

# Innovation and Competition: Theory, Evidence and Policy for the Great Recession

## *Dynamic Competition Lecture*

Osaka, November 27th, 2009

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First version: May 2009

Updated: October, 2009

Innovation to create new and better products, competition between producers and entry in the innovative and competitive processes are at the roots of modern economies. Nevertheless, their consideration in theoretical and applied macroeconomic analysis is still incomplete. The purpose of the endogenous market structures (EMSs) approach is to introduce strategic interactions and endogenous entry decisions in the analysis of aggregate phenomena. Its recent development started in the theory of industrial organization and policy (see Sutton, 1991, 1998, Etro, 2006, 2008b) and in the theory of innovation and Schumpeterian growth (Peretto, 1996, 1999; Etro, 2004, 2008a) to move to the theory of business cycles (see Devereux *et al.*, 1996, Cooper, 1999; Bilbiie *et al.*, 2007; Etro and Colciago, 2010) and the theory of international trade and finance and of trade policy (Peretto, 2003, Ghironi and Melitz, 2005; Sutton, 2007; Etro, 2010).<sup>1</sup>

The EMSs approach departs from the perfectly competitive environment, in the sense that firms do not take prices as given, but they do choose their entry, production and investment strategies and they interact strategically. It also departs from the standard industrial organization approach, which usually follows the *structure-conduct-performance paradigm* to adopt a circular approach.

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\*This paper was prepared for the Dynamic Competition Lecture held by the author at the International Workshop on Intellectual Property Rights and Competition Policy (Osaka, Japan, November 27-28, 2009). Much of the content is based on my research and I am grateful to coauthors for the joint work, in particular Dirk Czarnitzki and Andrea Colciago. Correspondence: University of Milan, Bicocca, Department of Economics. Piazza dell'Ateneo Nuovo 1, 20126, Building U6, Office 360. Email: federico.etro@unimib.it.

<sup>1</sup>For wide surveys see Etro (2007,a) on partial equilibrium applications and Etro (2009,a) on general equilibrium applications.

According to this approach, performance (profitability) affects structure (the number of firms) through entry, which affects conduct (the investment and production strategies of the firms), which in turn affects the size of the market (demand by consumers) through general equilibrium mechanisms. Since conduct and market size do affect the profitability of the firms, they exert a feedback effect on performance that creates further channels of causality.



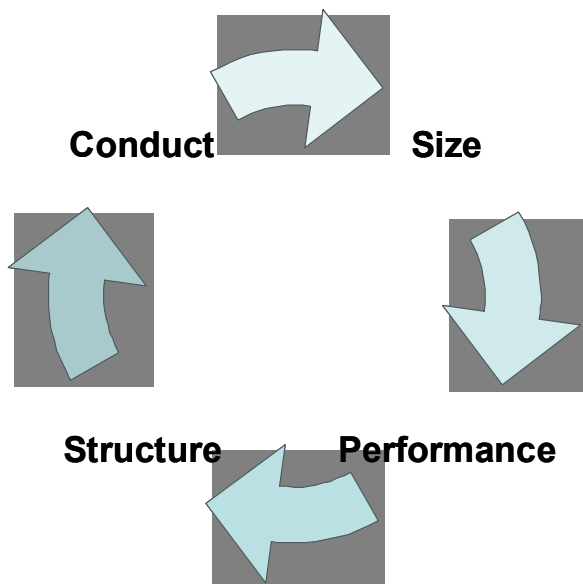
Traditional industrial organization approach to the analysis of markets

This leads to novel implications for the mechanism of propagation of supply and demand shocks, for the theory of the gains from trade and for the sources of the process of innovation and growth. Here, we review the main results of the EMSs approach in a non-technical manner, show the related empirical evidence, and discuss a number of macroeconomic and policy implications. For simplicity, we summarize them in ten principles, half of which have a positive nature, in the sense that they describe crucial aspects of the way the economy works, and half of which have a normative nature, in the sense that they provide policy implications. The discussion is going to be largely informal and try to link theoretical results to the current economic debates on macroeconomic issues and on relevant market structures, in particular of the New Economy.

The development of the EMSs approach relies on a general critique of the neoclassical approach: the main neoclassical assumption, perfect competition, is not only a bad approximation of realistic market conditions, but also a misleading one if we want to understand the aggregate behavior of the economy and derive correct policy implications. The first point is almost self-evident: large size of the markets and entry do not lead to market structures in anyway close to the perfectly competitive ideal. If we think about any major market of the global economy (automobiles, telecommunications, pharmaceuticals, computers, semiconductors, software, online advertising) we find high levels of concentration and sometimes only a few big players. Strategic interactions, variable mark ups and entry are crucial aspects of real world markets and they play no role in the neoclassical paradigm (or in the extensions to monopolistic behavior with constant mark ups and exogenous entry).

In real world markets, profitability is what attracts entry and investment in innovation and business creation. In turn, entry strengthens competition and reduces the mark ups through strategic interactions. The EMSs approach suggests that these factors lead to new mechanisms of propagation of the shocks over the business cycle, to additional consequences on the long run performance of the economy, to novel sources of gains (and losses) from trade associated with the globalization process, to a different role of market leaders in driving technological progress and growth, and to new forms of dynamic inefficiencies in the process of business creation.

Our hope is that the introduction of EMSs in the macroeconomic analysis can also shed new light on a number of policy issues. While our approach confirms the optimality of a countercyclical fiscal policy and a price stabilizing monetary policy, it provides alternative motivations for these policies. The former should optimize the process of business creation over the business cycle and requires a supply-based fiscal policy with countercyclical tax rates on sales and labor income. The latter should avoid the negative effects of nominal frictions on the process of business creation, and especially on the process of innovation driving growth. Finally, the EMSs approach provides new predictions for the optimal trade policy, for the role of exchange rate policy and for competition and innovation policy, predictions that are often in radical contradiction with the traditional results. For instance, our approach shows the general optimality of unilateral export promoting policies as export subsidies, against traditional results which are typically in favor of export taxes, or it supports most of the conclusions of the Chicago approach to antitrust policy within a solid game theoretic framework.



EMSs approach to the analysis of markets

In the rest of the paper we discuss the ten main results of the EMSs approach summarized in ten principles, and associate them with digressions on related applied issues, with a special attention to the endogenous structure of global markets that are relevant for the macroeconomic analysis, and to issues related to innovation and competition policy.

# 1 EMSs and the Business Cycles

The novelty of the EMSs approach to macroeconomics relies on its analysis of the structure of markets that populate modern economies. Perfect competition, which is the standard way to model competition in the neoclassical theory (Kydland and Prescott, 1982), requires that firms can be created at no cost, act as price-takers, in the sense that they do not perceive themselves as affecting market prices with their choices, and in equilibrium they sell goods at the marginal cost of production, obtaining always zero profits. In such a framework, the market structure is indeterminate, in the sense that we have nothing to say about how many firms should be in the market and how much each one should produce in equilibrium. Even the concept of (stock market) value of a firm as the discounted sum of its future profits has no sense, since expected profits are zero.

Of course, the New-Keynesian theory, starting with Blanchard and Kiyotaki (1987), has introduced product differentiation and imperfect competition in general equilibrium models to study the effects of aggregate demand and supply shocks. Most of this literature departed from the neoclassical framework assuming monopolistic competition *à la* Dixit and Stiglitz (1977) between an exogenous number of firms producing differentiated goods. This approach rapidly became the standard framework for the analysis of macroeconomic policy. Nevertheless, it led to exogenous market structures: it neglected the role of strategic interactions between firms of the same sectors, the endogeneity of the number of competitors, and the impact of entry on the same strategic interactions. The result is that the structure of the sectors of the economy remains a sort of “black box” whose main components, mark ups, number of competitors and their individual production level, are exogenous in the short and long run.

The EMSs approach to macroeconomics (see Bilbiie *et al.*, 2007; Etro, 2007,b; Colciago and Etro, 2008; Jaimovich and Floetotto, 2008; Etro and Colciago, 2010) introduces more realistic forms of competition between firms choosing their prices or their production levels and interacting in a strategic way. Moreover, this approach takes in consideration that firms decide rationally whether to enter or not in a market (or how much to invest in R&D to do it) according to the profitability conditions: in particular the technological conditions are generalized to include positive fixed costs of entry, so that only few firms enter in each market and only if they foresee enough gross profits to cover the fixed costs. The combination of these ingredients leads to markets where the strategies of the firms, their number and even their (stock market) value can be endogenously characterized in the short and long run as functions of the structural parameters of the economy.

To make things concrete, let us introduce a simple example of analysis of an endogenous market structure. Consider  $L$  agents with the following preferences over  $N$  goods produced by different firms  $U = \left[ \sum_{j=1}^N C_j^{(\theta-1)/\theta} \right]^{\theta/(\theta-1)}$  where

$\theta > 1$  is the degree of substitutability between goods: when  $\theta \rightarrow \infty$  the goods become perfect substitutes, when  $\theta \rightarrow 1$  they tend to complete independence. Under unitary income and price  $p_j$  for each firm  $j$ , the total demand for each firm is  $L$  times the demand  $D_j$  derived from utility maximization. If production requires a fixed cost of entry  $F$  and a marginal cost  $c$ , the gross profits are  $\Pi^j = (p_j - c)LD_j$ .

Under monopolistic competition *à la* Dixit and Stiglitz (1977), the optimal (gross) mark up can be derived as:

$$\mu = \frac{\theta}{\theta - 1} \quad (1)$$

which is constant and does not depend on the number of firms or on other structural parameters characterizing the market structure or size. Nevertheless, one can use a static zero profit condition  $\Pi^j = F$  for each to obtain the equilibrium number of firms as:

$$N = \frac{L}{\theta F} \quad (2)$$

Notice that in the case of homogenous goods with fixed costs approaching zero ( $\theta \rightarrow \infty$  and  $F \rightarrow 0$ ) we revert to the neoclassical case of an indeterminate market structure (we cannot say what  $N$  tends to) with marginal cost pricing ( $\mu \rightarrow 1$ ).

Under Cournot competition with endogenous entry, the equilibrium mark up is positive and depends on the number of firms and on the degree of substitutability. When  $\theta \rightarrow \infty$  it becomes:

$$\mu = \frac{N}{N - 1}$$

which is decreasing in the number of firms. In such a case, the endogenous entry condition implies the number of firms:

$$N = \sqrt{\frac{L}{F}} \quad (3)$$

which sets the equilibrium mark up at:

$$\mu = \frac{\sqrt{L}}{\sqrt{L} - \sqrt{F}} \quad (4)$$

which is decreasing in market size.

Of course, competition occurs in every period between the active firms and entry is a long run decision, it takes time for the market structure to converge to the steady state. This is the case if the number of firms follows the dynamic equation:

$$N_{t+1} = (1 - \delta)(N_t + N_t^e) \quad (5)$$

where  $\delta$  is a rate of bankruptcy and  $N_t^e$  is the number of entrants which is determined by the new endogenous entry. Given the interest rate  $r_t$ , the zero profit condition becomes  $V_t = F$  where  $V_t$  is the discounted value of expected gross profits:

$$V_t = \frac{(1 - \delta)(\Pi_{t+1} + V_{t+1})}{1 + r_{t+1}} \quad (6)$$

which becomes  $V = \Pi/(r + \delta)$  in steady state.

In such a dynamic case, the mark up is negatively correlated with entry on the transition path, and therefore it is countercyclical. Etro and Colciago (2010) have developed a fully fledged dynamic stochastic general equilibrium model with EMSs of this kind (where the interest rate derives from optimal savings decisions). In general, the mechanism of business creation works through a simple channel: the expectation of future profits induces entrepreneurs to invest in the creation of new products. However, this mechanism has already *in nuce* a counterbalancing effect. Entry of new firms increases the number of competitors, and these become more aggressive. They may actually compete in different ways, for instance by choosing the quantity of production, as above, or their prices, as in Bertrand competition, or in more complex ways in the presence of leaders, asymmetries, heterogeneity between firms and so on. In all these cases, entry strengthens competition, which reduces the mark ups and the profits that other firms can expect from entering in the same market. Ultimately, in equilibrium, each firm must choose the profit maximizing strategy given those of the other firms, and the number of firms must be such that there are no other firms with incentives to enter.

The characterization of the aggregate equilibrium with EMSs emphasizes a new mechanism of propagation of the shocks in the short run that can be relevant to explain the business cycle beyond the standard mechanisms emphasized by the neoclassical approach of Kydland and Prescott (1982). Consider a positive and temporary shock to the economy. The positive impact on consumption leads to an increase in profits for the active firms, which attracts subsequent entry of new firms. Entry is only gradual and temporary, but it strengthens competition between all the firms, which leads to a gradual and temporary reduction of the mark ups and, through a general equilibrium mechanism, to an increase of the real wages. The temporary reduction of the mark ups induces agents to substitute future consumption with current consumption, i.e. to temporarily increase consumption. At the same time, the temporary increase in the real wage induces agents to increase labor supply. The consumption boom and the work boom, in turn, have a feedback effect on profits, entry, competition and mark ups, which magnifies the impact of the shock. Of course, this mechanism could not take place in situations where mark ups were zero (as in the perfectly competitive framework) or in situations where mark ups were positive but constant and entry was independent from the profitability conditions (as in

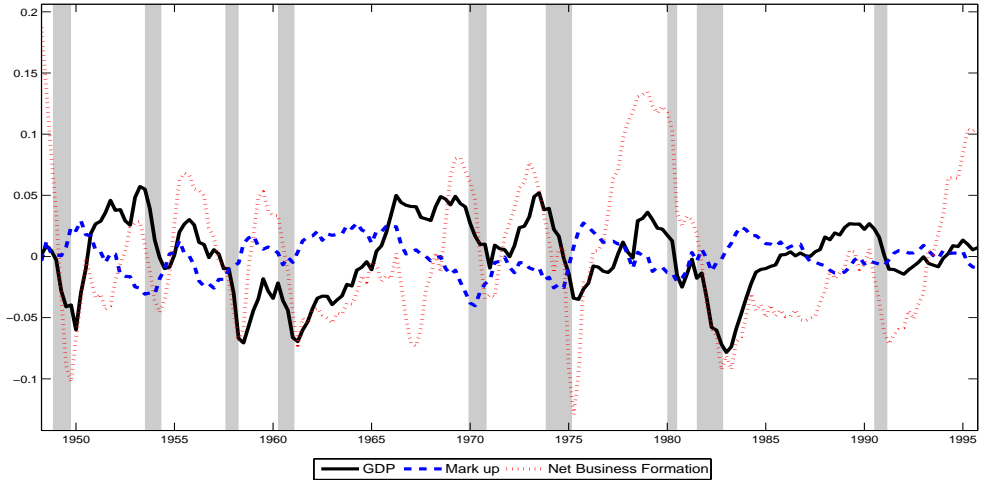


Figure 1: Cyclical component of GDP, Net Business formation and Price Markup. Shaded areas represent NBER recessions.

the New Keynesian literature). We can summarize this novel mechanism with the following principle:

**PRINCIPLE 1. IN THE SHORT RUN, THE EMSS LINK DEMAND & SUPPLY CONDITIONS WITH ENDOGENOUS ENTRY AND MARK UPS. A POSITIVE SHOCK TO THE ECONOMY ATTRACTS ENTRY, STRENGTHENS COMPETITION REDUCES MARK UPS AND INCREASES REAL WAGES, WHICH BOOSTS CONSUMPTION AND LABOR SUPPLY AND PROPAGATES THE SHOCK.**

An important consequence of this principle, is that the economy is characterized by procyclical entry of firms and countercyclical mark ups. To provide additional support to these empirical findings Etro and Colciago (2010) have performed a VAR analysis on US data. They constructed a labor share based measure of the price mark up for the U.S. Fig. 1 plots the series of detrended GDP, the markup and an index of net business formation at a quarterly frequency from 1948:1 to 1995:3. Net business formation is procyclical and negatively correlated with the mark up, which is countercyclical. The contemporaneous correlation between GDP and new business formation is positive and equals 0.45, while that between GDP and the price mark up is -0.42. Next, they considered a VAR(2) model including the mark up measure, a measure of the Solow residual corrected for the presence of market structure endogeneity, which is taken as the measure of technology, consumption, GDP, profits, and the index of net business formation. The technology shock is identified by imposing

a recursive structure on the system. In the baseline specification variables are ordered as listed above. The ordering is naturally suggested by the EMSs approach. The technology shock affects output and consumption, this leads, for given markup, to a change in profits which affects the entry decision of firms: the resulting number of competitors finally leads to a mark up change. Fig. 2 shows the estimated responses to an expansionary shock to technology. The responses of output and consumption are similar to those found in the literature. Most relevantly for our purposes, both profits and firm entry respond positively to the technology shock, while the price mark up declines significantly. This endogenous reaction is consistent with the hypothesis formulated in the EMSs approach.

The simulation of the simplest possible dynamic stochastic general equilibrium model with EMSs calibrated on the U.S. economy has shown that the EMSs approach allows us to mimic the variability of the main aggregate variables as output, consumption, investment, labor supply and profits at least as well as a more complex neoclassical model in the Real Business Cycle tradition, and to do even better at replicating second moments of the U.S. data.

