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**ABSTRACTS OF ACADEMIC PAPERS**

**I. PAPERS IN OPEN ECONOMY MACROECONOMICS.**

**Background Material for Papers 1-3.**

Currency demands of conventional models of exchange rate determination are typically motivated by appealing to money's role as a medium of exchange. This same basic construct lies behind dynamic, cash-in-advance models of exchange rates popularized by Stockman (1980), Lucas (1982), and Helpman and Razin (1982). All of these models essentially assume that different currencies are imperfect substitutes for transaction purposes. As a result, the demands for individual currencies may be described by well-behaved functions defined over a particular set of economic fundamentals. Movements in exchange rates in these models are attributed to movements in these underlying fundamental variables.

This view dominated the literature on exchange rate determination throughout the 1970's and 1980's. Two things, however, - one empirical, the other theoretical - challenged this view. First, Richard Meese and Kenneth Rogoff published a series of influential empirical studies in the early 1980's which documented the failure of empirical versions of several popular exchange rate models to provide accurate out-of-sample forecasts for several exchange rates. They measured the predictions of structural exchange rate models against other, theoretical models, such as a VAR and a simple random walk model of the exchange rate. Their results suggested that a random walk model provides the best short-run forecasts of the exchange rate, although some of the structural models in their study showed some improved forecasting power over longer time horizons. Other researchers, replicating the Meese and Rogoff result using other exchange rate data and other criteria to measure the performance of the models, came to similar conclusions. Based on these results, there is a consensus among many that do empirical research in international finance that many spot exchange rates behave like the price of a speculative asset, but over longer horizons they are related systematically to economic variables. Tests of cointegration between exchange rates and price levels lend support to the latter notion.

The second thing to challenge this view was an article by John Kareken and Neil Wallace published in the *QJE* in 1981. This piece made the point that in a world economy with unfettered capital movements (that is, one in which money demands are no longer restricted by legal tender laws), the exchange rate is indeterminate in any equilibrium in which more than one currency is traded. This indeterminacy stems from the fact that without restrictions on currency portfolios, different currencies are perfect substitutes. In other words, the demand for any individual currency is not a well-defined function, but rather, a correspondence.

The Kareken and Wallace result was viewed initially as an important theoretical argument in the exchange rate determination literature, with little practical application toward explaining actual exchange rate movements such as described in Meese and Rogoff. This stems from the fact that the Kareken and Wallace indeterminacy result is described in terms of a constant exchange rate, and of course, actual exchange rates are anything but constant. Three papers in the early 1990's - Manuelli and Peck (1990), King, Wallace, and Weber (1992) and Barnett (1992) - show that this indeterminacy result can be extended to stochastic models of the exchange rate. Exchange rate movements in these models are either more volatile than the volatility of underlying fundamentals of the economy (Manuelli and Peck), or else unrelated totally to *any* fundamental movements (King, Wallace, and Weber, and Barnett).

With this background material in mind, here is an overview of my research in this area.

**1. “Speculation, Incomplete Currency Market Participation, and Nonfundamental Movements in Nominal and Real Exchange Rates”** (*Journal of International Economics*, 1992).

Besides the observations by Meese and Rogoff regarding the unpredictable nature of spot exchange rates, there is also evidence that real exchange rates are unpredictable and are unit root. Empirical researchers generally have found that nominal exchange rates are more volatile than relative price levels, and there is some evidence that nominal exchange rates and real exchange rates are cointegrated.

A popular framework in the late 1970's for explaining the short-run excess volatility of exchange rates over price level volatility was Dornbusch's (1976) rational expectations model with 'sticky prices'. Sticky prices allow the nominal exchange rate to 'overshoot' its long-run value in response to a change in some long-run fundamental variable, like a permanent increase in the money supply. As is typical of this sort of model, there is no deep explanation of why prices are 'sticky'. The Dornbusch model was one of the structural models included in the Meese and Rogoff study.

