hiring or firing workers (Cole and Ohanian (2015)), unemployment benefits (Cole and Ohanian (2002)), limitations on product market competition that increase firm's monopoly power (Chari, Kehoe, and McGrattan (2007)), search and matching frictions (Cheremukhin and Restrepo-Echavarria (2014)), and possible departures from Cobb-Douglas production (Karabarbounis and Neiman (2014)) that form part of the "technology" of the economy.

Studies of taxes on labor income and consumption in European countries coincide closely with the European labor wedge. Prescott (2002) and Ohanian, Raffo, and Rogerson (2008) report that in most European countries consumption and labor taxes rose substantially between 1950 and the early 1980s and then were roughly stable on average after that. This closely mimics the pattern of the labor market distortion for Europe that shows a large increase until the mid-1970s and little movement thereafter.

Figure 8: Hours Worked and Labor Market Distortions



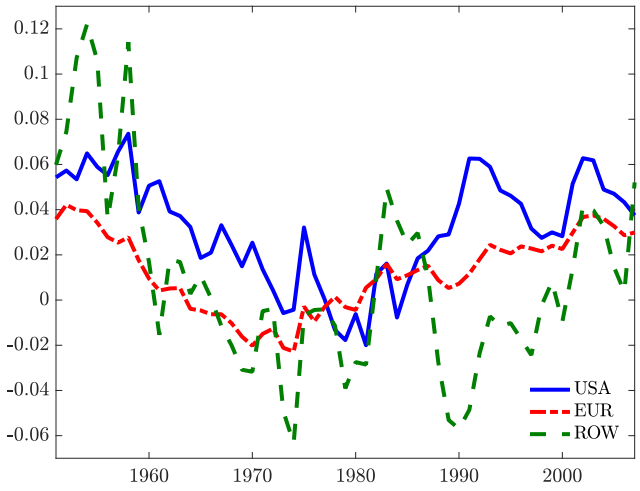
In summary, our method recovers quantitatively large movements in distortions to labor markets that plausibly coincide with important policy changes affecting labor taxes and labor market regulations in Europe.

Domestic capital market distortions Figure 9 presents the estimates of domestic capital market distortions τ^K. This distortion is identified from the Euler equation (13) and thus reflects the difference between returns to investment estimated from the marginal product of capital and the return estimated from the growth rate of consumption. Bearing in mind the caveat about the recovered levels of this distortion, under our normalization a value of 0.05 is equivalent to a 5 percent tax on capital income. This wedge may reflect capital income taxation, expropriation (Aguiar, Amador, and Gopinath (2009), financial market imperfections (Arellano, Bai, and Kehoe (2019)), and changes in financial development (Arellano, Bai, and Zhang (2012)).

The volatility of the capital wedge is decreasing across time for Europe and the Rest of the World, increasing for the U.S., and its value fluctuates around zero. The volatility of this wedge before 1973 is 49 percent and 65 percent higher for Europe and the Rest of the World, respectively, and 14 percent lower for the U.S. as compared with its relative volatility between 1973 and 2006.

In the following section, we conduct counterfactual analyses to evaluate the impact of the distortions affecting the international capital markets, domestic capital markets, and labor markets.

Figure 9: Domestic Capital Market Distortions



6 Counterfactual Analyses

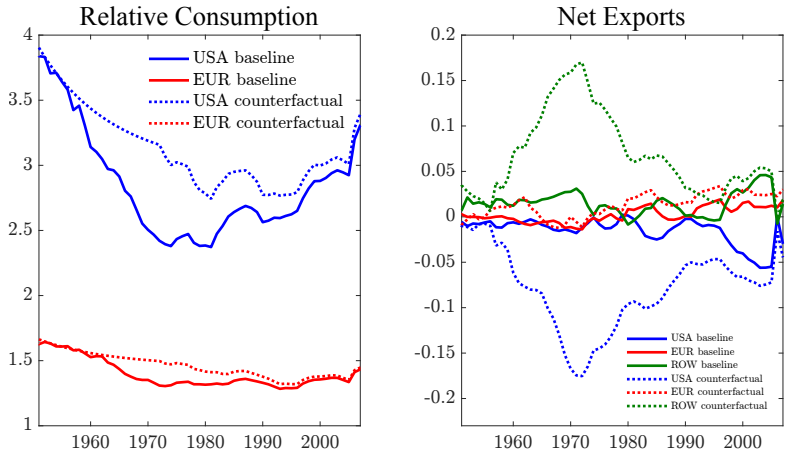
This section conducts counterfactual analyses. We first study the impact of the Bretton Woods capital controls by setting the international distortions for the U.S. and Europe, $\tau^B = 0$, to zero between 1950 and 1973, and then the process evolves stochasticaly after that. The model is re-solved so that agents' expectations are consistent with this change. This analysis thus evaluates the positive and normative effects of perfect capital mobility between 1950-1973.[1]