## 1.1 The boom of the 90s

If the mechanism of propagation of the shocks suggested here represents an important component of the business cycle, it may allow us to reinterpret the reaction of economies to shocks, and in particular to clarify what is going on in the current recession. With this purpose in mind, let us first look at what happened during the 90s, when a positive and permanent technology shock hit the global economy: it was the beginning of the so-called New Economy, founded on new general purpose technologies associated with PCs and the Internet. When the impact of the diffusion of these technologies on the global productivity became evident, growth opportunities opened up and profit expectations gradually improved in many sectors, and not just in the sectors of the New Economy. In particular, most service sectors, which represent the large majority of business in the developed world, benefited from the cost-reducing impact of new software and hardware, and a heavy process of business creation and innovation took place in these sectors.

The expectations on profitability and growth, mirrored by the stock market have been positive for such a long period (during the years of the Clinton Administration) that they drove one of the longest period of sustained growth. Observers and economists started welcoming a “new era” in which business cycle fluctuations were limited and could be smoothed with the standard tools of fiscal and monetary policy, and the growth rate became the main interest of policymaking and economic theory. Growth was high not only in the U.S., but also in all those countries where the market forces (of business creation) were working freely. As a matter of fact, U.S. consumption and imports started driving foreign growth, and U.S. investments (in business creation and innova-

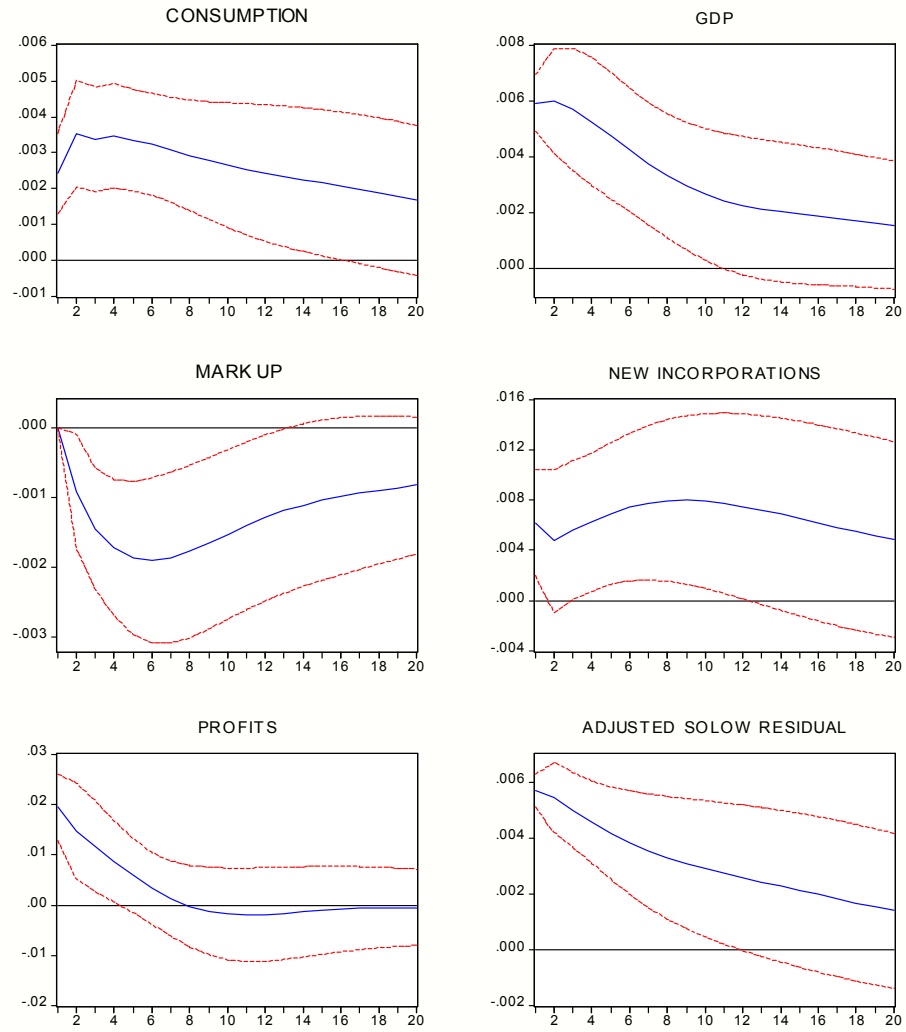


Figure 2: VAR(2) model. IRFs to a technology shock with 95 percent confidence bands.

tion) attracted capital from the rest of the world.

The American consumption boom went as far as to reach a rate of savings out of disposable income close to zero in 2000 and a rate of indebtedness out of disposable income at 140 %. While a similar extreme behavior could be rationalized on the basis of high growth expectations, it persisted when these expectations changed at the turn of the century (with the stock market crash first, and then with the terroristic attacks of September 11, 2001), and turned into a pathological incapacity to save, leading to serious imbalances. These can be summarized in three main critical consequences of the consumption boom: 1) the excessive imports of foreign goods maintained a large deficit in the foreign accounts, 2) the excessive borrowing in terms of easy mortgages put upward pressure on real estate prices, and 3) the excessive leverage of equity capital in the financial sector induced excessive risk taking and drugged stock market prices. Some commentators, led by Shiller (2005), have argued that the dot-com boom (peaking in 2000) and the real estate boom (peaking in 2006) could be explained only in part by structural factors, but also by cultural and psychological factors associated with a sort of “irrational exuberance”. Whether a large part of these booms were “bubbles” or not, the American imbalances could only be corrected with a drastic depreciation of the Dollar, with the house price crash and with the financial crisis.

## 1.2 The Great Recession

During 2008, the global economy has entered in its deepest economic recession since the Great Depression of 1929: for comparison with the latter, the current crisis is often called the Great Recession. Multiple factors have caused the Great Recession, including the rapid but temporary increase in the oil price during the first half of the year (a negative supply shock similar to those of the 70s, though shorter). However, there is a large consensus that the main source of the global recession was in the losses emerged from the subprime crisis associated with the bursting of the U.S. housing boom in 2006, and with the consequent stock market crash and the depression of consumer confidence (a negative demand shock similar to that of the Great Depression). What the debate is mainly about, however, is the mechanism that has propagated and deepened the crisis: is it revised expectations on future prosperity? or irrational depression? a collapse of consumer demand due to the wealth losses? a pure credit crunch? or bad and insufficient policy reactions? Before advancing our hypothesis, let us establish the facts.

For a decade before the real estate downturn in the U.S., loan incentives and a long-run trend of rising housing prices encouraged Americans to assume mortgages with the hope that they could refinance at more favorable terms later. However, once housing prices started to drop, refinancing became more difficult, and in front of a fall in prices by 25 % or more (especially in towns like Boston, Los Angeles or Miami), many borrowers ended up with negative equity,

that is with a mortgage worth more than the house, and became insolvent. The number of borrowers in default kept increasing with the housing bust (and now with the crisis of the real economy), but the worst consequences were going to happen in the financial sector.

The so-called “subprime crisis” was exactly due to the high default rates on subprime and other adjustable rate mortgages made to higher-risk borrowers with lower income or worse credit history than prime borrowers. The market for subprime lending reached a fifth of total U.S. mortgage market. The potential losses in the event of a real estate downturn would have not been such a big problem if risks were properly taken into account by the mortgage brokers: this was not the case since they were able to repackage the returns on these mortgages, bundle them together and sell them in different slices to financial institutions, even under high ratings that had no relation with the underlying reality of the actual subprime mortgages. In a recent book on the role of animal spirits in driving the economy Akerlof and Shiller (2009) notice that, as long as housing prices kept increasing this was “an economic equilibrium that encompassed the whole chain, from the buyers of the properties, to the originators of the mortgages, to the securitizers of the mortgages, to the rating agencies, and finally to the purchasers of the mortgage-backed securities. They each had their own motives. But those at the beginning of the chain - those who took on the mortgages and the houses they could not afford, and those who were the ultimate holders of the debt - were buying a modern form of snake oil.”

The wide (and unregulated) diffusion of derivatives based on these risky assets spread the related losses throughout the American and international financial markets, with effects that were largely ignored by rating agencies and that emerged in their magnitude only later, gradually and everywhere. In February 2008 a highly leveraged British bank, Northern Rock, had to be nationalized because of its heavy liquidity problems which triggered a bank run. Since then, a number of American and European financial institutions that were widely engaged in the securitization of mortgages started facing similar problems. In March 2008, Bear Stearns had to be acquired by JP Morgan Chase with the assistance of the Fed. In July, one of the largest mortgage lenders in the U.S., IndyMac Bank, collapsed. In September 2008, the U.S. Government placed the huge mortgage lenders Fannie Mae and Freddie Mac into federal conservatorship and bought 80% of the major insurance company AIG. On September 15, 2008, the investment bank Lehman Brothers filed for Chapter 11 (the largest bankruptcy in U.S. history) after the Bush Administration refused to bail it out (probably to avoid further moral hazard problems). In the meantime, Merrill Lynch was acquired by Bank of America (and Wachovia by Wells Fargo) and the two remaining large investment banks, Goldman Sachs and Morgan Stanley, were converted to traditional banks, concluding the era of investment banking, and maybe also the Anglo-Saxon dominance of the global banking sector.

In the Fall 2008 the crisis entered an acute phase characterized by a stock market crash, the failure of prominent banks, efforts by American and Euro-

pean authorities to bailout distressed financial institutions, lack of confidence and further defaults. As Krugman (2008) has noticed, “the result of this self-reinforcing process was, in effect, a massive bank run that caused the shadow banking system to shrivel up, much as the conventional banking system did in the early 1930s. Auction-rate securities, in effect a banking sector providing \$ 330 billion worth of credit, disappeared. Asset-backed commercial paper, another de facto banking sector, dropped from providing \$ 1.2 trillion in credit to providing only \$ 700 billion.” The lack of confidence froze interbank lending worldwide and induced a substantial reduction of lending to firms. Subsequent announced and implemented nationalizations spread additional fear and lack of confidence in the markets and led to further stock market crashes at the beginning of 2009.

The Obama Administration is reacting to the crisis with an unprecedented expansionary fiscal policy (see Section 6) and with a plan by the Treasury Secretary Tim Geithner to deal with the “toxic assets” that are clogging up bank balance sheets, while the Fed, led by the main academic expert of the Great Depression, Ben Bernanke, has implemented an equally unprecedented expansionary monetary policy (see Section 7). The rest of the Western world has followed a similar road adopting deficit spending and reducing drastically the interest rates. Meanwhile, the financial crisis has extended its disruptive impact from financial institutions to countries whose financial accounts and currencies were under heavy pressure, in particular Iceland, the Baltic Republics (Latvia in particular), Hungary, Bulgaria, Romania and Ukraine.

The melt down of stock market capitalizations reduced even more the incentives to invest and create new business activities. In the U.S., venture capital investment, a key source (and indicator) of innovation and business creation, went down by a third in the last quarter of 2008 (compared to the previous year). Other traditional forms of investments in business creation collapsed as well, possibly limited by a credit crunch. This weakness of the investment process transmitted the financial crisis to the real economy. First, firms reduced their production levels, exhausted their inventories and stopped hiring new workers, then they started to close factories and fire workers. At the end of 2008, consumer demand in the Western world started decreasing as well, quickly for durable goods (as it always happens during recessions), and slowly for the other goods. In the last quarter of the year most Western countries were officially in recession.

Markets have experienced two main phenomena. On one side investment has decreased, business creation and R&D spending have been often limited or postponed, many multi-brand firms have reduced the number of brands supplied on the market, other firms simply stopped exporting to selected countries, some others have merged or are trying to merge with direct competitors, and other firms have gone bankrupt. The consequent drop in net firms entry has led to a reduction in the number of firms or products within many sectors. On the other side, surviving firms have undergone a process of rationalization and job cuts.

This process has been quite spectacular in certain global and highly concentrated sectors, starting with the automotive and electronic markets, where most of the leading manufacturers announced job cuts almost at the same time. But of course, it is in smaller and local markets that business destruction leads to substantial reductions in the number of active firms. Likewise, many suppliers of large companies (for instance in the automotive and electronic markets) and downstream firms go bankrupt as a consequence of the problems of the leading companies. This is going to increase the levels of concentration in many markets, allowing the remaining firms to exploit the only chances to cover the fixed costs of production in the presence of a smaller aggregate demand: first by reducing the remuneration of labor and real wages when it is feasible, or reducing employment otherwise, and, second, by gradually increasing their mark ups.

The recession has generated a reduction of labor income and profits, but a relative increase of mark ups, and this has a crucial consequence: a further reduction in aggregate consumption (and total employment), generating an additional depression of the aggregate demand and a collapse of trade across countries. Surviving firms are reducing production and cutting jobs, contributing to the raise of unemployment. This is the competition effect in action, though of course it is working in reverse: in a recessionary context net business destruction deteriorates the division of surplus between input remuneration and mark ups and contributes to depress demand. In turn, this reduction in demand is going to exert a negative feedback effect on profits and stock market evaluations with an additional negative impact on business creation, competition and trade, so as to propagate the recession over time and space.

## 2 Steady-state EMSs

Even if the number of goods and firms, the mark ups and all the aggregate variables as output, consumption, investment, labor force and profits are changing over the business cycle, in the long run their pattern must be determined by the structural parameters of the economy.

In the neoclassical approach (Solow, 1956), the wealth and growth of nations depend on the productivity of the workers (and their machines) and on the evolution of this productivity, on their propensity to work which determines the size of the labor force in the economy, and on their propensity to save which determines the sizes of investment and ultimately the stock of physical capital of the economy. Of course, there is not a unique path toward economic progress. Some countries have based their prosperity on the achievement of high levels of productivity, others have obtained prosperity by working more and others have reached the same prosperity through high savings rates.<sup>2</sup>

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<sup>2</sup>Moreover, as suggested by Acemoglu (2009), there are other factors that affect the long run performance of economies, including luck, geography, culture, and formal and informal institutions.

Taking as given the long run impact of these fundamental factors on the production possibilities, following Etro and Colciago (2010), we claim that there is a second order impact that these and a few other technological and behavioral factors exert on the market structures and consequently on the long run performance of the economies. The EMSs approach has characterized the average structure of productive markets in steady state (number of firms, individual production and mark ups) depending on a few structural parameters and on the form of competition. The EMSs approach has emphasized five main determinants of the long run market structures and of the other aggregate variables.

The first determinant is given by scale factors as the size of the population or productivity (in general equilibrium where labor income is linked to productivity): higher productivity (or larger population) leads to a larger size of the demand inducing more business creation, which in turn increases the steady state number of firms and enhances competition while reducing the mark ups. This factor is already present in the simple example of Section 1, as shown in the positive relation between number of firms  $N$  and market size  $L$  in (3). This suggests also that the relation between the size of the markets and the number of firms should be less than proportional, reflecting the strengthening of competition associated with more competitors: as we will see below, this key hypothesis is strongly supported by the empirical evidence.

The second determinant of the steady state EMSs is the size of the barriers to entry: when these are high, the profitability of entry is low and the long run equilibrium is characterized by high concentration and high mark ups. Also this second determinant is present in our earlier example through the negative relation between number of firms  $N$  and entry costs  $F$  in (3). Notice that markets characterized by high sunk costs of entry due to technological conditions naturally lead to equilibria with few active firms, and this does not represent a problem in itself. However, the introduction of a general purpose technology which reduces the fixed costs of entry is going to positively affect business creation and therefore competition and output production.<sup>3</sup>

The third determinant of the long run equilibrium is the degree of substitutability between goods ( $\theta$ ). Higher homogeneity of the goods induces stronger competition between the firms and leads to lower mark ups, which in turn attracts a limited number of firms in the markets. On the contrary, when goods are highly differentiated, competition is relaxed and mark ups are higher, but this attracts more firms. Of course, markets with different levels of substitutability between goods coexist in the real world, and we should think of these relations only as general tendencies characterizing different markets.

The fourth structural factor determining the nature of the EMSs in the long run emerges when there are frictions and delays in the process of business

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<sup>3</sup>Moreover, to the extent that the entry barriers are artificial, in the sense that they are due to product market regulations, we can conclude that reforms leading to deregulation reduce concentration and mark ups in the long run, with a positive impact on the performance of the economy as a whole.

creation. It can be introduced easily through a rate of business destruction due to exogenous reasons: when the risk of bankruptcy is high, the expected value of business creation is lower and business creation is limited. Therefore, in case of a high rate of default ( $\delta$ ) there are only few firms in the long run (but with a high rate of turnover), and they apply a high mark up to their goods.

The fifth element emerges when entry is a long run decision, and is a behavioral factor: the way people discount the future. The degree of patience is what determines the propensity to save of the households, which in turn affects the equilibrium in the credit market. When agents are more patient, their large supply of savings reduces the interest rate ( $r$ ), which means that the discounted sum of future profits is higher: this attracts more entry, strengthens competition and ultimately reduces the mark ups. Therefore, more patient agents lead to a higher number of firms in the steady state.