My paper studies possible stochastic, nonfundamental movements in nominal and real exchange rates arising from a world with speculative currency substitution and nontraded goods. The model can generate equilibria in which nominal exchange rates are more volatile than relative price levels, without relying on an assumption of fixed or sluggish movements in prices. In addition, nominal and real exchange rates in the model are cointegrated. The paper is one of the few applied papers that uses an overlapping generations model with multiple goods. An earlier version of this paper shows how this framework can be used to explain observed anomalies in movements in exchange rates and trade accounts, such as the J-curve.

**2. “Sunspots, Currency Substitution, and Inflationary Finance”** (with Mun Ho). (*JIE*, 1996).

This paper is related to the paper described above in that it examines a world with speculation in currency markets and nonfundamental uncertainty. However, the paper goes beyond the first one in that it explores how this form of currency substitution affects the inflationary finance of public deficits.

The paper starts with the view of a fiscal authority that is dominant relative to a monetary authority. Sargent and Wallace (1981) explore in depth this view in a seminal paper on government finance in a closed economy called ‘Some Unpleasant Monetarist Arithmetic’. The general argument behind this view is that monetary and fiscal policies must be coordinated, since they each must follow policies consistent with a consolidated budget constraint for the government. By assuming the fiscal authority is dominant over the monetary authority, the burden of coordination falls to the monetary authority.

We make the claim that a dominant fiscal authority over monetary authority does several things in an open economy with currency substitution. First, it thwarts any seigniorage games monetary authorities may try to engage in, since each authority needs to raise revenues sufficient to finance its government's deficit. Second, since agents substitute among currencies and they know that each monetary authority must raise revenues through seigniorage, any announced monetary policy is not credible. In short, each monetary authority must accommodate its own fiscal authority *and* the portfolio decisions of private agents.

The main premise of the paper follows directly from this second point. If agents believe that certain variables in an economy (such as the exchange rate) vary across realizations of a nonfundamental process, and their decision variables reflect this belief, it may be possible that certain policy variables will also be affected by this same nonfundamental process. In this way, we are able to link long-run movements in exchange rates and movements in relative money supplies, a notion that has a long tradition in open economy macroeconomics. However, movements in exchange rates in our model are not tightly linked to movements in relative money supplies at any point in time, so in fact we have short-run movements in exchange rates and relative money supplies that are not inconsistent with the empirical findings of Meese and Rogoff.

This paper makes several other contributions to the literature. i) We suggest some sufficient conditions (for a deterministic case) that eliminate the type of exchange rate indeterminacy as described by Kareken and Wallace. ii) We argue that the median exchange rate in the uncertainty case is the same as the unique exchange rate we find in the certainty case. That is, our model has a 'long-run' exchange rate that is pinned down to certain fundamentals in the economy. iii) We demonstrate that this form of currency substitution leads to much higher average inflation rates than that which obtain in the certainty case. In addition, we show that there is no systematic difference in the inflation rates across countries (the unconditional mean of the inflation differentials is zero). iv) In the short run, the two countries *can* have quite different inflation rates, due to this type of currency substitution. Moreover, even for long (but finite) time horizons, these countries can have different average inflation and monetary growth rates, and it can be the case that the country with the high monetary growth rate has the lower average inflation rate. v) We study the how the size of the fiscal deficits affect exchange rate volatility, and we make the case that exchange rate volatility and the size of the world's deficits are inversely related. This result stems from the fact that the smaller the deficits in the world economy, the larger the permissible band for the portfolio. vi) We study the notion of a currency 'safe haven', making the case that the country which assumes a safe haven role is often based more on historical precedent (and/or hunch) rather than an assessment of current and prospective fundamentals. We ask whether such a role confers to the safe haven a lower inflation rate and whether this role has any impact on the long-run exchange rate. We argue that while the safe haven role will of course ensure that there is a larger number of appreciations than depreciations, these depreciations will be of larger magnitude. It turns out that the safe haven role does not significantly alter the country's average inflation rate and long-run exchange rate. vii) Finally, our paper makes some broader points directed at econometric tests for nonfundamentals or 'bubbles'. There is a branch of the macroeconomic literature that proposes tests for nonfundamentals (Flood and Hodrick (1990) contains a nice survey of the literature). We make the case that this sort of exercise is futile. Our model shows that the amount of variation in economic time series due to nonfundamentals may be much larger than at first appears, since policy variables such as the money supplies in our model vary due to the nonfundamental. Second, it turns out that our model is observationally equivalent to one in which the monetary authorities set monetary growth rates in some random fashion (i.e., there is fundamental uncertainty). We see little that econometricians can do to distinguish between these two possible views of the world.