Recall that the paths of the international capital control distortions are identified from the consumption paths of the U.S. and Europe relative to the ROW. Therefore, implementing this counterfactual pins down these relative consumptions. The levels of the individual consumptions and all the other endogenous variables will reflect the policy change operating through *all* the equilibrium channels in the model.

The left panel of Figure 10 shows the relative consumption paths for the U.S. and Europe relative to the ROW for the benchmark/data and the counterfactual. The left panel shows net exports. We first discuss the larger changes in the U.S.

[1] This analysis indentifies capital controls and other policy-related impediments to international capital flows as the factor driving the model's international distortion. While attributing all of the international distortion to Bretton Woods capital controls omits other potential factors, the evidence presented above from country-specific policies suggests that Bretton Woods was quantitatively important in the realizations of the distortion. Moreover, interpreting this counterfactual as due to international capital control/regulatory policies is simple and can provide a benchmark for other counterfactuals that include identifiable factors other than policies.

Figure 10: Counterfactual Relative Consumption and Capital Flows



The counterfactual path for U.S. relative consumption in the figure is considerably higher than in the data/benchmark analysis during the Bretton Woods period. To understand this pattern, we begin with the planner's problem. Recall from the equivalence between the planner and the competitive equilibrium that eliminating the U.S. international wedge means increasing the planner's Pareto weight for the U.S. relative to the ROW. This means the planner allocates relatively more consumption to the U.S. and relatively less to the ROW. Interpreting higher relative U.S. consumption within the competitive equilibrium reflects relatively higher U.S. wealth. Higher U.S. wealth resulting from eliminating international capital market distortions occurs through a relative capital gain on the U.S. international asset portfolio associated with the state of perfect capital mobility. Consequently, the wealthier U.S. consumes relatively more in the counterfactual. Note that since we analyze the computationally tractable planner's problem, we do not solve for these asset portfolios.

Also note that a region (or country) can achieve higher consumption by either increasing production or importing resources (capital inflows). The way this is achieved will be determined by the other distortions and state variables in the model, which we describe below.

The right panel of Figure 10 depicts the behavior of net-exports (capital flows). The solid lines show the benchmark (observed net-exports for the U.S. and the aggregate of Europe) and the dashed lines show the counterfactual. When we remove capital controls by setting $\tau^B = 0$ during the Bretton Woods, period we can see that capital would have moved out of the Rest of the World, and in much smaller amounts out of Europe, and into the United States.

This means that to attain a higher relative consumption, the U.S. imports it through capital inflows. This is shown in Figure 11, where all plots depict the results in relative terms to the benchmark trajectory of the variable; a value of 1.1 means that the variable of interest is 10 percent higher in the counterfactual relative to the benchmark. The blue line represents the U.S., the red line stands for

Europe, and the green line for the Rest of the World.

The figure shows that the U.S. enjoys a consumption that in 1971 is 15 percent higher than in the benchmark; the U.S. decreased hours worked by up to 8 percent, resulting in an output that is between 5 and 6 percent lower. In other words, in the absence of capital controls the U.S. would have imported capital to finance consumption while reducing hours and output. In the context of the planner's problem, this corresponds to an increase in the relative planner's weights that reflect relative wealth levels.

Figure 8 and Figure 9 in the previous section show how the U.S. had domestic distortions that represented a tax on labor income and the return to capital. Because these frictions were high during the Bretton Woods era, increasing production is not worthwhile because these distortions make it costly. Therefore, in order to achieve the higher relative consumption path that is dictated by the counterfactual, it is better for the U.S. to borrow against future consumption.