To exemplify these results, consider the case of a dynamic system characterized by (5), (6) and savings decisions derived from the maximization of a lifetime utility with logarithmic preferences. Under Cournot competition with homogenous goods, labor productivity  $A$ , in steady state we obtain the following mark up (Etro, 2009,b):

$$\mu = \frac{\sqrt{(1-\delta)S}}{\sqrt{(1-\delta)S} - \sqrt{(r+\delta)F}} \quad (7)$$

which is a simple extension of (4), where we define  $S = AL$  as the size of the market. This mark up is associated with the number of firms:

$$N = \sqrt{\left(\frac{1-\delta}{r+\delta}\right) \left(\frac{S}{F}\right)} \quad (8)$$

which is a simple extension of (3), always proportional to the square root of the size of the market.

Summarizing the results obtained until now with a focus on the impact on the mark ups, we have:

**PRINCIPLE 2.** IN THE LONG RUN, THE STEADY STATE EMSs ARE CHARACTERIZED BY MARK UPS INCREASING IN THE COST OF ENTRY AND IN THE RATE OF BUSINESS DESTRUCTION AND DECREASING IN LABOR PRODUCTIVITY, IN THE DISCOUNT FACTOR AND IN THE DEGREE OF SUBSTITUTABILITY BETWEEN GOODS.

Notice that the steady state structure of the markets determines not only what is produced and at which price it is sold, but also how much of it is consumed, which is what matters for our understanding of the behavior of the economy and for its reaction to structural changes. The impact of the main structural parameters on long run consumption under competition in prices in the markets is the following: higher productivity, more substitutability between

the goods and more patience ultimately lead to larger consumption bundles, while higher costs of entry and higher rates of business destruction lead to smaller consumption bundles in the long run.

The following analysis, based on joint work with Dirk Czarnitzki, provides evidence on the first determinant of the EMSs, market size (for related works see Bresnahan and Reiss, 1987, 1990, Manuszack, 2002, Campbell and Hopenhayn, 2005, Berry and Reiss, 2007, and Manuszak and Moul, 2008)

**Empirical evidence on market size effects** Systematic evidence on the relation between market size and the number of firms can be obtained from a panel study of different sectors. Following a preliminary work by Czarnitzki and Etro (2009), we have estimated the following structural relation between number of firms  $N_{jt}$  in sector  $j$  at time  $t$  and the market size  $S_{jt}$  of the same sector at the same time:

$$\ln N_{jt} = \beta_{0j} + \beta_1 \ln S_{jt} + \varepsilon_{jt} \quad (9)$$

where  $\varepsilon_{jt}$  is an error term. The Dixit-Stiglitz model implies  $\beta_1 = 1$ , as can be verified taking the logs of (2). Instead, Cournot competition with endogenous entry implies  $\beta_1 \in [0.5, 1)$ , with a coefficient that should decrease with the degree of substitutability between products. In particular, in case of homogenous goods we have  $\beta_1 = 0.5$ , as can be verified taking the logs of (3). On this basis we can test the Dixit-Stiglitz hypothesis and compare it with the predictions of the EMSs approach.

One can also check the relation between concentration and market size. Common indexes of market concentration can be highly criticized as a measure of market power, nevertheless we used the Herfindahl-Hirschman Index of concentration for robustness analysis. This index corresponds to the sum of the squared market shares, and in the case of symmetric competition it becomes  $HHI_{jt} = (1/N_{jt}) \cdot 1000$ , therefore we would expect an inverse relation compared to that found for the number of firms.

Our preliminary investigation of the relation between market size and number of firms is based on a panel of industry level data for the German manufacturing sector. The data stem from the bi-annual official publications of the German Monopolies Commission, that is obligated by law to publish regularly concentration statistics for competition policy purposes. This data source contains the number of firms, total industry sales, which we adopt as a measure of market size, and the HHI index for German manufacturing for different aggregations of the European standard industry classification called NACE. In the following, we utilize data at the NACE 3-digit level, which results in 102 different manufacturing industries. We have bi-annual data between 1991 and 2003. Table A shows the summary statistics of the number of firms,  $N_{jt}$ , the total industry sales,  $S_{jt}$ , that we use as market size variable, and the Herfindahl Index,  $HHI_{jt}$ .

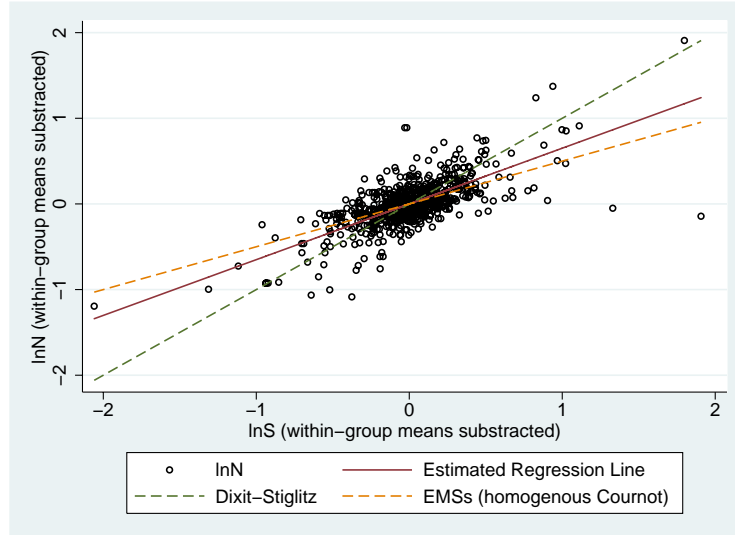


Figure 3: Number of firms and Market Size for German industries (from regressions). NACE 3-digit level. Source: Czarnitzki and Etro (2009)

**Table A.** Descriptive Statistics (711 observations, 102 industries)

	Mean	Std. dev.	Min.	Max.
$N_{jt}$	387	540	1	3851
$S_{jt}$	22456.38	34878.98	31.99	38569.31
$HHI_{jt}$	84.05	141.75	3.15	2431.14

We estimate three different panel models. First, we estimate a pooled cross-sectional OLS regression (POLS) where we implicitly assume that  $\beta_{0j} = \beta_0$  for any  $j$ . This is then relaxed by estimating two fixed effects models. We allow  $\beta_{0j}$  to be industry specific by applying the well-known within panel regression (FE: Within) and by estimating a first-difference model (FE: FD).

The results are displayed in Table B. Standard  $F$ -tests confirm the presence of industry-specific  $\beta_{0j}$ , so that the POLS models are rejected. Consequently, we should turn our attention to the fixed effects models. In the regression concerning the number of firms, we find that the slope of market size is positive and significant in both the within and the FD regression. The Dixit-Stiglitz hypothesis that  $\beta_1 = 1$  is clearly rejected in both models, with respectively  $F = 22.9^{***}$  and  $27.69^{***}$ .

Fig. 3 is representative of our results, and plots the (log) number of firms of the industries against the (log) sales per industry, here on the basis of the within regression. The 45°-dashed line represents the hypothetical relation between

number of firms and size that emerges from the Dixit-Stiglitz approach ( $\beta_1 = 1$ ), while the flatter dashed line is the relation that emerges from the EMSs approach in case of Cournot competition with homogenous goods ( $\beta_1 = 0.5$ ). We expect that the data lie between these two extreme predictions, and this is exactly what we find out. The Dixit-Stiglitz approach is rejected, meaning that there is a robust positive but less than proportional relation between the size of the market and the number of firms. The estimates for  $\beta_1$  in the within and first-difference model are respectively  $\beta_1 = 0.650$  (the case of Fig. 3) and  $\beta_1 = 0.507$  (which in Fig. 3 could not be distinguished from the flatter dashed line): this suggests that the EMSs model with Cournot competition and homogenous goods is a better approximation to the data (indeed, the hypothesis  $\beta_1 = 0.5$  cannot be rejected in both models). The results are confirmed when we group firms in macrosectors (ICT, machineries, chemicals, paper, metal, food- and textile-related industries) with the Dixit-Stiglitz hypothesis rejected always except for textile-related sectors. Finally, notice that even without controlling for other variables, our basic results are quite powerful, with  $R^2$  around 50%.

**Table B.** Regression Results

	POLS		FE: Within		FE: FD	
	Coef.	(Std. err.)	Coef.	(Std. err.)	Coef.	(Std. err.)
Regression of $\ln N_{jt}$ on $\ln S_{jt}$						
$\beta_1$	0.611	(0.07)***	0.650	(0.07)***	0.507	(0.09)***
Obs.	711		711		609	
$R^2$	0.45		0.56		0.43	

Note: Each regression includes a full set of time dummies. They are always significant at the 5% level. \*\*\* (\*\*, \*) indicate a significance level of 1% (5%, 10%).

The regressions on the HHI show a weaker relation with market size, but they nevertheless identify a negative slope much lower than one, again in contradiction with the Dixit-Stiglitz hypothesis.

We have also verified the robustness of our results with different datasets, always for the German manufacturing sector, obtaining similar patterns. Fig. 4 reports the basic within panel regression based on data at the NACE 4-digit level from the annual “Kostenstrukturhebung” published by the German Federal Statistical Office (235 groups between 1995 and 2006 for a total of 2695 observations). The results are in line with the earlier ones, except for one difference: when we look at more disaggregated data, the estimated coefficient  $\beta_1$  decreases, here to  $\beta_1 = 0.40$ . This may support another implication of the EMSs approach: a higher degree of substitutability, that we find at more disaggregated levels in the data, changes the relation between market size and number of firms and reduces the associated coefficient. Further research should try to verify whether the results of Czarnitzki and Etro (2009) are supported in other countries or datasets.

This analysis suggests that the implications of the EMSs approach for the relation between market size and number of firms are broadly supported by

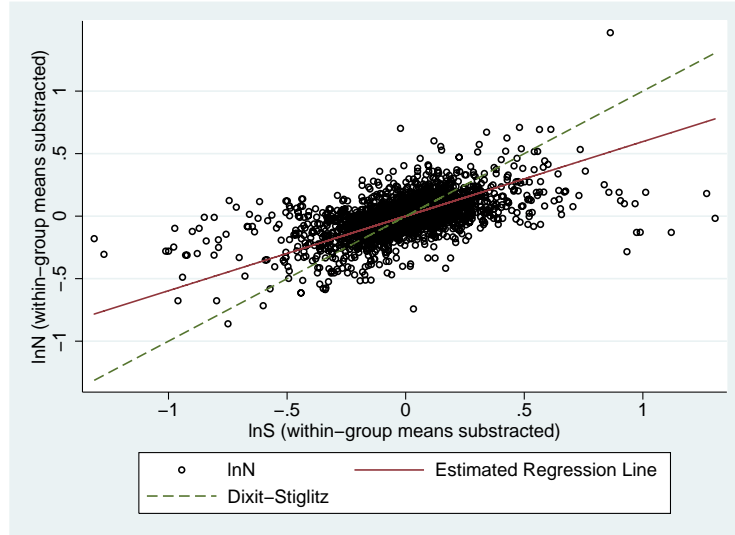


Figure 4: Number of firms and Market Size for German industries (from regressions). NACE 4-digit level. Source: Czarnitzki and Etro (2009)

microeconomic data. Recent works (as Broda and Weinstein, 2009) have shown that also the cyclical properties of the market structures are in line with the predictions of the EMSs approach: the number of firms, in particular, appears highly procyclical.

### 3 EMSs and International Trade

Globalization, defined as the increase in trade in goods and factors of production and associated with the reduction of natural and artificial trade barriers, is one of the main phenomena of the last decades, with implications and motivations that go far beyond economic factors. Understanding the impact of increasing (and decreasing) openness is one of the major aims of macroeconomic theory.

It is often claimed that globalization leads to lower prices for the consumers but also to business destruction at the local level. However, the new trade theory based on monopolistic competition *à la* Dixit-Stiglitz (summarized by Helpman and Krugman, 1985) has emphasized that opening up to trade leads mainly to other forms of gains and other forms of impact on business: it keeps prices at the same level and it does not affect the number of active firms, while it proportionally increases the total number of goods available for consumption at the local level, as can be seen from (2), which is linearly increasing in the

market size. This generates what are usually called the “gains from variety” due to openness.

The EMSs approach emphasizes a related but more complex mechanism. When a country opens up to trade, say with a bordering country, the domestic firms start competing with the foreign ones for both the domestic and the foreign market (that become an integrated market in the absence of trade frictions). This strengthening of competition leads to a reduction of the mark ups and therefore of the prices of all the goods. Profitability and entry are affected in three ways: first, each firm serves two markets rather than one, which enhances profitability; second, each firm is sharing each market with a larger number of firms, which reduces profitability; third, stronger competition reduces mark ups and profitability. The net effect determines the impact on the number of firms active in each market. In the absence of asymmetries between the firms, the first two effects balance each other and the overall impact of opening up to trade is a reduction of the total number of firms, which implies business destruction at the local level. Of course, the number of firms active in the integrated market increases, but less than proportionally, as can be seen from (3), which is concave in the market size. The associated competition effect generates price reductions and what we called the “gains from competition”.

If we extend the example of Section 1 to Cournot competition between firms selling homogenous goods in two perfectly integrated markets with size respectively  $L$  and  $L^*$ , the equilibrium (total) number of firms becomes:

$$N = \sqrt{\frac{L + L^*}{F}} \quad (10)$$

which implies the equilibrium mark up:

$$\mu = \frac{\sqrt{L + L^*}}{\sqrt{L + L^*} - \sqrt{F}} \quad (11)$$

To clarify the implications of the EMSs approach for trade, let us imagine that two identical countries ( $L = L^*$ ) opens up to trade. Suppose that ten firms are active in each country in autarchy. After the two countries open up to trade with each other, the EMSs approach implies that only fourteen firms, seven in each country, remain active. This implies that trade leads to the foreclosure of three firms in each country, which is the consequence of a reduction of the mark up by about 30%.<sup>4</sup> Nevertheless, it is clear that trade increases utility because the price of the homogenous good is reduced everywhere (and there is a more limited waste of labor resources in fixed costs).

The extent of this mechanism crucially depends on the type of traded goods. At one extreme we have perfectly differentiated goods with competition in prices:

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<sup>4</sup>Formally, if  $N = \sqrt{L/F} = 10$ , we must have  $N + N^* = \sqrt{2}N \simeq 14$ . Moreover, if the autarchic price was  $1/(1 - 1/10)$ , the new one must be  $1/(1 - 1/14)$ , which is equivalent to a reduction of the mark up from 11.1% to 7.7%. This is a 30% reduction.

for these goods, all the gains from opening up to trade derive from an increase in the number of consumed varieties and not from price changes, while business destruction is absent. This is the typical situation that Krugman (1980) had in mind when talking about the gains from intra-industry trade: globalization makes different brands of cars available for all consumers, which enlarges their options. At the other extreme, however, we have homogenous goods with competition in quantities: for these goods, all the gains from trade derive from lower prices, but business destruction is heavy.<sup>5</sup> This is probably what happened in most markets during the phase of intense globalization of the last years, and it is not surprising that many supporters of the globalization process have constantly emphasized the price-reducing impact of openness while associating the business destruction effect with a healthy reallocation of labor across firms and sectors. Nevertheless, when the labor market works imperfectly, the social costs associated with this process of job reallocation can be quite relevant. Summing up the main insights, we have:

**PRINCIPLE 3. GLOBALIZATION BRINGS GAINS FROM TRADE BY STRENGTHENING COMPETITION, REDUCING MARK UPS AND PRICES, AND INCREASING THE NUMBER OF AVAILABLE GOODS, BUT IT INDUCES BUSINESS DESTRUCTION AT THE LOCAL LEVEL.**

Finally, globalization strengthens the interdependence between economies, and leads to faster propagation of the shocks across countries. In a global world, we can re-examine the impact of shocks and their international propagation through the EMSs approach (Ghironi and Melitz, 2005). Imagine that the domestic economy is hit by a temporary positive productivity shock. Such a shock increases domestic consumption and profits, which attracts entry of new firms in the domestic economy and strengthens competition. Domestic entry increases labor demand at home compared to abroad, and exerts upward pressure on the domestic wages, which causes the relative price of non-traded goods at home to increase relative to foreign. As a consequence, the increase in domestic productivity generates a real exchange rate appreciation due to higher prices of domestic non-tradables and imports and to a larger demand for domestic goods, which leads to persistent deviations from the purchasing power parity (in line with the evidence). Meanwhile, the positive impact on the profits of the foreign firms and the temporary price reductions do exert an indirect expansionary effect abroad, which contributes to propagate the boom across countries. The opposite mechanism works in case of a negative shock, and the rapid diffusion of the 2008 crisis from the U.S. to the rest of the world has been one of the most dramatic examples of the deep interdependence of the modern economies.

Looking at these phenomena in a global perspective, it emerges quite clearly that macroeconomic policy at the national level is always less effective when it

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<sup>5</sup>Of course, in intermediate situations the gains from trade derive from both lower prices and more varieties, and business destruction is partial.

is not coordinated at a supra-national level, but also that there are large gains from coordinating policies within international unions or global agreements. The recent financial crisis has urged the coordination and the tightening of financial regulation at a global level to reduce the systemic risks associated with the tendency of unregulated financial intermediaries to overleverage their capital and to undertake excessive risk). Since only few countries would give away their sovereignty on this matter, it is at least important that most countries could agree on a number of basic principles (maybe through the Financial Stability Forum currently directed by Mario Draghi) and allow stricter regulation on a unilateral or bilateral basis. More or less as the W.T.O. has done to coordinate the process of tariff reductions toward free trade.<sup>6</sup> The future of globalization is deeply related with the willingness and the ability of developed and developing countries to coordinate properly their policies.