### **3. "Smuggling, Nonfundamental Uncertainty, and Parallel Market Exchange Rate Volatility."** (*Canadian Journal of Economics* 36 (2003), 701-727).

This paper studies a small open economy with smuggling and speculative currency substitution. It utilizes the basic framework of the previous two models to describe the currency demands of agents. In this case, however, I have two exchange rates - an official exchange rate, which is determined by PPP, and an unofficial or parallel exchange rate. I assume agents are prohibited legally from holding foreign currency, but of course they can obtain it illegally on the parallel market.

I set out to build a model in which variations in the parallel market exchange rate and the parallel market premium can: a) have income distribution effects; b) affect the level of national product; and, c) lead to an increasing ratio of parallel foreign currency to domestic currency (a form of 'dollarization'). To accomplish this, I assume there exists 'production frictions' which limit the size of legal and illegal operations. These frictions are meant to resemble actual frictions that confront firms, especially in developing countries. Large-scale illegal operations, for example, may be more visible to law enforcement officials and hence too costly to operate. Similarly, entrepreneurial talent for legal production can be limited to a particular firm size and not readily transferred to other firms or organizations. Next, I assume that agents are endowed with different legal and smuggling entrepreneurial talents. (I assume a continuum of agents, distributed over a rectangle. An agent is indexed by his entrepreneurial talent - an agent specific production function - to smuggle and to legally produce the good). Each agent, whether setting up a legal operation or an illegal operation, must hire workers to set up her operation. In this sense, both legal and smuggling operations resemble a small shop with a manager and worker. Each agent self-selects to be an entrepreneur in the smuggling sector, an entrepreneur in the legal sector, or a worker employed in either sector. This selection process depends on the agent's production function and the size of the parallel market premium.

This paper makes several important contributions to the literature. i) First, a good deal of the literature on parallel markets in foreign exchange is either done in partial equilibrium or else based partly on microfoundations (usually, the smuggling side of the economy is from a micro model, but money demands are tacked on from some other type of macro model). This model is dynamic and based on microfoundations. ii) Models in this area that are based on microfoundations are usually deterministic models or models that focus on stationary stochastic equilibria. In my case, the type of money demands I consider allows me to construct stochastic nonstationary equilibria. The model can generate artificial data for parallel market rates and parallel premium that resembles data from actual economies. This claim cannot be made of other models in this literature. iii) I believe this paper is the only one in the literature that examines the income distribution effects of smuggling *and* parallel currency markets. The paper is closer to the smuggling literature in this respect. Pure trade theorists that examine smuggling are concerned with income distribution effects, but their focus ignores parallel currency markets. I am aware of only one other paper (Thursby, Jensen, and Thursby (1991)) that allow for the degree of heterogeneity that I do, and that paper does not concern itself with parallel currency markets. In short, this paper is the one of the few attempts in the literature to address these two issues (smuggling and parallel currency markets) in a way that both monetary and pure trade theorists would find interesting. iv) The paper also provides 2 extensions of the model, one that looks at drug trafficking and parallel currency markets, and the other that looks at invoice falsification. No other model in the trade literature addresses the twin issues of drug trafficking and parallel currency markets.

#### **4. "Inflation, Growth, and Illegal Offshore Accounts"** (with Mun Ho). (*Currently being revised*).

Among the more interesting variables included in growth accounting studies for developing countries is the parallel market exchange rate premium (Fischer 1993; Fry 1995; Barro and Sala-I-Martin 1995; Barro 1996). The parallel market premium is intended to serve as a measure of market distortion more broadly defined, and there appears to be a small, but significant negative relationship between economic growth and the parallel market premium.

