Project Remix

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Indian Summer: Part I

By Sona Akkar

Summer is here and with it comes picnics, trips to the beach, outdoor parties, and last but not least lots and lots of food! Most of the time, Indian food takes a back burner here as grilled meats, summer salads, and fresh herb sandwiches take over the show. However, here at Team Masala, we have a few simple, Indian inspired recipes that are sure to fit perfectly into the summer niche at any picnic or party this season. Throughout the summer I'll be providing recipes for some great tasting, easy to make, Indian summer fare. Today, we'll start with our take on that iconic Indian classic, the samosa...

Baked Pastry Samosas

These are a great healthy (and easy to make!) alternative to traditional samosas, which are usually deep fried. The pastry shell can be found in ready-to-bake form at most grocery stores, and the filling is very easy to prepare. These treats are fancy looking ,and are perfect to serve at a summer party, or to take along to the beach in a picnic basket.

Ingredients:

1 packet of pre-made pastry sheets (Pepperidge Farm Puff Pastry sheets work best for me)

2 medium white potatoes, diced into quarter inch cubes

2 green chilies, very finely chopped

2 tbsp garam masala (can be found in most Indian grocery stores and even in some local ones)

1 tspn turmeric powder

1 clove of garlic, finely chopped

salt, to taste

red chili powder, to taste

4 tbsp vegetable oil

Filling Preparation:

Heat the vegetable oil on medium heat in a frying pan. Lower the heat, and add the diced onions and a dash of salt. Stir until the onions are golden colored.

Add the green chilies and chopped garlic. Mix will with the onions.

Next, add the potato cubes and all the spices, including between 1 and 5 tsp of red chili powder (depending on how spicy you want it!), and about one tbsp of salt.

Mix all the ingredients until they combine and the potatoes and onions are coated well with the spices. Lower the heat to low, and continue mixing the ingredients for about 4 minutes. Do NOT stop mixing.

Samosa Preparation:

Preheat the oven to about 400 degrees F

Cut the puff pastry sheet into about 5 inch squares (they may already be pre-cut into squares so just keep it as is, if that's the case)

Wet your fingertips slightly, and roll about a spoon of the filling into a ball. Place the filling in one corner of the pastry square.

Fold the square so that it becomes a triangle, making sure the filling does not spill out. If it does, take some filling out.

With wet fingertips, push the folded edges of the samosa together (Do NOT touch the middle of the samosa or the pastry might break). Use a fork and press down along the folded edges to seal the samosa and to give it a fancy touch.

Place the samosas in the oven on a baking sheet for about half an hour, or until the pastry shells are golden brown.

Eat and enjoy! Check back right here at Project Remix next week as we highlight a unique twist on another classic, the Mango Lassi!

Team Innovate: Biofuels Part I

By Gautham Sridharan

As you are all well aware, our global supply of crude oil and natural gas is slowly diminishing. As a result, many novel energy alternative solutions have been proposed to curb our addiction to oil. These include the utilization of biofuels, wind, solar cells, and geothermal energy. Here, at Team Innovate, the first objective is to make it easier to understand the scientific, as well as the economic implications of each of these alternatives. In this two part series, we'll take an introductory look at biofuels. In Part I, we'll explain what they are and the practicality of using them. In Part II, we'll discuss the economics and mention some unique ideas on how to enhance biofuel technology in the future...

What exactly is the gasoline that you put in your car? Crude oil, which was probably drilled somewhere in the Middle East, gets imported by the United States. This oil is a thick, black, nasty looking oil that is a result of dead plant and biological matter that has settled underground over millions of years. This crude oil then goes to oil refineries across our country that refine the oil to a much more engine-friendly octane, ultimately resulting in gasoline. The central and pressing concern is as follows: crude oil reserves are running out, and if we can not find an economically viable alternative, the outlook for our future will be bleak.

The most obvious question posed in the quest for alternative energy was 'what if we can create a fuel that does not require millions of years of layering dead plants?'. The solution to that was ethanol. While today folks talk about ethanol for fuel as if it is a completely new idea, people have used ethanol in automobile combustion since the early 1900s when cars were first made [6]. It just so happened that fossil fuels were more economically competitive, and at the time abundant in supply, so people no longer pursued ethanol as a viable fuel option until a couple of decades ago.