## 4 EMSs, Innovation by Leaders and Growth

Understanding the determinants of growth and the reasons for which differentials in growth rates are so large is fundamental to foster economic progress around the world. While growth in developing countries is largely associated with the process of industrialization through established technologies and with the accumulation of physical and human capital in the neoclassical sense, growth in the Western developed countries is largely driven by the continuous process of expansion of the technological frontier.

Technology-driven growth is mainly due to the innovations of firms investing in R&D to create new or better products and replace the existing ones (Romer, 1990, and Aghion and Howitt, 1992). Profits, associated with innovations and temporarily protected through IPRs, provide the incentives to invest in R&D for firms in high-tech sectors, and the structure of the competition between these firms is a crucial element of the engine of growth. The EMSs approach has widely examined this structure, endogenizing strategic interactions in the investment choices and the entry process, and it has been also focused on the peculiar role of market leaders.

Entry of firms in the competition for the market is primarily driven by the size of the discounted value of the expected profits from innovations, say  $V$ , and therefore it is directly related to the strength of IPRs protection. This protection, as the legal enforcement of contracts and the protection of the same physical property rights, is one of the founding elements of the free market economies, and possibly the most important, since dynamic growth (rather than static wealth) relies on it. Of course, entry changes the nature of the strategic

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<sup>6</sup>More generally, Alesina, Angeloni and Etro (2005) have shown that such a two-level system is politically viable and can improve the outcome of international coordination. For a similar proposal on financial regulation see Dani Rodrik (2009, *Economist*, "A Plan B for Global Finance", *Economic Focus*, March 14th, p. 72).

interactions between investors, increasing aggregate investment and reducing the expected profitability (per firm) at rates that depend on the substitutability or complementarity between the investments of the firms and on heterogeneities between firms.<sup>7</sup> The entry process is exhausted when the expected return on R&D investment is the same as the return on alternative investments, and this equilibrium determines the aggregate rate of technological progress.

For instance, in case each firm  $j$  bears quadratic costs of investment to have the probability  $z_j \in (0, 1)$  of innovating and obtaining a patent with value  $V > 1$  - for instance given by (6) - if no other firm innovates, the expected profits from investing are:

$$\pi^j = z_j \prod_{k=1, k \neq j}^N [1 - z_k] V - \frac{z_j^2}{2} - F \quad (12)$$

Solving for the optimality conditions and the endogenous entry conditions, one can characterize the EMS through the equilibrium investment:

$$z = \sqrt{2F}$$

which is assumed smaller than unity, and the number of firms:

$$N = 1 + \frac{\log(V/\sqrt{2F})}{\log[1/(1 - \sqrt{2F})]} \quad (13)$$

which is increasing (and again concave because of the strategic interactions) in the value of innovations.

The endogeneity of entry plays a crucial role in the decision of technological leaders to invest in R&D to perpetuate their status: leaders tend to invest less than their rivals and to reduce the aggregate investment when they face an exogenous number of competitors, but they tend to invest more and to increase the aggregate investment when they face an endogenous number of investors trying to replace the leading technology. In the example above, a leader facing endogenous entry would invest more than before, at the level:

$$z_L = 1 - \sqrt{2F}/V > \sqrt{2F} \quad (14)$$

which makes sure that no other firm invests (see Etro, 2004 and Kováč *et al.*, 2009). For this reason, it can be highly misleading to evaluate the competitiveness of a dynamic market on the basis of its concentration level or of the market share of its leader without concern for the entry conditions (this is a common mistake done by antitrust authorities).

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<sup>7</sup>For a recent general analysis see Denicolò and Zanchettin (2010).

## 4.1 Empirical evidence on R&D, entry and leadership

The hypothesis for which leaders invest more in R&D if and only if they face a strong entry pressure has been tested by Czarnitzki *et al.* (2008) on a unique dataset of the German manufacturing sector, the 2005 Mannheim Innovation Panel (MIP), which covers a representative sample of the German manufacturing sector. The dependent variable of our analysis is the R&D intensity in the year 2004 at the firm level. The intensity for firm  $i$  is defined as  $RDINT_i = R\&D_i / SALES_i \times 100$ . The most important right-hand side variables are aimed at identifying the endogeneity of entry in the market where each firm is active and the leadership position. An innovative aspect of this empirical approach is given by the fact that the same firms provide a subjective view on these two factors: rather than assigning a degree of entry intensity in a discretionary way or assigning a status of leadership on the basis of predetermined variables, we allow the firms to identify the existence of an endogenous threat of entry in the market and to identify who is the leader in the market.

The survey asked for several characteristics about the competitive situation in the firms' main product markets in 2002–2004. In particular, firms were asked to indicate if a list of six statements about the firms' competitive environment apply to their situation or not. The response was based on a 4-point Likert scale, from “entirely applies” to “does not apply at all”. Thus, our variable of entry threat,  $ENTRY_i$ , is an ordinal variable taking values from 0 to 3, where 3 indicates that the respondent firm strongly agreed to the statement that its market position is highly threatened by entry. When this is the case, we conjecture that entry in the industry where the firm is active can be regarded as endogenous; when the firm does not consider the threat of entry as present in its industry, this is regarded as one with an exogenous number of firms. According to our first hypothesis, we expect a negative sign of  $ENTRY_i$  in the regressions for the average R&D intensity.

The theoretical definition of a market leader is associated with a strategic first mover advantage, but a more general definition can be based on the leading position of the firm compared to its main competitors. Therefore, our crucial variable is defined through a question on a firm's position compared to its main competitors. The respondents indicated if their competitors are larger, smaller, of a similar size, or larger and smaller than their firm. Consequently, an incumbent leader in our analysis is identified by an indicator variable,  $LEADER_i$ , describing a firm that is self-defined as larger than the competitors in its main product market. According to our main testable hypothesis, we expect that the incumbent leaders choose to invest more than other contestants if and only if their market is threatened by entry. We capture this by an interaction term of leadership and entry ( $LEADER_i \times ENTRY_i$ ).

It is desirable to control for employment and capital requirement. We include firms' past employment ( $EMP_i$ ) as well as past capital intensity ( $KAPINT_i$ ) in the empirical model to account for such impacts on the investment decision.

We also control for the Herfindahl-Hirschman Index of concentration ( $HHI_i$ ) of the industry where the firm is active (multiplied by 1000). The main general determinant of the investment in R&D is the degree of protection of the intellectual property rights (IPRs) associated with the innovations that each firm can obtain. It is difficult to measure the degree of protection of the IPRs at the firm level, but we can proxy this with a measure of the stock of patents at the firm level. In particular, the differences between firms in the size of the patent portfolio can be associated with the differences in the degree of expected protection of the innovations of the firms, therefore we expect a positive correlation between R&D intensity and the patent stock. Our measure of the patent stock at the firm level accounts for all patent applications from 1978 onwards. In particular, we compute the patent stock using the perpetual inventory method for each firm,  $PSTOCK$ . Finally, we use twelve industry dummies to control for unobserved heterogeneity in investment across industries. The industries are: Food, Textiles, Paper/Publishing, Chemicals, Rubber, Glass/Ceramics, Metal, Machinery, Electronics, Information & Communication Technology, Instruments/Optics and Vehicles.

Table 1 shows the descriptive statistics of core variables used in the upcoming regression analysis. In total, we can use 1,857 observations for the empirical study. The average R&D intensity of firms is about 2.3 % and average firms size amounts to 307 employees in the sample; 8% of all firms are classified as leaders.

Table 1: Descriptive statistics (1,857 observations). Source: Czarnitzki *et al.* (2008)

Variable	Mean	Std. dev.	Min.	Max.
$RDINT_{it}$	2.271	5.112	0	38.914
$EMP_{i,t-1}/1000$	0.307	1.356	0.001	36.761
$KAPINT_{i,t-1}$	0.078	0.090	0.001	0.861
$LEADER_{it}$	0.080	0.271	0	1
$ENTRY_{it}$	1.531	0.851	0	3
$HHI_{i,t-1}$	36.778	61.022	3.15	650.17
$PSTOCK_{i,t-1}/(EMP_{i,t-1}/1000)$	8.864	26.906	0	222.447
IV candidates				
$MES_{t-1}$	0.079	0.166	0.009	2.102
$ADVERT_{it}$	2.219	1.428	1	6
$SUBSTITUTE_{it}$	1.874	0.840	0	3

## 4.2 R&D regressions

As not all firms invest in R&D, we estimate Tobit models that take account for the left censoring of the dependent variable. The Tobit model to be estimated can be written as:

$$RDINT_i^* = X_i' \beta + \varepsilon_i \quad (15)$$

where  $RDINT_i^*$  is the unobserved latent variable. The observed dependent variable is equal to:

$$RDINT_i = \begin{cases} RDINT_i^* & \text{if } X_i' \beta + \varepsilon_i > 0 \\ 0 & \text{otherwise} \end{cases} \quad (16)$$

$X_i$  represents the matrix of regressors,  $\beta$  the parameters to be estimated, and  $\varepsilon_i$  the random error term. In our basic specification,  $X_i$  includes  $EMP_{i,t-1}$ ,  $EMP_{i,t-1}^2$ ,  $KAPINT_{i,t-1}$ ,  $HHI_{i,t-1}$ ,  $LEADER_{it}$ ,  $ENTRY_{it}$  as well as 12 industry dummies (Model I). In further models, we add the interaction term  $LEADER_{it} \times ENTRY_{it}$  (Model II) and the patent stock  $PSTOCK_{it}$  to control for previous R&D (Model III).

We first consider homoscedastic regressions, and subsequently test for heteroscedasticity as coefficient estimates may be inconsistent if the assumption of homoscedasticity is violated in Tobit models. Table 2 shows the regression results for the heteroscedastic models.

As Table 2 shows, the assumption of homoscedasticity is rejected for all models (see the Wald tests on heteroscedasticity). The industry and firm size dummies are always jointly significant. The patent stock is highly positively significant, and the estimated employment effect is present. Our main findings on entry are in line with our testable hypothesis, for which investment decreases with the strength of entry threats. Furthermore, we find that incumbent leaders do not differ in their investment from other firms ( $LEADER_i$  is insignificant), unless they are threatened by endogenous entry (see the positive signs of the interaction term  $LEADER_i \times ENTRY_i$ ): in line with our main testable prediction, the competitive pressure of the potential entry of other firms induces the market leaders to invest in R&D more than any other firm.

In this empirical investigation we have proxied the endogeneity of entry in the market where each firm is active with the existence of a threat of entry perceived by the same firm. This short cut avoids the need of investigating what are the determinants of the fact that a market is characterized or not by endogenous entry as opposed to be limited to an exogenous number of firms.

A main concern with respect to the results presented so far is related to the independence of our entry variable from the dependent variable, R&D intensity. First of all, there may be a problem of reverse causality in the relation between R&D intensity and the entry threat. In principle, it is possible that successful innovative activity in the past leads to technological advantage of the firms

Table 2: Heteroscedastic Tobit models on *RDINT* (1,857 observations). Source: Czarnitzki *et al.* (2008)

Variables	Model I	Model II	Model III
$EMP_{i,t-1}/1000$	0.625*** (0.112)	0.640*** (0.111)	0.610*** (0.112)
$(EMP_{i,t-1}/1000)^2$	-0.016*** (0.003)	-0.017*** (0.003)	-0.016*** (0.003)
$KAPINT_{i,t-1}$	1.047 (0.919)	1.037 (0.927)	1.031 (0.924)
$HHI_{i,t-1}$	0.001 (0.002)	0.001 (0.002)	0.001 (0.002)
$PSTOCK_{i,t-1}$			0.032*** (0.005)
$LEADER_{it}$	0.147 (0.271)	0.135 (0.269)	0.045 (0.271)
$ENTRY_{it}$	-0.203* (0.120)	-0.322** (0.130)	-0.317** (0.128)
$ENTRY_{it} * LEADER_{it}$		0.302*** (0.115)	0.291** (0.114)
Intercept	-0.802** (0.331)	-0.909*** (0.334)	-0.949*** (0.338)
Industry dummies: $\chi^2(12)$	143.09***	142.86***	109.11***
Log-Likelihood	-3533.40	-3529.90	-3511.60
Wald Test on heteroscedasticity: $\chi^2(17)$	534.22***	530.71***	514.14***

Notes: Standard errors in parentheses. \*\*\* (\*\*, \*) indicate a significance level of 1% (5%, 10%).

which are presently active in an industry so that entry becomes difficult for the outsiders. Analogously, if the incumbents are not research active and neglect the development of new processes and products, entry may become relatively easy. Second, the EMSs approach has characterized R&D as a strategic factor, which is sometimes used by some companies to determine the market structure, including the entry conditions. For these reasons, the possibility of a reverse relationship has to be investigated with the IV approach through the analysis of the determinants of the endogenous entry threat variable.

Czarnitzki *et al.* (2008) have provide such a IV analysis. Making a long story short, they find relevant instrumental variables (the size of the median plant in an industry as a proxy for minimum efficient scale and therefore for the size of the cost of entry, and the importance of advertising in determining demand), but the potential reverse causality has been rejected by the tests. Given these results, they conclude that the results as presented in Table 2 still hold, and

that our two main hypothesis are thus confirmed: R&D investment decreases with larger entry threats in general, but leaders invest more than outsiders when threatened by entry.

### 4.3 Theoretical conclusions

In conclusion, the presence of sequential innovations, the consequence of the impact of the entry pressure on the investment of the leaders is somewhat paradoxical: the likelihood of persistence of leadership is high exactly when there is endogenous entry in the competition for the market (and not when there is high market power of the leader).<sup>8</sup> Therefore, growth is mainly driven by the investments of the market leaders to perpetuate their positions under the pressure of rival firms. We can summarize this result with:

PRINCIPLE 4. GROWTH IS DRIVEN BY THE PROCESS OF BUSINESS CREATION AND ENHANCED BY A STRATEGIC LEADERSHIP OF PATENTHOLDERS IN THE COMPETITION FOR THE MARKET, WHICH CREATES ENDOGENOUS PERSISTENCE OF THEIR TECHNOLOGICAL LEADERSHIP.

The New Economy is key to the engine of world growth because it is often associated with GPT innovations that spread their benefits in other sectors. For instance, this is the case of innovations in hardware, software, online business and advertising. Moreover, we have suggested that the leaders of these sectors contribute to drive global technological progress. Etro (2007,a, Ch. 6) provides a wide discussion of the software market in the perspective of the EMSs approach, with particular attention to the role of Microsoft as a leader forced by endogenous entry pressures to invest a lot in R&D.

## 5 EMSs and Dynamic Inefficiency

How much a country should save? By saving a lot a country can invest a lot and substantially improve the conditions of the future generations, but meanwhile consumption of the current generations is penalized. By saving less, a country privileges current consumption over growth. Apparently the right choice is just a matter of preferences, but this is not always true. There is a limit beyond which a country should never go: excessive savings may create such a large potential production that the country will not be even able to absorb it in the long run (Phelps, 1961). In these situations, the country could make current and future generations better off by simply reducing the rate of savings (this would expand current consumption without penalizing future consumption). Dynamic inefficiencies of this kind are only a theoretical possibility in the neoclassical

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<sup>8</sup>On the wide debate on the persistence of leadership see Doi (2008). See also Kealey (2008) for an interesting discussion.

framework, but they become a concrete chance in a world where markets are characterized by more realistic EMSs in the competition for the market (Etro, 2008,a) and in the market (Etro and Colciago, 2010).

When we depart from a perfectly competitive world to introduce imperfect competition, we can expect that some forms of inefficiencies emerge. Nevertheless, it is not obvious in which directions they should go in general equilibrium: in the competition in the market, should we expect excessive concentration and mark ups? or too many firms and too small mark ups? Likewise, in the competition for the market, should we expect a number of firms and an aggregate investment in R&D above or below the efficient levels? The general answers to these questions are much more clear-cut than what one could expect on the basis of casual intuitions. It turns out that under fairly general conditions, the number of firms is excessive both under competition in the market and for the market and, under more restrictive conditions, this form of excessive entry may lead to persistent negative consequences, namely dynamic inefficiency.

The excessive entry result is related to the fact that, whenever there are few firms, entry of a new one exerts a strong negative externality on the profitability of the incumbents, but this externality is irrelevant for the actual choice of entry. For instance, in our example of EMS in the competition in the market, the number of firms (3) was inefficient because at the production level it would have been more efficient to have a single firm. This phenomenon is well known in the theory of industrial organization as the business stealing effect (Mankiw and Whinston, 1987). However, in a general equilibrium context the business stealing effect has new implications for long run consumption levels. The dynamic inefficiency result emerges in the presence of competition in quantities in the market when the agents are extremely patient. In such a case, agents save a lot, which leads to excessive investments in business creation and to the proliferation of too many small firms (some empirical evidence of this possibility is in Berry and Waldfogel, 1999). Consider the particular case of firms producing homogenous goods: the creation of new firms is a poor way to increase production (relative to an increase in the individual production of the existing firms), since it requires a pure waste of resources in fixed costs of entry. Because of this waste, consumers could be better off reducing their savings to increase current consumption without reducing long run consumption. A similar phenomenon takes place in the competition for the market: savings are wasted in excessive creation of firms duplicating investments in R&D to replace each other, and a reallocation of resources could increase current consumption without penalizing long run growth. Of course, when investment creates steady growth, the damages of the inefficiency of the market structure are quite dramatic. Countries characterized by excessively small firms could grow at higher rates if they experienced a process of concentration leading to larger firms. Summarizing, we have:

PRINCIPLE 5. IN THE LONG RUN, THE EMSs CAN BE CHARACTERIZED

BY DYNAMIC INEFFICIENCY IN TERMS OF EXCESSIVE SAVINGS AND TOO MANY SMALL FIRMS ACTIVE IN THE COMPETITION IN THE MARKET AND FOR THE MARKET.