Figure 11: The World Without Bretton Woods

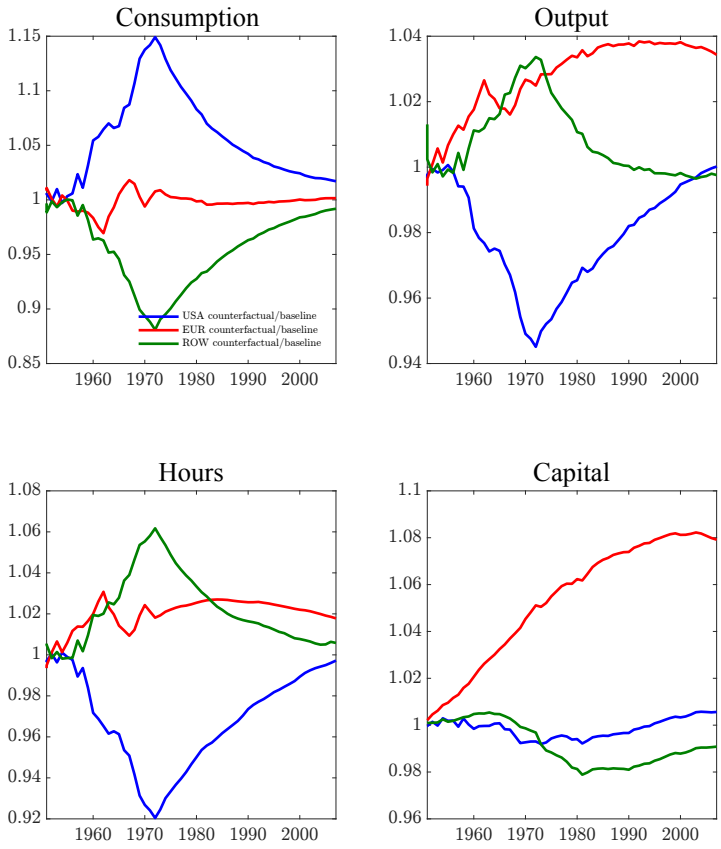


Figure 12: Counterfactual Relative Consumption and Capital Flows When U.S. Faces No Distortions

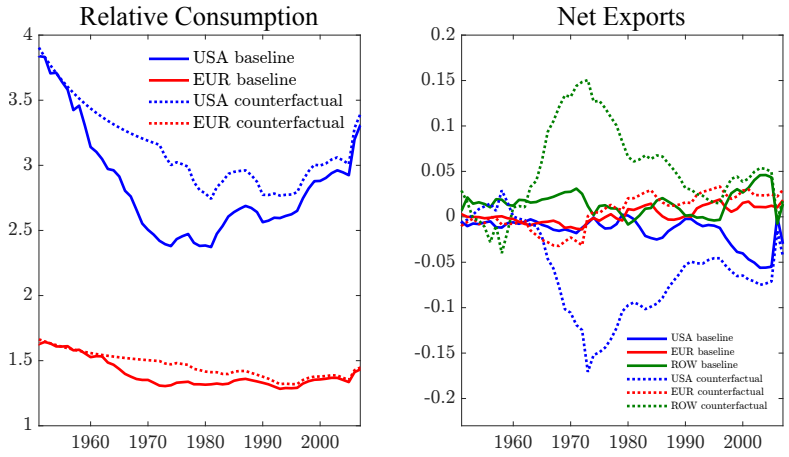
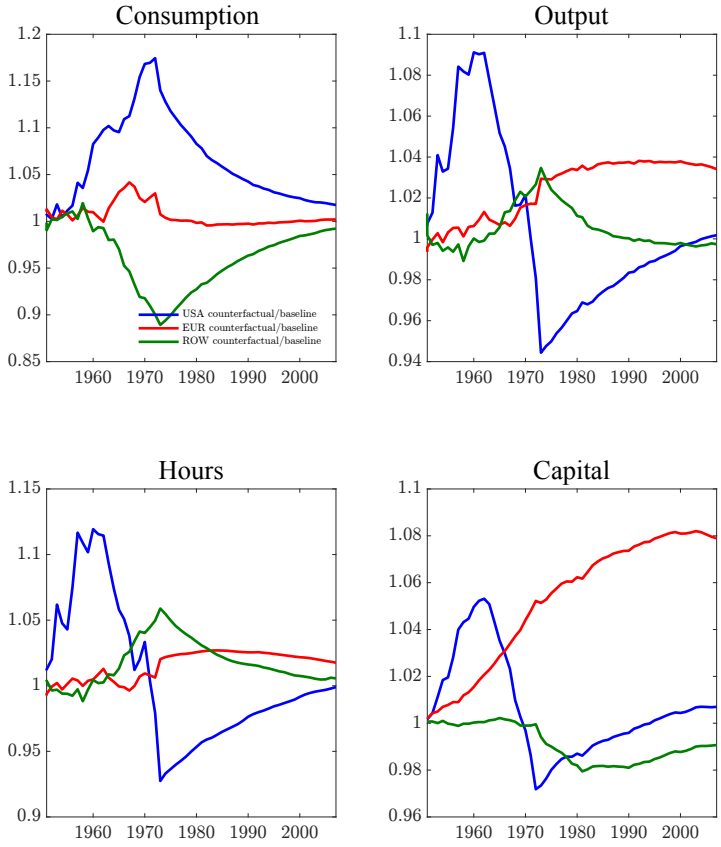