So how is the ethanol used for cars produced? Ethanol is fermented using micro organisms such as yeast. Yeast cells have the enzymes to convert sugars into ethanol under certain conditions, via the same process for fermentation to make the beer or hard liquor that you may enjoy this weekend. The idea here is to feed cells in very large scale with some high sugar feedstock (corn is currently the most prevalent) and have them produce ethanol. The resulting soupy mess of ethanol, cells, water, and other junk most go to downstream processing where said soupy mess of ethanol/water mixtures would need to be distilled to produce an ethanol of higher purity. The ethanol that is distilled can then be used as fuel. So, the logic goes, if we use corn as our feed stock, then all we have to do is plant more corn, and in theory we should always be able to make more fuel. However, as with most things in life, it's not that simple and there are many complications with using ethanol as a fuel which we will discuss below.

If you take a step back from the science fiction of having an endless supply of fuel, you will begin to ask certain questions such as 'How much more energy do we get out of ethanol than it takes to make it?'. Growing corn is not a trivial task and requires energy to maintain both the crop and the soil. The crops require copious amounts of water, and so we need to also consider the energy requirements for bringing water to the growing crops as part of the "input energy". There are also transportation costs associated with bringing the corn to the fermentation facilities. While these are all important, the most critical energy expenditure would take place during processing, as distilling the ethanol/water mixture during downstream requires a lot of energy. Several have attempted to answer the question as to whether or not we get positive net energy, or a so called Net Energy Benefit (NEB) on ethanol with current technology.

Its not surprising that even the experts disagree. Some contend that it is not possible to obtain positive net energy and that those who claim it does grossly overlook inputs in the energy balance[5]. Others say with conviction that the energy value of ethanol derived from corn is much greater than the direct and indirect energy inputs combined and go on to say that there is no support for the assertion that corn biofuels require more energy to make than they yield [3]. It is tough to say who is currently correct, but the fact that there is no clear consensus leads us to the conclusion that we must be very close to the break even point at which energy input = energy output. This would then imply that improvements upon current ethanol producing technology could result in a substantial NEB. In part II, we'll discuss the economics and ethics of ethanol, and also introduce the concept of metabolic engineering and discuss how it may significantly improve ethanol's prospects.

Team Innovate: Biofuels Part II

By Gautham Sridharan

You might be wondering how in the world ethanol fermentation facilities are currently thriving if we don't even know if there is a NEB to ethanol. The answer there lies in government incentives and policies towards companies utilizing biofuels [1]. In fact, ethanol is profitable only if there are government subsidies. Many cite Brazil as an example of a country heavily using biofuels for several decades now. However, even there, the government has been selling ethanol to the public for $0.22 per Liter while it costs $0.33 per Liter to make [5]...

Some policy makers in Washington like to convince us that ethanol is economically profitable and environmentally safe. Even the latter is not necessarily true. While ethanol fermentation reduces the amount of greenhouse gases emitted, the tradeoff is the significant erosion to our farmland that might occur [4]. Moreover, using a staple food crop such as corn to produce fuel raises several ethical issues when more than half of the world's population is malnourished.

So far we have mostly looked at the different issues regarding ethanol production from corn feedstock. Alternative feedstocks have also been proposed such as oils from seeds or more woody biomaterial. How cool would it be to use trees to make fuels!? (well i'm not saying we should cut down trees to make fuels now, so don't smack me yet). The difficulty in using material with high cellulose content (like tree bark), is that it requires a cellulose enzymatic digest preprocessing step which requires a lot of energy and is expensive.

In addition to looking at alternative feedstocks, a great deal of research is being performed in the area of metabolic engineering. In yeast, glucose enters what is called the Embeden-Megerhut-Parnas (EMP) pathway where it is broken down into pyruvate which subsequently gets converted to ethanol. The cell is a giant factory of enzymes that catalyze many biochemical reactions. Glucose for instance, can have several different fates depending on the path it takes, and the rate at which it chooses a specific path is called 'metabolic flux'. The basic concept of metabolic engineering then is simple: find a way to divert as much glucose as possible into the ethanol producing pathways of a cell, without killing the cell in the process. In other words, maximize the metabolic flux of glucose through specific ethanol producing pathways while maintaining the viability of the cell. Metabolic engineering aims to accomplish this task by selectively turning on and off certain genes that code for specific enzymes in the various pathways. I'm curious to know (perhaps requires a bit more research) what people think is the maximum yield we can get from these microrganisms. Currently, the theoretical yield in the organism Saccharomyces cerevisia (yeast) is 0.511 g of ethanol per gram of glucose. [2] This is a maximum theoretical yield and is never obtained because of the flux distributions in a yeast metabolic network. I'm curious what yield we might be able to obtain with metabolically optimized cells and if those yields would make ethanol a more profitable option.