Of course, even in the absence of dynamic inefficiency, EMSs generate always suboptimal outcomes. This inefficiency naturally leads to the normative analysis of the following sections.

## 6 EMSs and Fiscal Policy

The departure from a perfectly competitive environment and the emergence of inefficiencies generate a new role for fiscal policy in the EMSs approach. For instance, as a consequence of the dynamic inefficiency emphasized in the previous section and due to excessive investment in business creation, our theory suggests that it would be optimal to correct this steady state distortion with a production subsidy that leads firms to increase their individual production, and an R&D subsidy that leads firms to invest more in innovative activities. The former instrument should be associated with a wage subsidy to implement the optimal allocation of resources (investment and labor) in the competition in the market. The latter instrument should be associated with an appropriate capital income or profit taxation, or with an appropriate entry fee/subsidy to target the right number of firms active in the innovative activity and reach the optimal growth rate.

However, fiscal policy plays a more interesting role outside of the steady state (Bilbiie *et al.*, 2008a). The reason is that, contrary to a New-Keynesian environment where firms behave as independent monopolists, strategic interactions and endogenous entry lead to a complex impact of the fiscal tools along the transition path to the steady state. In particular, fiscal policy needs to change along the gradual process of entry because the inefficiencies in the allocation of resources are deeper when the number of firms is low and they are smaller when the number of firms is closer to the efficient level. The same efficient number of firms trades off the advantages of increased product variety and quality with the disadvantages of the costs of business creation. When competition in the market is still characterized by a small number of firms it is optimal to subsidize production and labor supply, or to reduce sales taxes and wage taxes. Since the number of firms is positively correlated with output along the transition path and over the business cycle, this implies that fiscal policy and also the optimal tax rates should be countercyclical.

Apparently, the result on the countercyclicity of the optimal fiscal policy is in line with a wide consensus in both the neoclassical and Keynesian approaches. However, here it derives from different reasons and it has more radical implications.

In the Keynesian approach it is the stabilizing role of government intervention on the demand side that leads to a countercyclical fiscal policy implemented

with deficit spending in recessions and budget surpluses in boom (Keynes, 1936). In the neoclassical approach, a countercyclical fiscal policy is the result of the principle of tax smoothing, for which constant tax rates are optimal to minimize the tax distortions on the supply side, so that the public deficit increases in recessions and decreases in booms (Barro, 1979).

In the EMSs approach the distortions are endogenously induced by the strategic interactions and by entry choices in decentralized markets, they get worse in recession when competition is weaker, and they are reduced in boom, when competition is stronger. Therefore, the optimal fiscal policy minimizes these market distortions with an expansive role that must be stronger in recession and weaker in boom (under both lump sum taxes and distortive taxes). In other words, the optimal fiscal policy has to minimize the market distortions rather than the tax distortions, and it has also to stabilize the economy through the supply side rather than the demand side. Finally, in the presence of tax rates on sales  $\tau_t^s$  and on labor income  $\tau_t^l$  needed to finance public spending, the optimal fiscal policy would require tax rules

$$\tau_t^j = \tau^j(N_t) \quad \text{with} \quad \frac{\partial \tau^j(N_t)}{\partial N_t} < 0 \quad \text{for } j = s, l \quad (17)$$

Therefore, not only debt policy should be countercyclical as in the neoclassical and Keynesian approaches, but also indirect taxes on sales and direct taxes on labor income should be countercyclical to stabilize the economy around the optimal steady state: this result is in contrast with the traditional tax smoothing principle and in favor of an active policy on the supply side. We can summarize these results as follows:

**PRINCIPLE 6. THE OPTIMAL FISCAL POLICY REQUIRES COUNTERCYCLICAL TAXES ON PRODUCTION AND LABOR, R&D SUBSIDIES AND CAPITAL INCOME TAXATION.**

The general necessity of capital income taxation or profit taxation emerges in an endogenous growth context, where fiscal policy has to target both the efficient EMSs and the efficient long run growth rate. This result is in radical contrast with one of the main policy prescriptions of the neoclassical model, for which steady state capital income taxation should be zero. In the neoclassical framework the taxation of the return on capital affects the marginal productivity of capital and distorts capital accumulation, therefore it is optimal to avoid it in the long run. In the presence of EMSs, the taxation of capital income affects the net return of investment in business creation, and a reduction of this return obtained through this form of taxation is beneficial when decentralized entry is excessive and needs to be limited.

## 6.1 Fiscal policy in the U.S. and the E.U.<sup>9</sup>

In the last decades U.S. fiscal policy has been often used in a countercyclical way, leading to surpluses during booms and deficits during recessionary phases. The most recent examples were the tax cut adopted by Bush at the beginning of 2008 and the recovery plan adopted by Obama at the beginning of 2009, the largest American fiscal stimulus package of all times.

At the beginning of 2008 the widespread dispersion of credit risk and the unclear effects of the subprime crisis on the financial institutions reduced the incentives to invest and to demand (and obtain) credit. Commercial papers for the finance of corporate business (mainly firms' working capital) collapsed,<sup>10</sup> leading to negative implications for business and job creation. The risks of further impact on the real economy and the real estate downturn were primary determinants of the Economic Stimulus Act signed by the Bush Administration. This \$152 billion package introduced tax rebates to low- and middle-income U.S. taxpayers and tax incentives to stimulate investment, and it relaxed prudential controls over government-sponsored mortgage lenders with the purpose of keeping real estate finance flowing. Unfortunately, the margins to stimulate aggregate demand were quite limited. Given the high current account deficit of the U.S. and the weak Dollar of the time, the only chance for such a fiscal package to stimulate the economy was by gradually restoring the incentives to create new business or to export. This did not happen because, as we have seen in Section 1, the financial crisis got worse in the second half of 2008.

In front of such a dramatic scenario, the new President Barack Obama has launched a massive Recovery Plan of \$ 787 billion spread over 2009 to 2013, including mainly new public spending in education, health care, energy and infrastructures, a tax cut, an expansion of unemployment benefits and other social welfare provisions. The American Recovery and Reinvestment Act is clearly inspired by a Keynesian philosophy and aimed at raising aggregate domestic demand at the cost of increasing the public deficit (and adopting some protectionist measures, as "Buy American" policies). The problem is that given the already high propensity to consume of the American citizens, an additional stimulus to private consumption may be partially ineffective: rather than spending, most Americans will simply repay their debts or start saving. It is true that a plan of additional public spending may increase aggregate demand, but on one side the associated additional burden of public debt may crowd out part of this increase, and on the other side the marginal return of additional public spending may be quite low in terms of business creation (relative to the return of private spending). Finally, it takes time before a fiscal stimulus exerts any impact on the economy, especially when largely based on long run public investments.

The IMF estimates that the size of the U.S. stimulus directly active in 2009

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<sup>9</sup>The following section has been written in April 2009.

<sup>10</sup>Between the third quarters of 2007 and 2008 U.S. nominal GDP was still growing by 3.4 %, but commercial paper outstanding was decreasing by 25 %.

should be at least 2 % of GDP: together with the rescue packages financed by the government, this expansionary fiscal policy is expected to increase the U.S. public deficit beyond 13 % of GDP in 2009, and to substantially increase American public debt toward 100 % of GDP for the years to come. In spite of such an impressive and unprecedented policy of deficit spending, we doubt that this will be the key factor to trigger a quick recovery. Even if the financial crisis has not eroded the physical capital or affected productivity, we believe that an expansion of the aggregate demand alone is not going to bring production back to its full-employment level in a short time (contrary to what both the Keynesian approach and the neoclassical approach may suggest). The reason is that the structure of the aggregate supply changes during a recession: when net business creation falls, when firms restrict production, when market structures become more concentrated and mark ups tend to increase, then the supply side is not going to satisfy anymore the same full-employment level of production as before. It takes time and further investments to recover the earlier supply levels, and a simple demand-based fiscal policy cannot succeed alone in the short term: there is the need for a supply-based fiscal policy.

Under the current conditions, we believe that it would have been better to focus the stimulus more on private investment, in particular enhancing the incentives to create new business. The U.S. have been consuming more than they were producing for more than a decade thanks to substantial imports: this imbalance needs to be cured by increasing production and exports (and not by decreasing imports with passive protectionist measures). Fiscal incentives for new enterprises, lower sales taxes and corporate taxes, export subsidies and R&D subsidies would have a better chance to promote the recovery in this moment.

As well known, continental Europe is characterized by a larger role of the government compared to the U.S., a richer (but sometimes less efficient) welfare state, stronger automatic stabilizers and more rigid labor markets with stronger unions. For this and other reasons, including differences in the political systems, the role of discretionary fiscal policy for stabilization purposes has been sometimes more limited. Moreover, the creation of the E.U. has set additional limits to the discretionality of national governments in adopting countercyclical fiscal policies (even if their rigid implementation has been avoided in the last years). The same E.U. has a limited spending capability and a limited role in coordinating fiscal policies, a role that would have been precious during the current crisis, as many observers have noticed. The reaction of European governments to the recession has been weaker than in the U.S., with small stimulus packages in France and Italy (respectively 0.7 % and 0.2 % of GDP) and larger ones in Spain (1.1 %), United Kingdom (1.4 %) and Germany (1.5 %), but this does not take into account the role of automatic stabilizers:<sup>11</sup> therefore, also the Euro-

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<sup>11</sup>Data are from the IMF and refer to planned interventions directly aimed at stimulating the recovery in 2009. Of course, additional (coordinated) efforts may emerge during the rest

pean fiscal expansion has been in line with traditional Keynesian prescriptions of a substantial deficit spending.<sup>12</sup>

Most European packages are mainly focused on supporting aggregate demand through new investments in domestic public infrastructures and support to domestic firms in bad conditions. Also in this case, limited attention has been given to the support of business creation and we are not aware of any attempt to reduce tax rates on the supply side even temporarily.

The IMF has calculated that more than a trillion Dollars will be concretely invested in stimulus packages worldwide during 2009 - much more has been (and probably will be) promised for the following years also in a coordinated manner. To have an idea of the size of these efforts, notice that 2008 worldwide nominal GDP is estimated in \$ 78 trillion, of which 18.9 produced in the European Union, 14.3 in the United States, 4.8 in Japan and 4.2 in China. This means that from a global perspective we are in front of a stimulus package of more than 1 % of world GDP, a percentage that may increase in the second part of the year, possibly through international fiscal coordination. However, we believe that the large size of this unprecedented global stimulus is not a sufficient condition to trigger the recovery. What matters is the way this money will be spent, whether to push aggregate demand and public investments only (as now seems to be the case), or also to boost aggregate supply, business creation and trade.

## 6.2 A supply-based fiscal policy

The EMSs approach suggests exactly the necessity of an intervention on the supply side rather than on the demand side during recessions. According to the conventional wisdom, when the market activity declines one can stimulate aggregate demand by artificially augmenting private and public spending, so as to force firms to produce more. This is the typical recipe given by (Keynesian) economists, but there is an alternative way to look at the problem and find solutions. Loosely speaking, market demand increases not only when available income is higher, but also when prices are lower (relative to the wages), that is when the mark ups are lower. In a world of constant mark ups (as the neoclassical one with perfect competition or the New-Keynesian one with monopolistic firms) a mark up reduction can never occur, but in a world with endogenous mark ups and entry this can happen whenever policy stimulates business creation. Any policy aimed at promoting entry and innovation is going to strengthen competition, reduce the mark ups and increase the real wages. This increases the aggregate supply and attracts demand. In front of the limited success of policies aimed at supporting aggregate demand to promote the

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of the year.

<sup>12</sup>Overall, public finances are going to largely deteriorate since 2009, with public deficits expected well beyond the Maastricht limit of 3 % of GDP: around 10 % in U.K., Ireland and Spain (where, however, initial debt levels are low compared to the Maastricht limit of 60 % of GDP), and on average above 4 % in the Euroarea.

recovery, we may start thinking seriously about policies aimed at supporting aggregate supply.

Fiscal policy can promote business creation acting either on expected profitability or on the fixed costs of entry. On the first element, one can act on corporate taxes, capital income taxation and other taxes whose incidence is born by the production side, including production and labor taxation. In particular, a heavy but temporary reduction of the indirect taxation on sales and direct taxation on profits could generate substantial positive effects on consumption and profits, and therefore on entry and production, and could induce significant reductions of the mark ups. Moreover, the impact on the economy of these tax cuts could be quite rapid, as opposed to the slow impact of increases in public spending (especially for infrastructures) and of cuts on general income taxes. On the second element of the supply side, the fixed costs of business creation, one can act on subsidies for business creation, on temporary reductions of regulatory constraints to new business activities, especially in key sectors (as the construction sector), on temporary tax exemptions for new SMEs, on R&D subsidies aimed at promoting new and innovative products and on export subsidies aimed at extending business activities abroad.

The need for a supply-based fiscal policy is by no means new. However, it has been largely neglected in macroeconomic theory, which has been often biased toward a demand-based fiscal policy in the Keynesian tradition (which assumes a flat aggregate supply equation) or toward a neutral tax smoothing policy in the neoclassical tradition (which assumes a fixed aggregate supply and limits the scope of fiscal policy to the minimization of tax distortions).

## 7 EMSs and Monetary Policy

The neoclassical approach to monetary policy in a frictionless economy generates the neutrality of inflation for the real economy and suggests the optimality of a zero nominal interest rate associated with a negative inflation rate and a negative growth rate of money supply (Friedman, 1968). The New-Keynesian literature has shown that in the presence of monopolistic behavior by an exogenous number of firms and nominal rigidities in price-setting, the real allocation of resources is affected by inflation (see Mankiw, 1985, and Blanchard and Kiyotaki, 1987). In this environment, the optimal policy requires monetary authorities to actively manage the nominal interest rate committing to a rule that links the latter to inflationary expectations and the output gap, as in the Taylor rule (see Taylor, 1993, and Rotemberg and Woodford, 1997).

When the structure of the markets is endogenous, inflation and monetary policy have new roles compared to those emerging under monopolistic behavior by an exogenous number of firms. In particular, nominal rigidities affect the real profits of each firm with consequences both on the strategic interactions between them and, most of all, on the process of entry of new firms. The EMSs

approach has emphasized static and dynamic consequences of this, studying the role of monetary shocks on the economy and revisiting the characterization of the optimal monetary policy.

The basic principle can be summarized as follows:

**PRINCIPLE 7. THE OPTIMAL MONETARY POLICY HAS TO IMPLEMENT THE INFLATION RATE WHICH MINIMIZES THE DISTORTIONS ON THE PROCESS OF BUSINESS CREATION DUE THE NEGATIVE EFFECT OF NOMINAL RIGIDITIES ON THE EXPECTED PROFITS.**

The new role of inflation and, consequently, of monetary policy emerges in a basic general equilibrium framework where inflation acts as a distortionary tax on firms profits and biases the allocation of resources between production of goods and business creation against the latter (Bilbiie *et al.*,a, 2008b). Under these conditions, as long as fiscal policy can take care of the inefficiencies in the market structures, the optimal monetary policy should simply avoid mark up non-synchronization by implementing producer price stability (while leaving the mismeasured consumer price index to fluctuate because of the endogenous entry process).

Moreover, the EMSs approach could be useful also to study optimal monetary policy along the business cycle in the absence of optimal fiscal policy. Then, during recessions monetary policy should stimulate entry (which is below the optimal level) through reductions of the nominal and real interest rates aimed at increasing the (stock market) value of firms and promoting investments in business creation, and during booms it should limit excessive investments in business entry with a tight monetary policy. In practice, since output stabilization requires the stabilization of the entry process and, therefore, of the (stock market) value of the firms, we suggest that including equity price stabilization in the targets of the monetary authority could be useful (indeed many central banks have been occasionally active in the stock market with this purpose in the last years).

When growth is endogenous and depends on technological progress, inflation plays a similar role in distorting the business creation process, but it now leads to more radical consequences (Etro, 2007,c). In a Schumpeterian world, what drives the aggregate investment of the firms in R&D is the value of the innovations  $V$ , which depends on level of protection of the intellectual property rights, but also on the appropriability of the rents from innovation through profit maximizing strategies. When nominal price changes are costly, profit maximizing strategies cannot be implemented in a systematic way. Firms choose mark ups that are increasing in the expected rate of inflation  $\pi$  between the current price adjustment and the next one, but their profits are gradually eroded until that adjustment occurs. Even if the negative impact on the real profits is small because price adjustments are frequent, this impact affects negatively the

incentives to invest for all the firms:

$$V = V(\pi) \quad \text{with } V'(\pi) \leq 0 \text{ for } \pi \geq 0 \quad (18)$$

Of course, this induces a non-negligible impact on the aggregate economy over time: accordingly, non-zero inflation decreases the rate of technological progress with permanent consequences on welfare. Therefore, when the objective is simply to maximize growth, price stabilization is optimal.