This paper attempts to study this link between the parallel currency market and economic growth more formally, by constructing a stochastic growth model of a small, open economy with a parallel market in foreign currency. The contribution of this paper to this segment of the growth and development literature is important, for without a theoretical basis to relate the empirical findings mentioned above, the parallel premium is a merely a proxy, pretty much left to measure whatever observer wish to claim it measures. In turn, these claims provide little credence to policy initiatives aimed at addressing distortions in developing financial markets, and they do not shed much light on how growth and the parallel premium are related to other macroeconomic factors, such as inflation.

The presence of the parallel market makes foreign assets an attractive alternative to domestic capital and agents hold a portfolio comprised of both assets. The return on domestic capital is linked to the growth rate in the money supply and inflation through a requirement imposed on banks which forces them to hold a fraction of deposits in reserve in the form of domestic cash. In this way, we link economic growth to a much broader set of macroeconomic factors, such as inflation, capital flight, reserve requirements, and the parallel market premium. This approach also relates this paper with the existing theoretical literature on financial intermediation, inflation and growth in closed economics (Haslag 1998; Haslag and Young 1998; Espinosa and Yip 1997;1998; Schreft and Smith 1997; Battacharya et.al. 1997; Chari, Jones and Manuelli 1995).

We use the model to generate artificial time-series and we study the cross-sectional properties of these series. We also study how the degree of participate in the parallel currency market affects the composite welfare of agents in the economy. In this case, restricting participation in the black market raises domestic economic growth and lowers domestic inflation. Competing with these welfare enhancing effects, however, is the negative impact the restrictions have on welfare due to the limitations they impose on the agents' ability to hedge against domestic asset risk.

##### **5. "Money and Growth in a World Economy."** (*Currently being revised*).

This paper examines the issue of inflation and growth in an open economy. Drawing on the closed-economy literature in this area, we develop a two-country model of a world economy in which governments impose binding reserve requirements in order ensure a monetary base sufficient to ensure the inflationary finance of government deficits. The reserve requirement, in effect drives a wedge between deposit and loan rates. Each ensures a minimum inflationary tax base, while asset substitution between countries limits both the size of the reserve requirement and the inflationary tax each country can levy. As in the closed-economy literature, there is a trade-off between the size of the reserve requirement, inflation tax, and the inflation base. For a given level of saving, an increase in a reserve requirement increases the inflation base, thereby reducing the inflation tax necessary to finance a given government deficit. On the other hand, the larger reserve requirement lowers the return on intermediated deposits, thereby decreasing the inflation base and raising the equilibrium inflation tax. In our open economy, changes in the inflationary base and rate of intermediated returns in one country naturally affect the base and returns in the other country. We use this framework and the underlying transmission of monetary/fiscal policies across countries to address several issues: i) how does the size of the reserve requirement affect output and economic growth? ii) what sort of transmission effect can be observed across countries?

**6. “The Advantage of Showing Your Hand Selectively in Foreign Exchange Interventions.”** (with Saltuk Ozerturk). (*European Journal of Political Economy*, March 2007).

This paper explores a market microstructure model of sterilized central bank intervention in the foreign exchange market. We show that, although public disclosure of a central bank’s exchange rate target is never desirable (Vitale 1999), selective disclosure of the target to other informed market participants (like pure speculators or other central banks with their own targeting agenda) may result in better targeting. Surprisingly, when the uncertainty about her target is above a threshold level, the central bank has incentives to strategically disclose its target even to a speculator, for better targeting. This result follows because the speculator’s response to the central bank’s target reduces some of the noise in the order flow and makes the market maker’s pricing rule more responsive to the order flow. The analysis suggests that although public disclosure is always detrimental for targeting intervention, full secrecy and too much uncertainty regarding the target may limit the bank’s ability to target the exchange rate.

**7. “The Behavior of Black Market Exchange Rates in 4 South American Countries”** (With Mun Ho) (*SUNY at Buffalo Discussion Paper #9109*).