Figure 13: The World Without U.S. International and Domestic Distortions



To make this point, Figures 12 and 13 show the results for a counterfactual where we not only shut down capital controls, but we also make both the domestic labor and capital market distortions for the U.S. equal to zero from 1950 to 1973. Note that in that case, increasing production within the

U.S. is worthwhile because hours worked and the return to capital are not taxed; so the U.S. increases labor and capital to produce more output, and the capital inflows are delayed until later on in the period. So in the absence of domestic frictions the U.S. produces more to increase consumption rather than immediately importing that consumption.

Even though Europe has an international distortion with behavior fairly similar to that of the U.S., and the counterfactual implies higher consumption from 1960 onward (as for the U.S.), when we set its $\tau^B = 0$, there are no capital inflows to Europe (while there are to the U.S.). This difference also relies on the domestic market distortions. As shown in the right panel of Figure 8, Europe has a labor market distortion that is strongly increasing during the Bretton Woods era, reflecting an important increase in labor income taxes. As a result, and due to the complementarity between labor and capital, the labor market distortion prevents capital from flowing into Europe, since labor is scarce, which in turn depresses the productivity of capital. This result is consistent with what we have found in our previous work (see Ohanian, Restrepo-Echavarria, and Wright (2018)). Instead, to attain the higher levels of relative consumption implied by the counterfactual, Europe increases hours worked and investment to accumulate more capital and produce more output than it consumes.

Our counterfactual exercise implies capital inflows that reach a magnitude of about 18 percent of GDP right around 1970. At first, this might sound like an implausibly large amount. However, when looking back in history, we can see that global capital flows averaged around 4 percent in the late 19th century rising to 7 percent before the first world war. At the country level, Argentina had flows of 18.7 percent of GDP in the late 1870s, Finland of 14.2 percent between 1914 and 1918, Australia of 12.8% between 1927 and 1931, France of 11.7 percent between 1919 and 1926, and Italy of 11.7 percent between 1914 and 1918. Therefore, the size of U.S. capital flows under the counterfactual experiment of perfect capital mobility during Bretton Woods are similar to those experienced by countries during the "Golden Age" of capital flows.

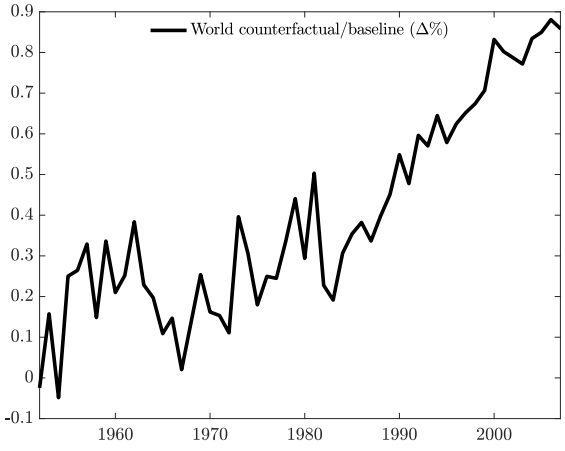
We find that these controls have very large effects on output and welfare. Figure 14 shows that the effects on world output oscillate between 0 and 0.9 percent of GDP, meaning that had there been no capital controls between 1950 and 1973, world output could have been as much as 0.9 percent larger. Table 3 shows the welfare effects from a consumption-equivalent perspective. The ROW had about 5.55 percent higher welfare in consumption-equivalent units for the 1950-1972 period, while Europe had a perpetual consumption-equivalent welfare loss of about 1.27 percent, and the loss for the U.S. was about 2.78 percent in consumption-equivalent units under the capital controls imposed by Bretton Woods. When we consider the whole period (1950-2007), losses were smaller for the U.S. and Europe because they saw a slower consumption rundown after the Bretton Woods era.