More generally, the distortive role of inflation on the incentives to invest in R&D induces an inverse-U relation between inflation and growth: in particular, and in line with the evidence, for moderate and high levels of inflation, the growth rate is decreasing in the inflation rate because the incentives to invest in innovation are reduced. Notice that, when the decentralized rate of growth under price stabilization is not optimal (as typically is the case), and there are distortions that cannot be fully eliminated through the fiscal incentives, a non-zero rate of inflation can be welfare maximizing. This outcome is more realistic since Central Banks around the world, including the Fed and the ECB, target low but positive inflation rates, and not zero inflation.

**Monetary policy in the U.S. and the E.U.**<sup>13</sup> In the last two decades most monetary authorities have formally committed to anti-inflationary policies, often adopting explicit inflation targets. Nevertheless, some of them have been also engaged in policies that were clearly aimed at output stabilization. These policies have been typically implemented through increases in the nominal interest rates in front of inflationary expectations and reductions of the same rates in front of reductions of the inflation. According to the leading view, when the reactions of the nominal interest rates are strong enough (according to the Taylor rule, a 1.5 % change of the interest rate for a 1 % change of the inflation rate), they affect the real economy through the impact on the real interest rate (which is the difference between nominal rates and expected inflation). For instance, in front of increased inflationary expectations, a temporary increase of the nominal interest rate, which increases the real interest rate as well, is expected to reduce current consumption (and investment in business creation), which slows down the economy and tends to reduce the inflation. On the other side, in front of a slowdown of the economy, a reduction of the interest rates is expected to promote consumption (and business creation) so as to trigger the recovery.

With the Chairman Alan Greenspan and his follower Ben Bernanke, the U.S. Federal Reserve has been quite active in the stabilization of the American economy,<sup>14</sup> implementing a tight monetary policy in booms and an expansionary one in recessions. For instance, a drastic reduction of the interest rates has

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<sup>13</sup>The following section has been written in April 2009.

<sup>14</sup>See Greenspan (2007) for a fascinating account of his reaction to the stock market crashes of 1987, 1998 and 2001.

been implemented in the aftermath of September 11, and another one during the last two years to contrast the current recession, arriving to nominal rates close to zero. After reaching this lower bound of the interest rate policy (nominal interest rates cannot be negative), a further expansionary policy requires a direct increase of money supply. Therefore, the Fed has implemented a form of “credit easing” by pumping new liquidity into markets. During the crisis, it has expanded its discount operations in particular with the creation of special loan facilities (as the Term Asset-Backed Loan Facility), has issued direct injections of capital into the main banks, has promoted direct lending from government-sponsored enterprises and has bought corporate debt. The hope is that this aggressive intervention would re-start the process of investment and business creation, and with it the recovery.

Following the Fed, all the main central banks have reduced their nominal interest rates. The Bank of England, led by Mervin King, has been the first monetary authority to announce a policy of “quantitative easing”, that is to buy long-term government bonds and, at the beginning of March, it launched a reverse auction with investors as sellers, rather than buyers, of U.K. “gilts” to the central bank. In mid March, also the Fed announced it would buy long term U.S. Treasury bonds. The European Central Bank, led by Jean-Claude Trichet, has reduced the interest rates in a less aggressive way, and has not adopted forms of unconventional monetary policy. In particular, the European monetary authority has not been engaged in outright purchases of private securities or unsecured lending to the private sector<sup>15</sup> or in purchases of public debt, but has adopted a different approach: it made available unlimited credit to banks at the official rate with short term maturities. This credit is provided against eligible euro-denominated collateral defined in a very liberal way, so that there is a large short-term liquidity in the Euroarea and the unsecured overnight interbank rate is quite close to the American one. As a result, money supply has been growing at substantially high rates, especially for the Dollar and the Pound.

In front of the strong resistance of the real economy to react to these forms of monetary stimulus, two are the possible motivations. The simplest one is that after all monetary policy is not as effective as New-Keynesian theory would claim, for instance because the reactions of the monetary authorities are by now fully expected and already discounted, and therefore cannot be effective (Lucas, 1972; Sargent and Wallace, 1975): if this is the case and the real economy follows its path in a way that is largely independent from monetary actions, central banks should focus on controlling the inflation rate around a favorite level, rather than taking the risk of creating undesired inflation in the medium run. The alternative hypothesis is that a suboptimal policy has been implemented.

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<sup>15</sup>The rationale behind this has probably to do with the different structure of the European financial system compared to the Anglosaxon one: European firms and households rely more on banks than on capital markets, so it is better to lend freely to banks so as to help cap lending rates rather than to lower the cost of capital in securities markets.

According to many economists,<sup>16</sup> during the last decade the Fed set excessively low interest rates compared to the optimal Taylor rule, and did not contrast the equity boom at the end of the 90s with a properly tight policy. This would have been at the roots of the current crisis inducing excessive debt and risk taking within the economy and generating the well known problems of the financial sector. Moreover, the low interest rates kept penalizing savings and postponing a solution to the current account deficit problem, which remains a critical aspect of the American situation. On the top of this, the Fed has been increasing money supply at a very high rate, which may create substantial inflation and depreciation of the Dollar in the medium term (see Section 9), and may also change the role of the central bank in harmful ways in the absence of a quick recovery. According to John Taylor, “the success of monetary policy during the great moderation period of long expansions and mild recessions was not due to large discretionary interventions, but to following predictable policies and guidelines that worked.”<sup>17</sup>

Contrary to the Fed, the European Central Bank has traditionally followed a less aggressive management of the interest rates to stabilize the economy, paying much more attention to the control of inflation in the Euro area. Even at the beginning of the financial crisis, European rates remained above the American rates for a while. Only during 2008, when residual inflationary pressures were over, the European monetary authority has started reducing the interest rates to contrast the recession, and a policy of quantitative easing has not been adopted yet. This is not surprising for a more heterogenous area where opposite shocks often occur in different member countries and where the monetary authority is largely independent (and not even backed) from fiscal authorities.

Many economists have claimed that the current recession undermines the relevance of the neoclassical approach to macroeconomics and can only be explained within the (New-)Keynesian approach. However, we believe that the real test of the Keynesian approach will emerge from the success or the failure of the demand-based policies that are currently implemented to trigger the recovery, both on the fiscal and monetary front. As of now, the results appear to be limited, more or less as they have been during the “lost decade” of ineffective expansionary fiscal and monetary policies in Japan. Time will give its verdict.

## 8 EMSs and Trade Policy

The implications of the EMSs approach for trade policy are against many forms of passive protectionism, including import tariffs and quotas, which are aimed at restricting trade volumes. However, under certain conditions, they are in favor of what could be called an active protectionism, based on strategic export

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<sup>16</sup>See Taylor (2009).

<sup>17</sup>*Financial Times*, “The Threat posed by Ballooning Fed Reserves”, March 24th, 2009, p. 9.

promotion, which may distort trade, but does not restrict trade volumes.

Our analysis of trade policy (see Etro, 2009,a, Ch. 4) confirms that positive import tariffs represent the optimal unilateral policy for the domestic market both in the traditional case of an exogenous number of firms and in the case of an endogenous number of firms competing in the domestic market. In both cases, the optimal tariff tends to zero under perfect competition, that is when the (exogenous or endogenous) number of firms increases. In this sense, the qualitative predictions of the neoclassical trade policy are not changed by the endogeneity of the market structures. Neither are the standard critiques to these predictions: import tariffs often lead to retaliation, and equilibria with multiple countries adopting tariffs and quotas end up reducing the gains from trade. Passive protectionism ultimately hurts global welfare.

In spite of this, under certain conditions, the EMSs approach supports active forms of promotion of domestic firms in the international competition, as export promotion, export subsidies, R&D subsidies and protection of intellectual property rights for the exporting firms. It is interesting to focus on this novel aspect starting from the rationale for export subsidies.

What is the optimal trade policy with respect to exporting firms? How much should we invest to promote international demand of domestic products? There is a lot of debate about these questions between policymakers. This is not surprising since also at a theoretical level there are not clear or unambiguous answers. Common wisdom on the benefits of export subsidization largely departs from the implications of trade theory. While export promotion is often seen as welfare enhancing at least in the short run and often supported by governments, theory is hardly in favor of its direct or indirect implementation. In the standard neoclassical approach with perfect competition, the scope of trade policy is to improve the terms of trade, that is the price of exports relative to the price of imports, and, as long as a country is large enough to affect the terms of trade, it is optimal to tax exports (since this is equivalent to set a tariff on imports). In case of imperfect competition, a second aim of strategic trade policy is to shift profits toward the domestic firms. Therefore, a large body of literature, started by Brander and Spencer (1985) and Eaton and Grossman (1986), has studied international markets with a fixed number of firms to determine the optimal profit-shifting policy. Also in this case the optimal unilateral policy is an export tax under price competition, because the tax induces the domestic firm to increase its price and relax competition, which augments its profits more than enough to compensate for the social cost of the subsidy. Under quantity competition, an export subsidy could be optimal, but only under restrictive conditions (on demand and on the number of domestic firms).

Even if the World Trade Organization forbids export subsidies (except for agriculture), different forms of direct or indirect export promotion are widespread. Governments strongly support exporting firms, they often hide forms of export promotion behind nationalistic pride, and consider the conquer of larger

market shares abroad as a positive achievement in itself. The E.U. coordinates trade between its members and the rest of the world in a similar spirit, and subsidizes exports of agricultural products and the aircraft industry (Airbus is probably one of the main examples of strategic trade policy). France supports its “national champions” with public funding. Italy has a long tradition of public support of the “Made in Italy”. Japan has adopted a policy of targeted export promotion through its Ministry of Economy, Industry and Trade. Korea and other East-Asian countries have implemented export promoting policies for decades. Heavily protected South-American countries have tried to subsidize manufactured products in which they could develop a comparative advantage (and not only those). Even U.S. has implemented strong forms of export subsidization through tax exemptions for a fraction of export profits, foreign tax credit and export credit subsidies.

The EMSs approach provides a new theoretical argument for the general optimality of export subsidies whenever the domestic firms compete in international markets where entry is endogenous (notice that free entry is a realistic assumption since a foreign country without a domestic firm in the market can only gain from allowing entry of international firms). Under EMSs, export subsidization becomes the best unilateral policy under quantity and price competition. The intuition is simple. While firms are playing some kind of competition in the foreign market, the government can always give a strategic advantage to its domestic firms with an appropriate policy. When entry is endogenous, an export tax would lead the domestic firms to increase their prices or to reduce their production levels. On impact, this would induce the other firms to increase their prices or production levels respectively, so as to increase their profits. However, the increase of these profits would attract entry *ex ante* until any extraprofits were eliminated. As a result of this, the domestic firms would end up worse off and the policy would fail. To the contrary, it is optimal to adopt a policy that induces the domestic firms to be aggressive, that is to expand production or (equivalently) reduce prices. This behavior limits entry of international competitors and increases the market shares of the domestic firms. Such an outcome can only be induced by subsidizing exports.

Etro (2010) has derived the optimal unilateral subsidy under different market conditions. It turns out that, in case of homogenous goods, the optimal specific subsidy  $s^*$  is inversely related to the elasticity of foreign demand  $\varepsilon$ :

$$s^* = \frac{p}{\varepsilon} \tag{19}$$

Ironically, the optimal export subsidy is identical (but with an opposite sign) to the optimal export tax emerging in the neoclassical trade theory (Lerner, 1934). In both cases, the distortions due to the policy increase with demand elasticity, therefore high elasticity recommends lower intervention. However, the neoclassical policy is aimed at increasing the price of exports, while the policy recommended by the EMSs approach is aimed at decreasing the price of exports.

The general lesson about trade policy can be summarized as follows:

PRINCIPLE 8. THE OPTIMAL UNILATERAL TRADE POLICY HAS TO PROMOTE DOMESTIC FIRMS COMPETING WITH FOREIGN ONES THROUGH EXPORT SUBSIDIES UNDER ANY FORM OF COMPETITION (WITH THE OPTIMAL EXPORT SUBSIDY WHICH IS INVERSELY PROPORTIONAL TO THE ELASTICITY OF FOREIGN DEMAND).

**Against passive protectionism, in favor of export subsidies** As we have seen, the EMSs approach does not provide support for passive protectionism in the form of import tariffs or other trade restrictions, but it is in favor of export subsidies (and not generic state aid) because they do not restrict trade volumes, but they actually tend to increase them. The same argument can be applied to other forms of indirect export promotion, as policies which boost demand or decrease transport costs for the exporting firms: as long as these policies increase the marginal profitability of the domestic firms, there is a strategic incentive to use them unilaterally. Ultimately, the scope of export policy is just to conquer market shares abroad and shift profits from firms of other countries towards domestic firms. If we interpret globalization as the opening up of new markets to international competition we can restate the main principle as follows: in a globalized world, there are strong strategic incentives to conquer market shares abroad by promoting exports and adopting forms of active protectionism. The positive aspect of the latter is that it does not restrict trade, but it actually promotes it.

According to the World Trade Organization, the volume of world trade in merchandising is expected to fall by 9 % during 2009, the largest decline since World War II. Meanwhile, passive protectionism is rising and the fear is that it may aggravate the crisis, as it happened in the Great Depression, when the American Smoot-Hawley Act of 1930 increased U.S. import duties and provoked widespread retaliation, which reduced global trade by a quarter. Notice that at that time trade was less developed and was mainly inter-industry trade, while today it represents a larger fraction of GDP and it is mainly intra-industry trade: this leads to a deeper interdependence of economies and worse consequences of import tariffs and other forms of passive protectionism. We believe that in a period of crisis and globalization backlash as the current one there is an additional reason why certain forms of export promoting policies for high-tech and differentiated products could be welcome.<sup>18</sup> They would redirect the protectionist tendencies away from the adoption of import tariffs and quotas, toward a form of intervention (export subsidies) that can revitalize intra-industry trade and help the recovery.

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<sup>18</sup>Notice that the WTO allows export subsidies for agricultural goods, that are usually homogeneous goods traded under perfect competition. We recommend the opposite policy: forbid (or at least reduce gradually) export subsidies in inter-industry trade and allow those in intra-industry trade.

The typical argument against foreign export subsidies is that subsidized foreign firms exert unfair competition against unsubsidized domestic firms. This sounds quite similar to the typical argument in favor of passive protectionism: since more cost-efficient foreign firms exert unfair competition toward less cost-efficient domestic firms, we should adopt import tariffs. We believe that both arguments are flawed. In both cases, subsidized or more efficient foreign firms end up selling goods at lower prices with clear gains for the domestic consumers. The only difference is that in the former case foreign governments are paying for those gains, and in the latter case foreign workers are receiving lower wages to provide those gains: ultimately the costs are abroad and the gains are at home. Therefore, adopting import tariffs or forbidding export subsidies simply reduces consumer welfare to protect domestic profits. It is quite surprising that many economists and the same World Trade Organization keep condemning both import tariffs and export subsidies as if they were equivalent policies.

## 9 EMSs and Exchange Rate Policy

In a fixed exchange rate regime, governments undertake occasional devaluations with the specific aim of supporting the competitiveness of domestic firms in international markets: for this reason we talk about competitive devaluations. In a flexible exchange rate regime this is not possible, but for the same reasons a depreciation of the nominal exchange rate, due for instance to an expansionary monetary policy, is expected to support the competitiveness of domestic firms exporting abroad.

In spite of this common wisdom, economic theory has been rather ambiguous on the role of the nominal exchange rate. In the frictionless neoclassical macroeconomic approach, exchange rate policy is neutral just like monetary policy, and it cannot affect real variables. In the Keynesian approach, as long as the devaluation improves the trade balance in the medium-long run, it boosts aggregate demand with an expansionary effect on the domestic country and possibly a negative effect on the trading partners. The result is confirmed within the modern approach of the New Open Economy Macroeconomics (Obstfeld and Rogoff, 1996), but not even under all circumstances (a devaluation could be even welfare decreasing when the reduction in the purchasing power of the domestic agents is strong enough). Finally, partial equilibrium models of competition in international markets with firms engaged in pricing to market (Dornbusch, 1987) show that devaluations can start price wars between firms active in different countries, which ultimately leads to lower profits for all of them. The intuition for the last mechanism is simple: after a devaluation, exporters reduce their prices in foreign currency thanks to the better exchange rate, but this induces their rivals to do the same in order to defend their market shares and profitability, with the consequence that all the firms end up with reduced prices and profits.

In front of these contrasting theoretical positions it is difficult to make sense of the common wisdom according to which devaluations provide a positive strategic advantage on the international markets with net benefits for the devaluating country. However, the EMSs approach provides a consistent rationale for this common wisdom by evaluating the strategic incentives to implement exchange rate devaluations in a scenario where the incidence of exchange rate variations on prices is endogenous.