This paper examines the behavior of black market exchange rates in Argentina, Brazil, Chile, and Peru for the years 1958-88. We first study the relationship between the black and official exchange rates using a simple bivariate causality test. We then compute tests for unit roots, using the black and official rates, over the sample period as well as for predetermined sub-samples of the data set. Given the different behavior of the series across sub-samples, we apply simple tests for shifts in the trend function, as developed in Perron.

We then perform tests for long-run purchasing power parity using both black and official exchange rates. Our results fail to find strong support of cointegration of each exchange rate and prices over the sample period. Lastly, we employ the Johansen (1988) multivariate test to see if there are any common trends among the official rate, the black rate, and relative prices. The overall evidence from these tests suggests that these variables are not tightly linked, even in the long run.

This paper was rejected by *Economic Journal*. A referee noted that high inflation data typically displays ‘thick tailed’ distributions, which violate the normality assumption used in tests for common trends. Upon learning this, we felt uncomfortable about resubmitting the paper elsewhere. Since then, of course, there are quite a few published papers that use cointegration techniques and data from high inflation countries.

## **II. PAPERS IN CLOSED-ECONOMY MACROECONOMICS**

**8. “Inflation, Taxes, and the Coordination of Monetary and Fiscal Policy by use of a Game of Chicken”** (*Canadian Journal of Economics* 34 (2001), 82-99).

A central issue surrounding modern theories of government finance is the monetary-fiscal coordination problem. This problem arises whenever two or more independent taxing authorities try to implement policies that are mutually inconsistent with the overall government budget constraint. Sargent and Wallace (1981) liken this coordination process to a game of chicken, with one agency ('the chicken') eventually capitulating in order to accommodate the policy of the other and the government budget constraint. Such a coordination process can inject uncertainty into an economy, in the sense that private agents are uncertain about future outcomes of this policy struggle between taxing authorities.

This study illustrates a general point regarding random taxation of different activities, and the coordination problem and uncertainty that may ensue in a struggle between independent policy agencies like a monetary and fiscal authority serves as a nice basis to illustrate this general point. A macroeconomic model with no bond finance is constructed in which distorting taxes are set by two independent taxing authorities. Each authority implements a distorting tax, yet each tries to pursue a simple tax rule - a low (zero) tax rate. These policy goals are mutually inconsistent with the government's overall budget requirements and are coordinated by a simple random coordination process whereby at each date one of the agencies prevails as the dominant agency and sets a low tax. Coordination then comes entirely at the other agency's expense, in the sense that it must abandon its own low-tax policy in favor of a tax high enough to raise revenues sufficient to finance the government's purchases. Agents face uncertainty about the future outcome of this struggle between authorities, or more precisely, the size of future inflation and income taxes. This in turn alters the tax base and ultimately the equilibrium tax rates.

If there exists a central agency that can coordinate tax policies, an optimal tax policy under no uncertainty will generally include some combination of both inflation and income taxes; neither low tax policy will be optimal. Absent a central administration, however, the uncertainty induced by a policy struggle between two competing independent agencies can improve upon allocations that obtain under no uncertainty and where one dominant agency initiates a low-tax policy at the expense of the other agency. Such uncertainty offers private agents a kind of tax mix, albeit in an *ex ante* expected value sense. While an uncertain policy process never dominates a policy crafted by a central optimizing administration, it can move tax rates in the right direction and closer to the optimal tax mix. In this sense, the game of chicken between agencies can be beneficial and can compensate in part for the lack of a specific coordinating administration. The paper provides an interesting counter-example to the conventional wisdom that stable, predictable monetary and fiscal policies are preferable over uncertain ones.

**9. “When is Price-Level Targeting a Good Idea?”** (with Merwan Engineer). (In *Price Stability and the Long-Run Target for Monetary Policy*, Bank of Canada (2001).

This paper provides a critical examination of the recent literature supporting price-level targeting over inflation targeting. We provide a comprehensive discussion of the various ‘target rules’ proposed in the literature, as well as look at the basic modeling ingredients typically used by researchers in this area. The paper also draws some comparisons between models incorporating ‘New Classical’ versus ‘New Keynesian’ Phillips Curves, and we posit and study the properties of a model incorporating a hybrid ‘New Classical - New Keynesian’ curve. The hybrid shares properties of both curves, but the policy prescriptions inferred from the model favor inflation targeting over price targeting when the central bank can commit to a policy plan. The paper closes with a review of alternative targeting objectives proposed in the literature.