Table 3: Welfare Effects of Bretton Woods

Region	Consumption Equivalent	
	1950-1972	1950-2007
	(1)	(2)
U.S.	-2.78%	-2.40%
Europe	-1.27%	-1.09%
Rest of the World	5.55%	4.80%

Notes: Column (1) presents the change in consumption equivalent after shutting down the international wedge for the period 1950 to 1972, while making it coincide with the baseline's wedge thereafter. Column (2) shows the change in consumption equivalent after shutting down the international wedge for the entire period (1950 to 2007).

Figure 14: Effects of Capital Controls on World Output



To understand why setting the international distortions to zero raises U.S. welfare but reduces ROW welfare, it is useful to consider that in the pseudo-social planner's problem, the negative of the international distortions ($-\tau_j^B$) is approximately equal to the innovation in the planner's Pareto weight. Thus, reducing τ_U^B corresponds to an increase in the planner's Pareto weight for the U.S., which relatively shifts resources from the ROW to the U.S., resulting in higher U.S. consumption and lower US labor supply, and lower ROW consumption and higher ROW labor supply.

Put somewhat differently, the observed rapid and large drop in U.S. consumption relative to the ROW during the Bretton Woods period suggests these policies significantly depressed U.S. welfare, based on consumption-smoothing motives alone. This raises the important question of why the U.S. had promoted these controls in the first place, which we discuss in the following section.

7 Why Did the U.S. Want Capital Controls?

Bretton Woods' goal was to support international economic and political stability through regulations that governed international trade, payments, and currency values. Bretton Woods immediately followed one of the most politically and economically unstable 30-year periods in modern history, a three-decade span that included two world wars, a pandemic, the Great Depression, and trade wars.

This section focuses on the U.S.'s goals to support economic reconstruction and international economic growth and promote stability of ally governments to protect against future hostilities with other nations. We will describe how the two major architects of Bretton Woods, Harry Dexter White of the U.S. and John Maynard Keynes, were very concerned that free-flowing international capital could endanger these goals and that capital controls were implemented with these concerns in mind.

The evidence and discussion presented in this section provide context for interpreting the welfare results that show that the U.S. would have been significantly better off had the Bretton Woods capital controls not been adopted. We will describe how the U.S. was willing to adopt capital control policies that significantly depressed U.S. welfare within a standard, open economy growth model, to promote broader international economic and political stability goals. The evidence shows that the U.S. (i) was very concerned about international capital flight from other countries, (ii) that capital flight would damage economic and political stability in these countries, (iii) that developing countries were particularly vulnerable to capital flight, and (iv) that foreign capital would likely come to the United States. The U.S. concerns from that time that significant international capital would flow from developing countries to the U.S. dovetails with our model findings.

We therefore interpret the Bretton Woods capital controls as a tool to preserve economic and political stability in ally countries. We find that the implicit value of capital controls is large, and perhaps plausibly so, given the literature's views about the U.S.'s ambitious foreign policy goals, and given the size of U.S. military spending during Bretton Woods. The welfare costs of the Bretton Woods capital controls calculated here thus provide the first quantification (to our knowledge) of U.S. international policy choices relating to the economic and political stability of other countries.

Economic views of capital controls in the 1940s The key concern for both White and Keynes was that capital flows could destabilize a country by draining it of investment funds, which in turn could weaken the country's economy and political stability. They viewed capital controls as being useful for several reasons, including economic reconstruction of ally countries after the war, the desire to support developing countries and keep capital in those economies, and the desire to keep unaligned countries from politically aligning with hostile countries, notably Nazi and communist countries.

White described the essence of capital controls as follows:

> [A capital control cooperation provision's] acceptance would go a long way toward solving one of the very troublesome problems in international economic relations, and would remove one of the most potent disturbing factors of monetary stability. Flights of capital, motivated either by prospect of speculative exchange gain, or desire to avoid inflation, or evade taxes or influence legislation, frequently take place especially during disturbed periods. Almost every country, at one time or another, exercises control over the inflow and outflow of investments, but without the cooperation of other countries such control is difficult, expensive, and subject to considerable evasion.