To obtain a comprehensive understanding of the impact of exchange rate variations on market structures, we need to briefly review the role of exchange rates in affecting market competition. Imagine first a market in a foreign country in which international firms produce and compete with independent production units. This is typical of multinationals which are directly active in other countries where they sell their products. Under price competition, this case of local currency pricing with market power implies no pass-through of nominal exchange rate variations on prices. In this situation, a devaluation is not going to affect the equilibrium in the foreign market. All firms would choose the same prices in foreign currency after a devaluation, but the profits of the domestic firm would be artificially increased in the domestic currency. The same would happen under quantity competition, since production decisions abroad would be independent from the exchange rate again, but profits in domestic currency would be inflated by a devaluation. From a welfare point of view, the gains in profits from such a devaluation should be compared with the losses for the society in terms of higher prices of the imports. More importantly, in this situation there is not a strategic incentive to implement a competitive devaluation: this policy does not give a real strategic advantage to the domestic firm in the foreign market but just artificially increases its profits.

A totally different situation occurs when all firms produce in their domestic country, bear production costs in domestic currency, choose their strategy taking into account the exchange rate and then export abroad (under price competition this corresponds to the case of producer currency pricing). Such a case is typical of SMEs which are active at a national level, often producing typical domestic products and exporting some of them abroad, but also of larger firms which are not directly active in the foreign market under consideration but sell their goods to distributors of this market. In this situation competitive devaluations are always desirable to provide a strategic advantage to domestic firms as long as entry in the international market is endogenous. The reason is that devaluations induce an aggressive behavior (lower prices or larger production) of the domestic firm in the international market, and this is the only way to shift positive profits at home when entry in those markets is endogenous. The domestic firm ends up with a larger market share and positive profits compared to the unsubsidized competitors. Finally, we need to remember that the competitive devaluation can be effective only in the short run, while inflation differentials tend to re-establish the situation pre-devaluation in the long run.

In a world where exchange rates fluctuate freely, our results need to be rein-

terpreted. In such a world, a depreciation of the domestic currency, due to any international or monetary reason, has a strategic impact on the exporting firms. Consider the likely case in which these firms export in foreign markets whose access is open to any international firm. As a consequence of the depreciation, the domestic firms are always led to reduce their prices in foreign currency, because the prices earned in domestic currency have been artificially increased and these firms can always earn more profits by reducing mark ups a bit to gain a larger market share. Some international firms will try to follow this price cut and the average mark ups in the industry will go down, with a consequent reduction in the number of firms able to remain in the market. Nevertheless, the domestic firms manage to earn larger profits in domestic currency thanks to the increase of their market shares.<sup>19</sup> The same identical result follows if firms compete in quantities: the domestic firms increase their production because the marginal revenues in domestic currency are higher, they gain market shares and earn more profits. More generally, depreciations provide a strategic advantage to the exporters under any market conditions as long as entry in the international markets is endogenous, and they always increase exports and market shares of the domestic firms in these markets. Of course, this has a positive effect on the trade balance and on the current account, at least in the short run, before inflation differentials neutralize the impact of the depreciation.

We can summarize our results as follows:

**PRINCIPLE 9. IN THE SHORT RUN, A DEVALUATION OR A DEPRECIATION OF THE EXCHANGE RATE INCREASES MARKET SHARES AND PROFITS OF THE DOMESTIC FIRMS COMPETING IN INTERNATIONAL MARKETS WITH ENDOGENOUS ENTRY AND INCREASES ALWAYS DOMESTIC WELFARE.**

**The depreciation of the Dollar<sup>20</sup>** An immediate application of our discussion on exchange rates concerns the effects of the depreciation of the Dollar between 2002 and 2008. This started in the aftermath of the terrorist attack of September 11, 2001 and was strengthened by the expansionary monetary policy implemented first by Greenspan and later by Bernanke to contrast the downturn of the economy, especially during the first part of 2008, when the reduction of the U.S. interest rates compared to the European rates, and a general tendency of the international central banks to diversify their monetary reserves contributed to weaken the Dollar in favor of the Euro.

The initial consequence of the depreciation of the Dollar was that U.S. firms could reduce their prices in foreign markets and gain market shares, sometimes inducing the exit of other firms from those markets. Meanwhile, European firms

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<sup>19</sup>The reader should keep in mind that in the absence of endogenous entry, the opposite result occurs: a depreciation leads the domestic firms to reduce their prices, which induces a price war in the foreign market. As long as entry is exogenous, the ultimate effect is simply to reduce profits for all the firms. Therefore, a depreciation would hurt exporters.

<sup>20</sup>The following section has been written in April 2009.

were forced to increase their prices in the U.S. and loose market shares, or to maintain similar prices and reduce their effective mark ups. In markets where firms price to market, price differentials between the same goods sold in Europe and the U.S. became substantial.

At the aggregate level, the depreciation of the Dollar was slowly contributing to promote U.S. exports and reduce the huge American current account deficit, from a high of 6% of GDP in 2005 to 3.3 % in the third quarter of 2008. However, the process of depreciation of the Dollar was inverted in the second half of 2008, when the ECB started reducing the interest rates to face the crisis.

The current global scenario is characterized by a dichotomy between two groups of countries. On one side U.S. and U.K. (with few other European countries including Spain) running current account deficits that are driven by trade balance deficits and now also by huge public deficits. On the other side, countries as Germany, China, Japan and other energy-exporting countries running large surpluses, led by trade balance surpluses and now only partially reduced by larger public deficits. The first group of countries has been characterized by low (or negative) saving rates of the private sector that only now are increasing, the second group by consistently high saving rates. This dichotomy has worked fine until recently, with net savers/exporters on one side financing net investors/importers on the other side, but such an unbalance may create sustainability problems now. Especially if deficit spending is stronger in the group of countries running current account deficits, as it appears to be the case.

To have an idea of the substantial difference between these groups, notice that in the last years U.S. household consumption was above 70 % of GDP, while Chinese consumption was about 35 % of GDP. There are good reasons for which the largest country (U.S.) can specialize in technological investments and import final goods from the rest of the world while running a current account deficit. However, this cannot go on forever, in particular while another country (China) is growing at a much higher rate through excessive saving rates (probably beyond the border of dynamic inefficiency), and is expected to become the largest economy in the near future (it is currently becoming the second largest economy surpassing Japan).

In front of the current situation, we need further international policy coordination (possibly with a bigger role for a reorganized IMF) or even rethinking the international monetary system. However, without substantial policy changes, the main correcting factor could be the exchange rate. As of now, U.S. and U.K. are implementing a massive monetary expansion, much stronger than in Europe. While the recession is now depressing prices and in the short run prices are expected to be stable, in the medium run this policy may create heavy inflationary pressures in both the U.S. and the U.K. This may lead to further depreciation of the Dollar and the Pound, which in turn may finally increase U.S. exports and reduce the global unbalance. In such a case, different scenarios are possible for the medium and long term.

In the best scenario, we will arrive at inflationary pressures with an ongoing

recovery of the real economy and of the stock market, which will boost both investment in business creation and consumption: this may be an easy way out from the recession because interest rates and taxes could be gradually increased to avoid excessive inflation and to keep public finances under control. However, notice that we may end up in a quite different world from the one we are used to: without U.S. imports driving foreign growth, but possibly with a pro-active role for Europe, which is now the largest integrated market in the world, and, mainly, with a new role for the emerging China, and especially for Chinese consumption and for Chinese investments in the Chinese economy (rather than in the American one, as in the last decade).

The alternative negative scenario is now becoming less likely: in such a scenario, the stock market would fail to recover and investments and consumption would remain weak while inflationary pressures emerge, leaving the monetary and fiscal authorities with two options. The first one would be to fight inflation back (and increase taxes to keep debt under control) so as to fall in another recessionary phase before recovering. The second one would be to inflate the economy and reduce both private and public debt by means of inflation. Also in this case, the growth model based on U.S. imports from the rest of the world would have to change drastically.

However, there is a third scenario for the medium term, which is less likely, but that we need to take into account. This is a scenario with an appreciated Dollar and a recovering stock market, with an American demand-based fiscal policy that artificially sustains a weak boom while increasing U.S. public and foreign debt, and with European and Chinese economies unable to drive global growth (respectively through innovations or expanding consumption rates). However, it is unlikely that such an unstable scenario could last for long.

## 10 Innovation and Competition Policy

The main message of the EMSs approach to the macroeconomy is that the structures of the markets and their determinants (of technological, behavioral, strategic and policy nature) are crucial for the evolution of the aggregate economy. For this reason industrial policy, including 1) innovation policy affecting competition *for* the markets and 2) antitrust policy affecting competition *in* the markets, must be taken in consideration when evaluating the general macroeconomic policy. This becomes more important for markets whose efficiency has a direct impact on other markets and whose technological progress is a main driver of the entire economy, namely high-tech markets.<sup>21</sup>

We have already encountered a number of results concerning industrial policy. It is now time to put them together and draw the implications for the

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<sup>21</sup>For applications of the EMS approach to industrial policy issues see Tesoriere (2008), Creane and Konishi (2009), Ino and Matsumura (2007) and Ishida *et al.* (2009).

policies aimed at enhancing efficiency and growth in the global economy. The basic principle emerging from the EMSs approach can be stated as follows:

**PRINCIPLE 10. THE OPTIMAL INDUSTRIAL POLICY HAS TO PROMOTE ENTRY IN THE COMPETITION IN AND FOR THE MARKETS, SUBSIDIZE R&D AND PROTECT IPRs.**

In the following subsections we will briefly comment on innovation and competition policy issues, topics on which we have extensively discussed in Etro (2007,a, Ch. 5).

## **10.1 Innovation policy and coordination**

The general need to subsidize R&D and to protect IPRs departs from the ambiguous results of the traditional theory of Schumpeterian growth and derives from a result that we have emphasized repeatedly: in the presence of EMSs, firms tend to invest too little in innovation and they tend to be engaged in excessive duplication of their investments. This result is independent from the aggregate size of the investment in innovation, which could be above or below the efficient level: in either case, the organization of R&D could be made more efficient concentrating it in larger firms that invest more in innovation. R&D subsidies and a stronger protection of the IPRs can achieve the same outcome, but they do it in a different way and they should both be used.

A second implication of the analysis of EMSs in the competition for the market is that incumbent leaders tend to invest more than their rivals when they face a strong entry pressure. This leads them to innovate more frequently, to persist in their leadership position and to drive the growth process. Understanding the nature of this phenomenon is crucial to implement the proper industrial policy toward market leaders of dynamic sectors. Contrary to a populist ideology, the EMSs approach has shown that the protection of IPRs is fundamental to promote sequential innovations, because it strengthens the incentives to invest by both the incumbent leaders and the followers. Therefore, a policy discriminating against the IPRs of persistent leaders can have deleterious consequences on the aggregate incentives to invest in R&D.

R&D policy becomes even more important in a global perspective. When firms compete for international markets, their investments generate global growth, but each country tends to free ride in the implementation of the optimal R&D policy. This happens because each country subsidizes unilaterally its domestic firms with the purpose of shifting expected profits toward home and not with the purpose of promoting global growth. Alternatively, countries tend to protect more the IPRs of the domestic firms than those of the foreign ones, sometimes with a discriminatory use of antitrust policy. These tendencies lead to suboptimal investments in new technologies at the global level.

International coordination for the protection of IPRs and the coordination of fiscal policies to promote R&D are required to improve the allocation of re-

sources at the global level (Etro, 2008,a). While some countries have been trying to coordinate the support of R&D activities at a supra-national level, heterogeneities in policy views and lack of binding commitments have undermined these efforts (in the case of the European Union, think of the Lisbon Agenda or the attempts to harmonize patent protection between the member states). Nevertheless, further coordination for the protection of IPRs could enhance the global incentives to invest in R&D in a substantial way. Additional delegation to an international organization may be difficult because there are still different views on innovation policy (with the U.S. much more in favor of the strengthening of IPRs protection than the E.U.). However, as in the case of other forms of coordination, it would be efficient to establish international standards for R&D promotion and subsidization, probably at the level of the TRIP agreements, leaving individual countries to do more.

## 10.2 Competition policy in the U.S. and the E.U.

The promotion of competition in the market and the reduction of entry barriers are crucial elements for the proper functioning of market economies and become particularly important in a period of crisis, when tendencies to relax competition and increase mark ups emerge naturally.

Antitrust policy plays a fundamental role in this sense, especially with its action to deter collusive behavior aimed at increasing mark ups and to stop mergers than can be detrimental to future competition. On this front both the American and European antitrust authorities have adopted a similar and wise approach, focusing on markets characterized by barriers to entry and not on markets where endogenous entry forces can neutralize attempts to exercise market power. Nevertheless some differences remain, with the U.S. approach sometimes excessively neutral in front of mergers between firms that do not face a fully endogenous entry threat and that may engage in accommodative strategies post-merger. A recent example is discussed in detail below.

**The Oracle-Sun Merger** The European Commission has just issued a formal Statement of Objections (S.O.) against the merger between Oracle and Sun Microsystems, a merger which was previously cleared by U.S. regulators. This delicate initiative shows the maturity reached by the European antitrust authorities in the field of merger regulation, because the deal, or at least part of it, creates substantial concern for the future of competition and innovation, especially in the market for enterprise database software and especially in Europe.<sup>22</sup>

First of all, notice that a merger can lead to negative consequences for the consumers in a specific market when it allows the merged entities to soften competition, increase prices and reduce investments in R&D, which ends up

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<sup>22</sup>What follows heavily borrows from the article “When a Merger Softens Competition: the Oracle-Sun Case”, by F. Etro (VOX, November 11, 2009).

decreasing the welfare of current consumers (because of higher prices) and future ones (because of less innovations). This is possible if and only if the merger is between firms that are directly competing and if it does not attract endogenous entry of new and better producers that may exploit the softer competition. At first glance, a merger between a company that is mainly focused on software (Oracle) with one focused only in part on software and to a large extent on hardware (Sun) would not appear to raise many antitrust concerns. However, a closer look at the interests of the two companies in the area of software provides a different impression, in particular if we recall that on a number of occasions Oracle has engaged in acquisitions aimed at substantial business change that led to higher prices (for instance in the case of the BEA Web Logic products) or discontinued production (for instance in the recent case of the Virtual Iron products).

A key issue concerning the current merger is that, while Oracle is focused on commercial software, most of the software by Sun is open source, as in the case of Solaris, the most popular operating system derived from enterprise Unix, and MySQL, the most popular database for websites (bought by Sun last year): in general, one may wonder what will be the destiny of these technologies and of their current users, and what will be the impact on the large European open source sector.

If the Oracle-Sun merger goes through, the company of Larry Ellison would become the dominant company as a single supplier of enterprise hardware and software. In this unique position, it may try to limit competition, reduce consumer choice and increase prices. The problem is crucial in the market for database management systems, whose current leader is Oracle if we look at revenues, but is My SQL if we look at units. The reason for this difference relies on the different business models: while Oracle provides a proprietary database and gains from both licenses and maintenance fees, Sun freely distributes its open source product and gains only from maintenance and support fees. Together, Oracle and Sun account for the large majority of database sales and about 90 % of the Linux/Unix segment (which is almost half of the total). This joint leadership is even stronger in Europe, where open source software is more popular because of the wide presence of small and medium size firms with lower IT budgets compared to US companies. The other two relevant competitors in the database market are IBM and Microsoft, followed at distance by Teradata (focused on data warehousing), Sybase and a fringe of open source products unable to provide valuable alternatives (as Ingres and PostgreSQL).

In the global database market, which is worth about \$ 20 billion, Oracle and Sun compete directly, with the latter traditionally ahead as a web server database and rapidly growing as a business database (for both small and large companies) and as an embedded database (to be used within other products). Thanks to many recent improvements, Sun has made available by far the best open source alternative, which has forced Oracle to invest heavily in R&D to innovate and maintain its lead. This was a sort of “escape competition effect”

forced by the entry pressure exerted from the best fruits of the open source community. Moreover, the free distribution of MySQL has created a binding price constraint on Oracle, which has been unable to perpetuate a high mark up policy and has been forced to reduce its prices to match the low “total cost of ownership” associated with the open source solution (characterized by free distribution plus cheap maintenance). This outcome is reminiscent of the behaviour of a market leader facing endogenous entry of competitors (Etro, 2008,b), and was guaranteeing an efficient evolution of the market. One may compare these competitive effects with the positive effects exerted by Linux and the competitive pressure of the open source distributors of operating systems on the innovative and pricing strategies for Windows.

For the competitive pressure to continue to be effective in the database market, Oracle should remain constrained by a fringe of rivals and by the most efficient one in particular. This is exactly what Oracle is trying to avoid through the merger with Sun, a sort of “escape competition merger” made possible by the lack of other effective or potential entrants in the database market. It is important to notice that no other company could replace (“fork” in jargon) the strategic role of MySQL in the open source business: the reason is that Oracle, as the new copyright owner of its source code, could adopt the so-called “dual license”, excluding commercial exploitation by other firms and at the same time enjoying any enhancement made by others under the open source GPL. Since the existing database vendors have been unable for years to become a substantial threat, this simple merger would allow Oracle to get rid of its main competitive stimulus (and possibly to find a method to deal with similar threats in the future), and therefore to soften competition. The consequence for the database market would not be that different from what would happen in the market for operating systems if Microsoft was allowed to be in control of Linux.