In this article, we have taken a good look at biofuels - both at understanding what they are as well as how economic viable they are. I have also proposed a few things that interest me about it and how I think I would personally optimize this process. The idea now is for others to augment this by suggesting their own ideas and or thoughts on the matter. They not necessarily need to be scientific - one could shed greater light on the ethical implications of using corn for fuel for instance. More importantly, it would be good to obtain a similar fact sheet/article set about other energy ideas such as wind, solar cells, and geothermal. Go Team Innovate!

Team Innovate: Repo Markets Part I

By Amit Bapat

The turmoil of the past 24 months has dominated the media, from TV to radio to print. It even dominated the later stages of the presidential election cycle, with John McCain famously (or infamously, more accurately) suspending his campaign to come to Washington to deal with the crisis. However, the media doesn't have the patience to examine the next level and explain, (in terms you can understand) some of the more interesting details that have played a role in this so called "Great Recession". Team Innovate-Finance aims to bring light to these aspects without confusing anyone with a bunch of financial mumbo jumbo.

For our first topic, we'll examine the role of something called the repo market. The repo market was the fundamental cause of the Bear Stearns collapse, and played a significant role in the aftermath of Lehman Brothers chapter 11 filling, but odds are you haven't heard of it. Because it's a complex topic, we've split it up into multi-part series, so that you can go at your own pace. Part I (below, click "read more") explains the basic mechanics of a repo transaction and basic uses of the repo markets. Part II, coming soon, will explain more complex uses and mechanics of repo markets. Together, Parts I and II will provide the background for Part III (still in the works) which will explain how repos were involved in Bear's collapse and how they brought debt markets to a grinding halt immediately after Lehman's bankruptcy .

In order to understand how repo markets brought about the demise of Bear Stearns we first need to develop a good understanding of the repo markets in general. A repo transaction is essentially a securitized loan. In such an arrangement, party A receives a cash loan from party B in exchange for a security (typically a debt security, like a treasury, commercial paper, or mortgage-backed security). At the end of the loan term (which could be overnight, or of longer maturity), party A repays the principal and interest on the cash loan to party B, and party B returns the security back to party A. In the event that party A defaults on the loan, party B retains ownership of the security. If all goes well, party A "repurchases" his/her security from party B at the end of the loan term. Hence the name "repo", short for "repurchase agreement".

So as you can see, there are two types of people who would want to enter into a repo transaction: those that have excess cash (or those that need securities), and those that have excess securities (or those that need cash). By bringing these two sets of people together, the repo markets aid in the execution of liquidity management, money supply management (the Fed's version of liquidity management), debt-market brokerage, and speculative trading. I've listed these in order of increasing complexity, so lets tackle them one at a time and see how important repo markets really are!

The most basic use of the repo markets is for short-term liquidity management. At any given time, there are market participants that need to increase their short-term liquidity (raise cash) and market participants that have excess liquidity (extra cash) that they are looking to invest short-term. These two parties could just engage in an old fashioned loan, but a repo could work out better for both. By providing a security, a T-bill, lets say, as collateral, those in need of cash can reduce their cost of borrowing. Meanwhile, those with excess liquidity can sleep better at night knowing that they've reduced their credit risk by obtaining some collateral (the T-bill, in this case).