This paper was one of six papers of a conference on price stability and monetary policy sponsored by the Bank of Canada, June 2000. Others presenting include Michael Parkin, Frederic Mishkin, Jean Fare and Thomas Lemieux, Paul Beaudry and Mat Doyle, and Dinah Maclean and Hope Pioro.

**10. “Coordinating Macroeconomic Policy in a Simple AK Growth Model.”** (*Journal of Macroeconomics* 27 (2005), 621-647).

This paper examines the long-run effects of monetary and fiscal policy in a model with government debt, endogenous growth, and reserve requirements. The model addresses the simultaneity between inflation and growth that necessarily arises in an environment with a dominant fiscal authority. The issue goes to the heart of unpleasant monetarist arithmetic and its emphasis on the economy’s growth rate and the real return on government debt, though the models that have been used to study this arithmetic assume a fixed rate of growth and hence have very little to say on the subject of inflation and growth and how the two might respond to a change in government policy.

The paper addresses a long-standing question in the literature on unpleasant monetarist arithmetic: Under what conditions will a tightening of monetary policy - an open market sale of government debt for cash - produce an increase in the inflation rate? The debate surrounding Sargent and Wallace (1981) initially focused on the plausibility of the conditions viewed as necessary for this result - namely, that the real return on government debt be greater than the real growth rate of the economy. More recently, Bhattacharya, Guzman, and Smith (1998) show that unpleasant monetarist arithmetic can arise under conditions where the real return on government debt is less than the economy’s growth rate, provided there is an alternative asset that provides a return greater than the real growth rate.

Our model displays unpleasant monetarist arithmetic as well, but under a seemingly less stringent condition than that suggested in Bhattacharya, Guzman, and Smith. Our result stems from the fact that an open market sale increases the amount of government debt held by the general public, thereby crowding out rental capital and lowering the economy’s growth rate. This negative growth effect in turn may be sufficiently large as to require an increase in the long-run inflation rate in order to satisfy the government’s budget constraint, even in situations where the economy’s growth rate is greater than the real return on government debt and no other asset pays a return greater than the growth rate. Evidently, unpleasant monetarist arithmetic appears under a broader set of circumstances than those considered previously in the literature.

The paper also provided a comprehensive look at other aspects of changes in a nation’s ‘seignorage policy’, and how differences in policies appear in cross sectional plots of growth and inflation.

**11. “Rejuveniles and Growth”** (with Joydeep Bhattacharya). (*Revise and Resubmit, European Economic Review*).

‘Rejuveniles’ is a term coined by Christopher Noxom; it refers to the growing phenomena of youth-like behavior in adults. We model this behavior as the result of a consumption externality across generations – agents’ utility depends on their own consumption relative to the consumption to their peers, a ‘Keeping up with the Jones’ if you like. We assume agents draw influence for consumption purposes not only from their own age cohort, but also from those of other generations present at the time. The possibility that older individuals wish to ‘keep up’ their consumption with their younger counterparts is *rejuvenile* as we define it. We embed these types of preferences in an otherwise standard AK growth model and examine the consequence of this behavior for long-run growth.

We provide an analytical comparison of our results to models with similar keeping up preferences, such as habit formation, minimum consumption requirements, and even bequeathed tastes (derived from the possibility that the consumption of parents may, in part, shape the consumption decisions of their

offspring). One surprising finding of our work is the fact that rejuvenile behavior can generate endogenous stable 2-period flip cycles in *growth rates* and this is not present in any other variation of

keeping up that we consider. Endogenous cycles in levels of output are not common but can be observed in a number of theoretical settings. Endogenous cycles in growth rates are not common; to the best of knowledge, all models to date that generate growth cycles are technology not preference driven. We conclude that rejuveniles may raise the long-run growth rate – as compared to a similar economy with standard preferences – but their presence may also expose the economy to endogenous growth fluctuations that were impossible in their absence.