The design of the Bretton Woods capital controls was based on White's and Keynes's views on capital flows during the 1920 s and 1930 s. Both White and Keynes agreed that capital flows during this period were "speculative,"and that capital flight had exacerbated economic crises during these periods. They believed that capital flows needed to be controlled during periods of instability and recovery, such as the reconstruction period after World War II, though Keynes viewed controls as being a permanent requisite for stability.

A primary goal of capital controls was promoting the reconstruction of devastated countries and the economic development of poor nations. White viewed capital controls as protecting these countries from capital flight:[2]:

> Even more harmful than exchange disturbances is the steady drain of capital from a country that needs the capital but is unable for one reason or another to offer sufficient monetary return to keep its capital at home. The assumption that capital serves a country best by flowing to countries which offer most attractive terms is valid only under circumstances that are not always present.

For both White and Keynes, the interwar period contained several episodes of what both considered to be destabilizing capital flows, including the French capital flight in 1925 and 1926, the 1931 Austrian banking crisis, and related crises in Germany and in the U.S. This led White to write as follows:[3]:

> There has been too easy an acceptance of the view that an enlightened trade and monetary policy requires complete abandonment of controls over international economic transactions. There is a tendency to regard foreign exchange controls, or any interference with the free movement of funds and of goods as, ipso facto, bad. This view is both unrealistic and unsound. It ignores the fact that there are situations in which many countries frequently find themselves, and which all countries occasionally meet, that make inevitable the adoption

[2]International Monetary Fund. (1996). "The White Plan", in IMF History Volume 3 (1945-1965): Twenty Years of International Monetary Cooperation Volume III: Documents USA: INTERNATIONAL MONETARY FUND.

[3]International Monetary Fund. (1996). "The White Plan,"in IMF History Volume 3 (1945-1965): Twenty Years of International Monetary Cooperation Volume III: Documents. USA: INTERNATIONAL MONETARY FUND.

> of controls of one character or another. There are times when it is in the best economic interests of a country to impose restrictions on movements of capital, and on movements of goods. There are periods in a country's history when failure to impose exchange controls, or import or export controls, have led to serious economic and political disruption.

American concerns with capital flight from developing countries prior to World War II influenced the Bretton Woods agreement. In 1939 American Treasury officials and Latin American officials actively worked on the creation of an Inter-American Bank (IAB) to halt capital flight from Latin America. Assistant Secretary of State Adolf Berle believed capital outflows from Latin America to the U.S. were largely responsible for the lack of capital in Latin America, and White was concerned about the rapid increase in Latin American capital coming into the U.S. in the 1930 s (see Helleiner (2014)).

By the early 1940s, the U.S. was actively promoting capital controls in Latin American countries, reflecting the extreme volatility these countries experienced from agricultural production. The view was that open markets and limited regulation were dangerous for developing economies, which often were highly open economies that exhibited large output fluctuations outside of their control. Robert Triffin wrote[4]:

> We often lose sight of the fact that the general attitude taken in this country with respect to exchange controls may be related to the peculiar circumstances of our own economy and does not take into consideration the fundamentally different characteristics of other economies, more dependent on international transactions and subject to violent disruptions associated with quasi monoculture. In other words, we tend to generalize and give universal validity to rigid principles derived from familiarity with conditions specific to the United States or at least to highly developed and well balanced economies.

International policy restrictions to counteract Nazi and Soviet influences The U.S. also worried about Nazi influence in Latin America. Helleiner describes that White wrote that the U.S. would need to support Latin America, given that Latin America was being targeted by the Nazis. Helleiner writes:[5]:

> White argued 'Latin America will gradually succumb to the organized economic and ideological campaign now being waged by aggressor nations. A bold program of financial assistance to Latin America that could be an important part of our international political program of peace, security and encouragement of democracy.' In addition, White argued

[4]Helleiner, E. (2014). "International Development and the North-South Dialogue of Bretton Woods,"Forgotten foundations of Bretton Woods: International development and the making of the postwar order. Cornell University Press, p. 143-144.

[5]Helleiner, E. (2014). Forgotten foundations of Bretton Woods: International development and the making of the postwar order. Cornell University Press, p. 43.

> 'Latin America presents a remarkable opportunity for economic development. Only capital and technical skill are needed to develop the area so that it could provide for a much larger population, for a higher standard of living and a greatly expanded foreign trade."