After the merger, absent any competition between Oracle and MySQL, any innovative effort of the latter would slow down, turning MySQL into a niche product and locking in its customers. Oracle would have all the incentives to force the customers of MySQL to migrate toward its proprietary database and, given the wide product range of Oracle, they would face excessive switching costs to move toward different solutions. All this would allow Oracle to increase the mark ups for its own products. Followers as IBM and Microsoft may not lose money from such a softer competition, but they may lose in terms of market shares (not by chance IBM tried to merge with Sun before Oracle). Without doubt, the largest losses would be for the customers in terms of higher prices and less choice, especially for small firms currently relying on open source solutions. Therefore, we believe that E.U. authorities are right in pursuing this investigation.

**Abuse of dominance issues** Substantial differences between U.S. and E.U. industrial policy emerge in the general approach to market dominance and in

the antitrust treatment of monopolization issues, which are extremely important not only for their impact on the effectiveness of competition, but also for their possible interference with aggressive competition (which is often borderline with abusive practices) and with innovation policy (which must protect some degree of market power to guarantee the proper incentives). The different approaches are well illustrated by the report issued by the US Department of Justice in September 2008, *Competition and Monopoly: Single-Firm Conduct under Section 2 of the Sherman Act*, and the *Guidance on the Commission's Enforcement Priorities in Applying Article 82 to Abusive Exclusionary Conduct*, issued by the European Commission three months later. These documents contain the general principles that guide the two authorities in deciding which cases to pursue and how to deal with specific types of conducts.

The American approach emerging from the Report is aimed at the defense of the competitive process both in principle and in practice, reflecting “a national commitment to the use of free markets to allocate resources efficiently and to spur the innovation that is the principal source of economic growth.” The analysis of dominance pays a lot of attention on the limits imposed by endogenous entry, emphasizing the role of entry pressure in disciplining market leaders in spite of their large market shares. The Report provides an enlightening example which is in perfect accordance with the implications of the EMSs approach: “Suppose a large firm competes with a fringe of small rivals, all producing a homogenous product. In this situation, the large firm’s market share is only one determinant of its market power over price ... if the fringe firms can readily and substantially increase production at their existing plants in response to a small increase in the large firm’s price (that is if the fringe supply is highly elastic), a decision by the large firm to restrict output may have no effect on market prices.”

More in general, the Report recognizes the poor correlation that can exist between market share and market power, especially in high-tech sectors: “in markets characterized by rapid technological change, for example, a high market share of current sales or production may be consistent with the presence of robust competition over time rather than a sign of monopoly power. In those situations, any power a firm may have may be both temporary and essential to the competitive process.” As a consequence the U.S. Department of Justice adopts a non-intrusive role for antitrust policy in the competition in and for the markets. For instance, predatory pricing can be established only when recoupment is likely, that is only when entry is difficult once the market is monopolized. Moreover, the efficiency role of tying is recognized as a primary role (against a long-lasting hostility), especially for technological tying, “an area where enforcement intervention poses a particular risk of harming consumers more than it helps them in the long run. Technological tying often efficiently gives consumers features they want and judicial control of product design risks chilling innovation.” Finally, the Report marginalizes also the need for intervention in case of a refusal to supply, because “forcing a competitor with monopoly power

to deal with rivals can undermine the incentives of either or both to innovate” and because “judges and enforcement agencies are ill-equipped to set and supervise the terms on which inputs, property rights, or resources are provided”. In conclusion, the U.S. approach is based on the belief that competitive entry forces are the main constraints on the exercise of market power and when they are present antitrust intervention should be a marginal or residual necessity.<sup>23</sup>

The European approach is more interventionist. The cited Guidance of the European Commission states the adoption of an “effect-based” approach that is aimed at maximizing consumer welfare and protecting an effective competitive process, and not simply competitors. There is an important new aspect in the Guidance, the emphasis given to the role of entry in determining whether a dominant position exists or not. The key element in the Guidance definition of dominance is the extent to which the firm can behave independently of its competitors, customers and consumers, which relates to the degree of competitive constraints exerted on this firm by the supply of actual competitors, by the threat of expansion of competitors and potential entrants and by the bargaining power of customers. Therefore, entry plays a crucial role and dominance should be incompatible with the presence of a threat of endogenous entry. In particular, a leader “can be deterred from increasing prices if expansion or entry is likely, timely and sufficient”, but it would be also important to recognize that the same entry can induce the leader to decrease its prices below those of the rivals, or to adopt other aggressive strategies, without any anti-competitive purpose, as the EMSs approach has made clear.

Beyond this, we have a strong concern on the way the positive premises of the Guidance are carried through its details. The defense of consumers is strongly emphasized in theory but not in practice: most of the focus of the Guidance is on the foreclosure of competitors and not on the relation between this and the harm to consumers, which is what should matter.

A related concern is about the nature of the foreclosure effects under the “effects-based” approach. The Guidance indicates that a key element of abuse is anti-competitive foreclosure, defined as “a situation where effective access of actual or potential competitors to supplies or markets is hampered or eliminated as a result of the conduct of the dominant undertaking” which is likely to profitably increase its prices with harm for the consumers. However, it is not entirely clear which facts are going to prove foreclosure and which not. For instance, consider a situation in which new competitors enter in the market and some competitors increase their market share to a significant extent: one would expect that this proves that the dominant company’s practice is not abusive, but not even this can be taken for granted on the basis of the E.U. Guidance (we provide an example below).

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<sup>23</sup>The Report largely reflects the Chicago approach to antitrust that was prevailing during the Bush Administration. It is not entirely clear that the Obama Administration will adhere fully to the approach laid down in the Report. However, for a related point by a moderate leader of the so-called Harvard approach to antitrust, see Hovenkamp (2005).

Another issue is about the standard of undistorted competition. As regards pricing abuses, the European approach introduces the “as efficient competitor” test: “the Commission will normally intervene where the conduct concerned has already been or is capable of hampering competition from competitors which are considered to be as efficient as the dominant undertaking”. However, the document introduces several exceptions to this principle (for instance, a dynamic view for which less efficient competitors may become as efficient in the future through network or learning effects), and the test does not apply to non-pricing abuses. This means that companies are left without a clear standard.

As a last issue we welcome the confirmation in the Guidance of an efficiency defense: a dominant firm may justify a conduct leading to foreclosure on the ground that efficiencies are sufficient to guarantee that consumers are not penalized. Now, while the consideration of efficiencies generated by a conduct is extremely important to re-direct antitrust policy toward the maximization of consumer welfare, in our view the Guidance appears to adopt a too vague approach and to make it hard, if not impossible, for dominant companies actually to avail themselves of the efficiency defense. The main reason is that their verification appears to be postponed after the establishment of an anti-competitive foreclosure that harms consumers, and not during the decision on whether the same foreclosure harms consumers. Moreover, there appears to be a bias against the possibility that efficiencies can occur: for instance, technological tying is not even mentioned as a source of efficiency in tying cases, but it is actually considered a source of greater risk of anticompetitive foreclosure (because more costly to reverse).<sup>24</sup>

Finally, the new guidelines do not seem to reduce the amount of uncertainty that is associated with the move toward the rule of reason approach. For instance, the potential conflicts between IPRs protection and antitrust policy remain entirely unsolved: while the U.S. have taken a clear position against the possibility of compulsory licensing of IPRs, the E.U. approach still contemplates this possibility under vague conditions. This kind of uncertainty can be a source of inefficiency and distorted behavior, especially when decision rules are imperfect and subject to errors.<sup>25</sup> More in general, antitrust uncertainty on exclusionary strategies may deter genuinely competitive or innovative strategies to be adopted by leading firms, and therefore it may exert negative consequences

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<sup>24</sup>It is not clear why the possibility of an efficiency defense (and with it the possibility to enhance consumer welfare) is to be off-limits for an entire class of companies, as the Guidance makes clear when it states that an “exclusionary conduct which maintains, creates or strengthens a market position approaching that of a monopoly can normally not be justified on the grounds that it also creates efficiency gains”. It is positive that the Commission eliminated the reference to firms with a market share above seventy-five per cent which appeared in its 2005 document, but still, in our view, efficiencies should be assessed in the same manner in all cases, regardless of the defendant’s market share.

<sup>25</sup>The lack of legal certainty is particularly regrettable in a context of increasing punitive fines and important efforts by the Commission to increase the scope for private enforcement to complement public enforcement of E.U. competition law.

on consumer welfare. Leading scholars of competition policy have noticed that “the welfare cost of this lack of clarity and excessive caution must be enormous to the E.U. economy as a whole - something the E.U. can ill-afford given its lack of competitiveness relative to other international blocks and the stated objectives of the Lisbon Agenda in this regard.”<sup>26</sup>

In conclusion, the E.U. competition policy remains largely linked to a naive version of the post-Chicago approach which is biased against market leaders and in favor of their competitors in a way that is largely unrelated to the real protection of consumers. The U.S. approach, closer to the principles of the Chicago school, has proved to be much more useful in promoting competition, business creation and innovation, especially in high-tech sectors. We conclude our analysis of competition policy with a second case study concerning the software market.

**Moving on from the E.U. vs. Microsoft case** Elsewhere we have discussed a symptomatic example of the perverse E.U. approach to abuse of dominance issues, the Microsoft case on the tying of Windows MediaPlayer to the Windows operating system and the refusal to supply interoperability information protected by IPRs.<sup>27</sup> The saga continued with the investigation on the tying of the browser Internet Explorer with Windows. However, the European Commission has recently taken important steps towards turning the page on the long-running Microsoft competition case. Over the summer, the Commission issued a tentative welcome to proposals the company had made to address the EU’s concerns regarding the integration of IE in Windows. Microsoft’s proposed solution would allow computer manufacturers and individual consumers to easily install their favourite web browser as the default and, if they wish, disable IE. In the weeks following the July announcement, the Commission conducted an informal market test of the proposals, sending out questionnaires and looking for feedback from competitors and other third parties, and obtaining substantial changes on the basis of that feedback.

On October 7th, 2009, the Commission announced the opening of a formal market test, inviting comments from consumers, software companies, computer manufacturers, and other interested parties over a one-month period to end on November 9th. Since the Commission already “welcome[d] Microsoft’s proposal as it has the potential to give European consumers real choice over how they access and use the internet”, it seems likely that the additional formal market test will set the scene for a binding decision before the current Commission’s mandate runs out in November.

Whatever one’s view of the Commission’s prosecution of the Microsoft case,

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<sup>26</sup>O’Donoghue and Padilla (2006, xi).

<sup>27</sup>See Etro (2007,a, Ch. 6). On September 17, 2007 the Court of First Instance concluded the Appeal of the case and essentially upheld the 2004 Commission decision. The rest of this section heavily borrows from the article “Beyond browsers: Moving on from the EU vs. IE case”, by F. Etro (VOX, October 8, 2009).

it is clear that a settlement in Europe would constitute a welcome development and an achievement for Commissioner Neelie Kroes personally, confirming her unerring political instincts. Though the case was one she inherited from her predecessor Mario Monti, in the past five years she has made it her own, reaping political dividends for her tenacity on a technically complex dossier. A solution along the lines proposed by Microsoft would allow the Commission to quit while it is ahead, gaining important concessions from its old adversary and deftly avoiding what could have been negative political fallout from the arrival on Europe's shores of an unpopular, "IE-free" version of the new operating system.

To evaluate from the point of view of economic theory the consequences of this important step, we need to have a look at its background. In the last twelve years, Microsoft has distributed its operating system bundled with IE – and for eight of those twelve years, this has been done under a Consent Decree issued by the U.S. antitrust authorities. Even without the recent proposal of a "ballot screen" offering an opportunity to download rivals' browsers, alternative browsers can be easily installed on every PC. Competition in the field is on the basis of quality and functionality, at least since the introduction of IE in the mid-90s resulted in browsers' prices dropping to zero. Recently Mozilla's Firefox has seen considerable success, with the gap between IE and Firefox's respective market shares narrowing with every passing month; Opera and Safari have consolidated their market positions, while Google's new Chrome quickly picked up a few percent of the global market following its launch in the fall of 2008 (see Fig. 5 for world market shares). This tendency is even stronger in Europe, where the most recent data (from W3 Counter) show a large drop of the market share of IE (in all its different versions), from more than 80% a few years ago to 60.6% in July 2008 and 52.9% in July 2009, while Firefox grew from 29.7% to 31.4% in the last year, Safari moved from 1.9% to 3.1% and Opera from 1.1% to 1.2%, with the new Chrome reaching a market share of 3.1% in July 2009.

In spite of this dynamic competitive scenario, following a formal complaint by Opera, in January 2009 the European Commission sent a Statement of Objections to Microsoft concerning the possible anti-competitive consequences of tying Windows with IE. The Commission was applying the judgment rendered by the Court of First Instance in the earlier European case. In that case, Microsoft was accused of excluding competition in the market for media players and was forced to commercialise a new operating system without its media player, which, by the way, no one purchased. In the current case, the focus is on the market for browsers, which is characterised by lively competition and increasing market shares for rival products.

To a large extent, this industry seems extremely competitive, with a firm that is the leader in a primary market (operative systems) pressured by entry and innovation in a secondary market (browsers). The latter is characterised by an increasing degree of product differentiation (in terms of performance and visual experience) and by demand that overlaps with the primary good (almost any PC has access to the Internet) and typically covers multiple browsers at

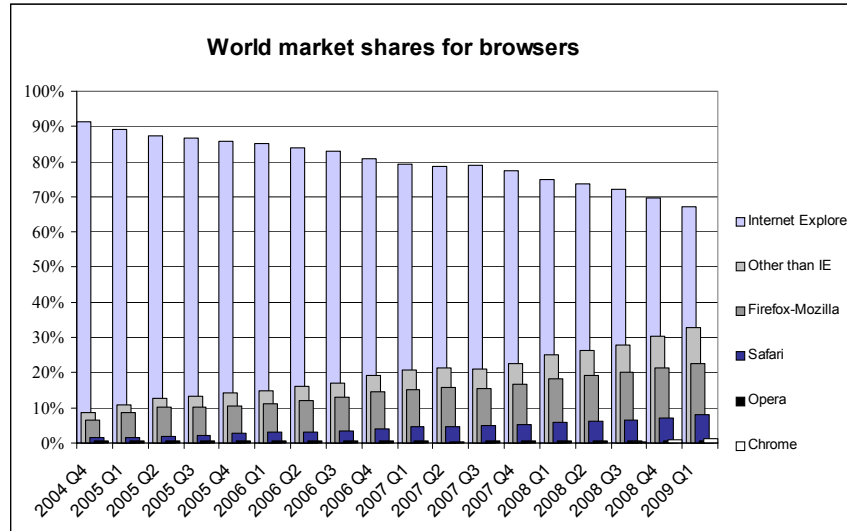


Figure 5: Market structure in the browser market (2004-2009). Source: our calculations on Net Applications data

the same time (Internet users often try and sometimes use different browsers on their devices). Under these conditions, tying becomes a normal aggressive strategy of the leader without exclusionary purposes, but aimed at strengthening competition and reducing prices in the secondary market to gain scale economies in the secondary market (against a modest sacrifice of profits in the primary market). Moreover, this is the classic situation in which the entry pressure in the browser market reinforces innovation by leaders and followers, producing important consumer benefits in terms of price, quality, and product variety (Etro 2006).

In such a scenario, it is hard to see other pervasive anti-competitive consequences of the Microsoft strategy. It seems unlikely that it could have a predatory purpose because any future increase in the price of IE is now unrealistic. Moreover, Microsoft mostly gains from the introduction and the diffusion of other browsers because this increases the quality of PCs and therefore the demand for Windows and Office applications, its main products. Finally, there are technological efficiencies from the design of an operating system including a browser. Therefore, tying Windows with IE could represent a constraint for competing browsers in theory but not practice; after all, IE could be substituted with another browser in a few seconds and freely even before the introduction of the ballot screen.

With the new mechanism launched by Microsoft, minor browsers and even new entrants will get a boost, strengthening the competition against Microsoft. As a matter of fact, the ballot screen will show up if IE has been installed, but if the computer manufacturers install an alternative browser, no ballot screen will appear for the final consumers – this may represent a substantial advantage for Firefox, Opera, and other competing browsers. Interestingly, the proposed mechanism may even strengthen the leadership of Google as a search engine, since browsers as Mozilla and Opera are currently paid to pre-set the leading search engine as the default, and computer manufacturers will be probably paid to do the same in the future. This may reinforce the dominance of Google in the market for online advertising. Not by chance, Google has heavily supported the investigation on Microsoft, while advertisers and content providers fear such a bonanza for Google.

In conclusion, given the ballot screen proposed by Microsoft aimed at installing alternative browsers and disabling IE, one can safely argue that even the theoretical constraints to entry and competition in the browsers' market will all be eliminated. It is therefore time to move on from this long-running case, leave market forces to work by themselves, and turn to other priorities, including in the IT sector.

## 11 Conclusions

In this Lecture we have applied the main principles of the EMSs approach to discuss three broad topics: the evolution of global markets of the New Economy and their endogenous structures (as for cloud computing, online advertising or browsers), the evolution of macroeconomic phenomena (as business creation, long run growth, globalization and innovation), and the prescriptions for policymakers (on macroeconomic policy, trade policy, innovation policy and competition policy).

With this mix of applications we want to make a key point: there is no way to understand the aggregate economy that does not start from the structure of the markets that belong to it, especially the high-tech and global markets whose shocks, innovations and exchanges are at the basis of economic fluctuations, growth and trade.

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