## 12. “Endogenous Inflation Cycles” (with Joydeep Bhattacharya and Helle Bunke). (*Currently work-in-progress*).

This paper examines endogenous fluctuations in inflation rates and inflation cycles that can arise in a model with minimum consumption requirements. We show that with these preferences, the conditions for optimality conditions and market-clearing at any point in time can be summarized by *two* possible difference equations describing the evolution of money balances over time. The law-of-motion derived from one of these difference equations supports a bona fide *equilibrium* sequence and it is the type of difference equation we focus on when describing a monetary equilibrium. The other difference equation cannot, by itself, support an equilibrium; while at any point in time the market-clearing and optimality conditions of the model may be satisfied, the trajectory of real money balances inferred by this law-of-motion will, at some point, conflict with the minimum consumption requirements and therefore cannot be sustainable as an equilibrium.

A curious thing happens, however, when we use *both* difference equations to construct an equilibrium sequence for this economy. Since both difference equations are consistent with market-clearing and optimality, these requirements of an equilibrium are clearly satisfied. But the paths we generate using both equations can display cycles of two, three, or more, periodicity.

The paper sheds new light on a very early approach to dynamic aggregate analysis and rational expectations called *temporary equilibrium*. This approach was spearheaded by Jean-Michel Grandmont (1977). Grandmont’s approach did not generate much interest among macroeconomists at the time and has since fallen out of favor with most rational expectations economists, since it fails to explain equilibria in terms of infinitely-long sequences for prices and quantities and there are few assurances that a temporary equilibrium is consistent with a bona fide equilibrium for the economy. Our work suggests such wholesale dismissal of Grandmont’s approach may have been too sweeping. One can construct a temporary equilibrium using both laws-of-motion derived from our model. This temporary equilibrium never obtains as a bona fide equilibrium described by an infinite sequence of prices and quantities generated from just one of these difference equations, and as such, it would be rejected out-of-hand as being inconsistent with equilibrium behavior (in other words, agents’ beliefs about future prices and quantities would be deemed ‘out-of-equilibrium’). However, our work shows that such a temporary equilibrium can be part of a broader, genuine equilibrium, one consistent with market-clearing and optimality at all dates. Equilibria of this sort are constructed using both difference equations and displays cycles in inflation rates and money balances.

### III. PAPERS IN GROWTH AND DEVELOPMENT

**13. “Barriers to Capital Accumulation and the Incidence of Child Labor,”** (with Marco Espinosa-Vega) (*IMF Working Paper #2005/220 and currently under review, Journal of Economic Dynamics and Control*).

This examines a simple Diamond growth model of overlapping generations with physical and human capital. Parents are assumed to make a saving and consumption decision for themselves and human capital decision for their child. The paper is motivated by a cross-sectional observation from World Bank data showing an inverse relationship between child labor and real GDP per capita. We consider differences in barriers to capital (distortions in the market for physical capital, such as bribes or bureaucratic red tape) as one potential explanation for these differences in real output and child labor across countries. Elsewhere in the literature, capital barriers have had some success in explaining several stylized observations on economic growth, transitional dynamics, and world income inequality. Our study asks what sort of role they might play in this important issue in economic development.

Our paper examines several model variations. Our benchmark model considers a case with the sort of preferences typically used in dynamic analysis. These are represented by time-separable utility functions that generate first-order conditions displaying the usual Inada conditions. In this case, barriers to capital accumulation affect long-run output, but they have no impact on steady-state child labor participation rates.

In the showcase version of our model, one where agents are subject to a minimum consumption requirement, lowering capital barriers can result in transitory and permanent reductions in child labor as well as increases in real GDP per capita. Cross-sectional observations of different steady-states generated by the model by considering economies similar to one another with the exception of the size of the capital barrier resemble the aforementioned observation on child labor participation rates and output from World Bank data from actual economies.

Why the potential difference in these models? From the first-order conditions, it is evident that the schooling decision made by the parent depends negatively on the size of the effective steady-state return on capital or savings. *Ceteris paribus*, an increase in the effective return reduces the present value of the child's future earnings from additional human capital, reducing the benefit of education. The parent in turn will respond by increasing the number of hours the child works.