More broadly, Helleiner (2014) argues:[6]:

> What explains the US interest in promoting international development? Particularly important was the strategic goal of offsetting the Nazi threat. By offering to back the development aspirations of Southern (Latin American) governments, US officials helped secure alliances and provide a wider moral purpose to the Allied cause in the war, particularly at a time when fascist (and communist) ideals provided alternative routes to development from the preferred US model.

By 1950, the Nazi influence was over, but the Cold War had begun with the Soviet Union. Eichengreen (2019) notes that even stricter capital controls were implemented in Europe at that time, with the view that these controls would support European reconstruction. This was an even more pressing matter, given the geographic proximity between the USSR and free Europe.

Where would capital flow? Based on previous experiences of massive capital inflows to the U.S. during the Great Depression, and the relative health of the U.S. economy as World War II ended, it was expected that the U.S. would be the source for these flows after the war. Broughton (2009), who researched the history of the IMF, describes how in 1935 White advised Treasury Secretary Morgenthau that taxing foreign purchases of U.S. assets would be a way to limit capital inflows, as White viewed these inflows as a potential problem should investors withdraw those funds quickly. In 1938, White advised taxation again as capital inflows to the U.S. continued from France.

Taken together, the political and historical literature indicates that the U.S. viewed capital controls as an important tool to prevent capital from moving from friendly countries to the U.S., which in turn would promote economic and political stability in those countries. The U.S. had important political/national defense motives for supporting allies and preventing neutral countries from becoming aligned with governments hostile to the U.S. at this time, motives that support our estimate of the large cost of capital controls to the U.S.

The large U.S. military budget at that time is also consistent with this view. Military spending averaged about 11.8 percent of GDP per year during Bretton Woods, whereas it averaged just 1.6 percent of GDP between 1929 and 1940. If one considers investments in military spending and investments in political and economic stability in other countries as complements in producing national defense, then one would expect the U.S. to be willing to pay a high cost of capital controls, given the size of its military spending.

[6]Helleiner, E. (2014). Forgotten foundations of Bretton Woods: International development and the making of the postwar order. Cornell University Press, p. 12.

8 Summary and Conclusion

Little is known about the quantitative effects of capital controls on the world economy during Bretton Woods because of the number of controls implemented, because of their complexity, and because their *de facto* implementation may have differed from their *de jure* specifications.

This paper analyzed the positive and normative impact of the Bretton Woods *de facto* capital controls within an open economy general equilibrium framework, and identified the effect of capital controls using NIPA and other data, while bypassing the significant difficulties in trying to directly measure these controls and incorporate them into a general equilibrium model.

We find that capital controls had very large effects on world capital flows during Bretton Woods, preventing a considerable amount of capital from flowing from the ROW to the U.S. These controls raised welfare for the ROW, but substantially reduced welfare for the U.S. In particular, U.S. per capita consumption relative to the ROW dropped by about 40 percent over the Bretton Woods period. Our analysis identifies capital controls as the factor responsible for this relative decline.

This finding raises an important question: why was the U.S. keen on international capital controls when this appears to be sharply at variance with U.S. interests? We find that the purpose of these controls - to promote political and economic stabiity in ally and unaligned countries - was highly valued because the U.S. had a strong interest in preserving friendly relationships with these countries, many of which were fragile after the war.

The historical literature from that time documents that Harry Dexter White, the U.S. architect of Bretton Woods, viewed capital controls as an important tool that would prevent capital flight out of allied and developing countries to the U.S.

The cost of capital controls to the U.S. is considered here as an implicit U.S. investment that promoted U.S. foreign interests and geopolitical stability. This view aligns with the expensive military involvements after World War II, including the Korean War, the Vietnam War, the Cold War, and smaller interventions in Latin America and the Middle East, in which military spending averaged nearly 12 percent of GDP between 1950-1973.

More broadly, these findings open a new avenue for research that integrates open economy macroeconomics with political economy considerations and global conflict. Among other possible lines of inquiry, this type of research can provide a new perspective on U.S. international economic policies since World War II, with a focus on the provision of national defense, whose production includes both traditional investments in military machinery and personnel, and investments in promoting global political and economic stability among ally and unaligned countries.

Moreover, the complete markets specification used here can be used as a benchmark for future research that analyzes these issues using alternative market frameworks.

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