Indeed, the ultimate form of liquidity management is the Fed's management of the money supply, and so if we zoom out, we can see how the Fed can use repos to manage the nation's liquidity. In Econ 101, you might have learned that the Fed increases and decreases the amount of cash available in the system by engaging in so called "Open Market Operations" (OMOs). In class, they generally simplify these to consist of the Fed directly buying Treasuries (thus increasing the money supply), or directly selling Treasuries (thus decreasing the money supply). But if this was the only way the Fed could adjust the money supply, they would have limited control, because such operations are permanent in nature. Repos, by their very definition, are temporary. If the Fed enters into a repo to increase the money supply today (receiving T-bills as collateral), the terms of the repo imply that this exact amount of money will be taken out of the system at a later date when the repo matures. Thus each and every day, the Fed can decide to renew a specific fraction of all the repos that are coming due, and thus precisely control the amount of money in the system. You can think of buying and selling treasuires as the "coarse focus knob" on the Fed's money supply microscope, with repos being the "fine focus knob".

Now that we've covered the basics we're ready to move on to Part II, which will explain how repos facilitate debt brokerage and speculative trading. If you have any feedback on the article, particularly relating to its readability and simplicity (or lack thereof), please let us know! Again our goal is to make complex topics that shape finance easier to understand.

Team Innovate: Repo Markets Part II

By Amit Bapat

Now that we've covered the somewhat dull topic of liquidity management, we can talk about the more fancy ways in which repos make the financial world go round. For one, repos are critical to **debt brokerage**. The idea behind brokerage is simply to match buyers and sellers of a security. Ideally, at any given time, the broker will not hold a position in any security. He will buy the security from a willing seller, and immediately match and sell the security to a willing buyer...

This works very well in liquid markets, like stock exchanges, where a given security may trade millions of times a day. Debt markets generally tend to be less liquid than equity markets. As such a dealer may have to buy a debt security from a seller, have to hold it for some time while he finds a willing buyer, and then resell it to that buyer. During the time in which he is trying to find a buyer, the broker owns the security and is thus exposed to any change in the price. But broker’s don’t want any price exposure, they simply want to make a commission as market makers!

So how does our broker get out of this fix? While there might not be immediate demand for that exact security, he/she might find that there is demand for another very similar security. If the dealer can short-sell this similar security to the willing buyer, then the dealer will have one security that he has bought (the original one from the previous paragraph), and one very similar security that he has sold (the new one from this paragraph). Thus by short-selling the new security the dealer is essentially hedged to a net neutral position.

But where do repos factor into all of this? Repos are the mechanism that enables the dealer to short sell the second security (thus hedging his risk an remaining net neutral). In order to short sell something, you have to borrow it from someone, and sell it on the market, ultimately buying it back later. For debt securities, repos are the mechanism by which you borrow securities! So our hypothetical dealer would exchange some excess cash for the security he needs to short sell, and then sell it. Again, to emphasize, he does this so that he maintains no exposure to price movements of the security. So basically, without repos, you probably wouldn’t have any bond brokers, and without those, you’d have a really inefficient bond market with massive transaction costs.

The last paragraph shows that short selling can have a true economic value because without it, broker/dealers wouldn’t exist and markets would be very inefficient. But of course, like any market tool, short selling can be broadly used for **speculation** by market participants. So since repos facilitate short selling of debt securities, they by definition facilitate speculation that the value of those debt securities will decline by hedge funds and the like. But repos can also play a huge role in speculation that the debt securities will *increase* in value. Similar to how buying on margin can create leverage in an equity position, repos can be used to buy up massively leveraged long positions in debt instruments. Say I start with 10 dollars and buy a bond. Then I use a repo to exchange that bond short term for 10 dollars of cash. I use this new found 10 dollars to buy another bond, called bond2. Then I use another repo transaction to exchange this bond2 short term for 10 more dollars and buy yet another bond, bond3. I’ve been able to buy $30 worth of bonds by putting up only $10 of my own money! I’ve effectively used repos to create a leveraged long position in this bond.

Parts I and II can be summed up pretty quickly in a couple key takeaways. Repos can be viewed as a way to borrow cash at a lower securitized rate and as such help with liquidity management. Repos can also be viewed as a way to borrow securities and as such allow for the shorting of debt securities, which facilitates debt brokerage and speculation/price discovery. Now that we’re all comfortable with how the markets are intended to work, Part III will discuss the various risks that are implicit in repos and how they ultimately lead to systemic risks that brought about the collapse of Bear Stearns and brought debt markets to a complete halt after Lehman’s chapter 11 filling.