Without the minimum consumption requirement, the steady-state excess supply of credit is homogenous of degree zero with respect to an increase in the capital barrier. This means that in the standard model, savings rises by the same proportion as effective investment with an increase in the capital barrier. On the other hand, introducing the minimum consumption into the mix means the elasticity of intertemporal substitution depends positively on the agents' wealth. A higher barrier makes them poorer, and this reduction in wealth in turn means that agents save proportionally less of their income when confronted with an increase in the capital barrier. As a result, aggregate excess supply of credit falls, and the effective return on saving must rise in order to clear the credit market. As noted above, this rise in the effective return reduces investment in human capital, i.e., the incidence of child labor rises.

Our model can be used to study several policies aimed at reducing the incidence of child labor. In one such case, we show that in the presence of high capital barriers, an out-and-out ban on child labor can reduce welfare and steady-state output. This problem can perhaps be alleviated somewhat, in countries with high barriers, by simultaneously reducing the barrier when enacting a ban, as our model examples illustrate.

**14. “Rural-to-Urban Migration and Economic Development: An Overlapping Generations Model.”** (with Alex Mourmouras). (*Currently work in progress*).

This study develops a two-sector growth model where the ratio of rural-to-urban workers is determined endogenously in the model. The model attempts to explain the rate of internal migration that has occurred in several emerging economies, such as India and China. Despite phenomenal rates of real economic growth, these economies have experienced relatively slow reductions in the rural-to-urban populations since 1980 (for China, this ratio has dropped about 25%, for India it has fallen considerably less, by approximately 6 2/3%. Both countries currently have rural-to-urban populations well over 50%; this compares against a ratio of 5% observed in most developed economies).

Our study examines the effects on both the rural and urban sectors as this transition to a modern economy progresses. We also examine the effects of policies that are aimed at speeding up modernization, such as subsidies to the urban sector. Our plan is to calibrate the model to Chinese data and examine the impact policies liberalizing internal migration have on the economy.

#### **IV. OTHER PAPERS**

**15. “Comment on: ‘Do Sunspots Matter When Spot Market Equilibria are Unique?’”** (with Eric O’N. Fisher). (*Econometrica* 70, (2002), 393-96).

This note discusses a in error Hens (2000). Hens purports to show that a long-standing conjecture made by Mas-Colell made in 1992 regarding the need for multiple spot equilibria in generating non-trivial sunspot equilibria is false. Hens provides a counterexample to Mas-Colell’s claim. The original conjecture has been in the literature for nearly 10 years (Mas-Colell himself in the article adds comment to his own paper acknowledging Hens has shown the conjecture is false). Fisher and I show that Hens’ counterexample contains a fundamental flaw and that Mas Colell’s original conjecture still stands.

**16. “A Hierarchy of Market Power”** (*SUNY at Buffalo Discussion Paper #9404*).

This note examines several issues surrounding market structure and the hierarchy of market power within the context of a simple partial equilibrium model of a market with three firms. I explore five possible market structures which reflect five different degrees of hierarchy of market power. These include, on the one extreme, a case in which no firm can establish a dominant player position in the market, and on the extreme, a case in which there are two dominant players in a market and a hierarchy of dominance.

Within this framework, I am able to make several points regarding prices, profits, and market shares. First, since the price level is inversely related to the degree of hierarchy in the market, it is possible that a reduction in market power of some of the participants in the market can increase the profits of all of the firms in the market. This can occur if the reduction in market power of one firm is accompanied by a simultaneous reduction of power of another firm. Second, it is possible that for some players, a decrease in market share can be accompanied by an increase in profits.

This note was politely rejected from a journal (it was one of the most thoughtful rejections I have received, about 4 pages long, which is quite remarkable, considering the note itself is 8 pages long). Not long afterward, I discovered a paper written by Simon Anderson making a similar argument. Some have suggested that I might want to look at market power and market concentration indices, but since this work is a bit out of my field, I never pursued that idea.

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