

## Chapter 12: North American Energy: A Clear Path Forward?

**Kenneth B. Medlock III**

In his presentation, Kenneth B. Medlock III, professor of economics at Rice University, discussed shifts in global energy production and in North American energy markets over the past 20 years, particularly as regards the development of shale crude oil and natural gas. He also described the obstacles holding back energy sector development and the conditions needed for robust growth in the sector. Medlock's main conclusion was that, despite large-shale endowments in the NAFTA countries and the fast-paced development of the industry in the United States, all three member economies still need to undertake reforms to boost production, market development, and energy security in North America.

Medlock stated that North America—particularly the United States—has undergone a remarkable transformation in energy terms over the past 10 years due to its natural shale endowments, as well as the investment into and development of the technologies that make it possible to extract shale gas and oil. He pointed out that while geologists have been aware of North America's shale basins for some time, high natural gas prices in the early 2000s created investment and production incentives that triggered the boom in the industry.

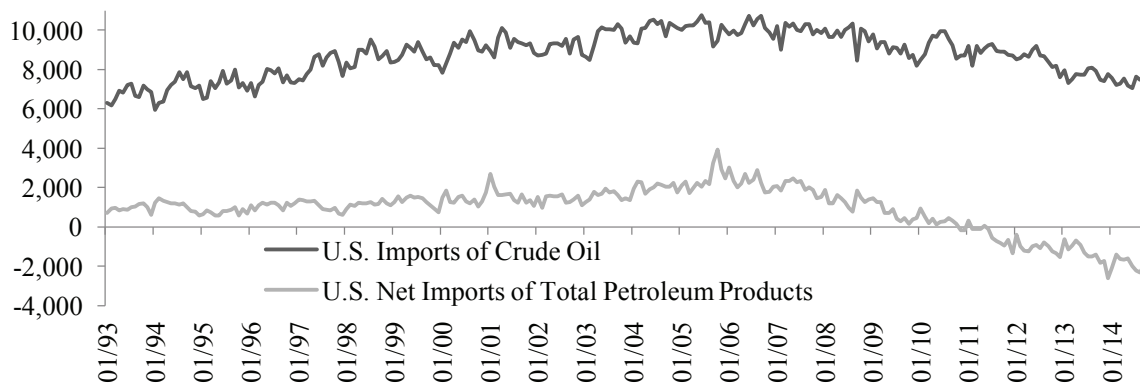
Favorable geological conditions and market structure, Medlock argued, are only two of the ingredients necessary for the successful development of a shale gas and oil industry. A host of other factors—largely regulatory, infrastructural, and legal—are vital to achieving robust development. For the United States, these factors have included:

- Upstream firms that negotiate directly with landowners for access to mineral rights.
- A market in which liquid pricing locations, or hubs, exist and are easily accessed due to liberalized transportation services being unbundled from pipeline ownership.
- A well-developed pipeline network that can accommodate new production volumes.
- A market in which interstate pipeline development is relatively seamless due to a well-established governing body—the Federal Energy Regulatory Commission—and a comparatively straightforward regulatory approval process.
- A market in which demand pull is sufficient and can materialize with few regulatory impediments, thus allowing new supplies to compete for market share.

- A market where a well-developed service sector exists that can facilitate fast-paced drilling activity and provide rapid response to demands in the field.
- A competitive service sector that strives to lower costs and advance technologies in order to gain a commercial advantage.
- A rig fleet that is capable of responding to upstream demands without constraint.
- A deep set of upstream actors—independent producers—that can behave as “entrepreneurs,” thereby facilitating a flow of capital into the field toward smaller-scale, riskier ventures than those typically engaged by vertically integrated majors.

Under these conditions, the United States has experienced a boost in both natural gas and crude oil production. The year 2006 marked the beginning of the resulting downturn in U.S. crude oil imports; by 2011, the U.S. had become a net exporter of petroleum products (figure 1).

**Figure 1. U.S. Petroleum Net Imports and Crude Oil Imports, 1993–2014, Thousands of Barrels per Day**



Source: U.S. Energy Information Administration

Despite the U.S. success, there are some potential barriers that are limiting or have limited further industry growth. Most notably, Medlock pointed to regulations banning exports of crude oil that may hinder demand for U.S.-produced shale oil unless changes in legislation are made. Also, as sectors that consume petroleum products become more energy-efficient, the demand for these products may also decrease over time.

In Mexico, Medlock pointed out, other impediments have held back the development of its energy industry relative to the U.S. industry, despite the existence of large endowments. First, local-content requirements have created the need for local entities to be involved in the development of the industry. He argued that Mexico already has a large offshore oil industry that could more easily participate in onshore

energy development—because of the infrastructure and service industry that has developed around it—if strict local-content requirements were not an issue. Medlock also noted concerns about shortfalls in infrastructure, services, and security:

“When you talk about onshore activities, there’s a lack of infrastructure, there’s a lack of a well-developed service industry south of the border to support the activity, and there are real concerns about security . . . really, all of those things have to be addressed if you’re going to see rapid movement on that space as well.”

Medlock said that these impediments have had considerable effects on Mexican industry’s ability to attract capital and develop market structure. He noted that there is a need for energy policy reform to “try to invite or entice capital into Mexico so that we can revitalize the upstream sector there.”

Canada’s gas and oil development has also been hindered relative to the U.S. boom, despite Canada’s large natural endowments. Medlock stated that the impediments in Canada largely involve policy-related demand constraints and infrastructure. The U.S. failure to approve the completion of the Keystone Pipeline XL has dampened demand for Canadian shale resources. Furthermore, Canada’s natural gas and oil also suffer from a lack of transportation infrastructure, due to geographic isolation and the cost of building a pipeline network in some areas where it is virtually nonexistent.

In summary, Medlock reaffirmed that much needed to be done to unlock North America’s shale resources. He argued that impediments—both on the supply side, including infrastructure, and the demand side—need to be addressed and resolved in order for greater energy security to be achieved in North America.

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# Chapter 13:

## NAFTA and Mexican Industrial Development

**Eric A. Verhoogen**

In his presentation, “NAFTA and Mexican Industrial Development,” Eric A. Verhoogen, Associate Professor and Co-Director of the Center for Development Economics and Policy (CDEP) at Columbia University, discussed the role that NAFTA and international integration have played in Mexico’s recent growth. He noted that Mexico’s recent performance has been mediocre relative to other middle-income countries, and offered what he called an “old-fashioned idea” as a potential partial explanation for Mexico’s disappointing performance. He argued that integration into the international economy led Mexico to specialize in less capital- and skill-intensive activities, which tended to be less innovative. The sectoral shifts within the Mexican economy, tended to lower Mexico’s rate of innovation overall, and may well have caused some of the economic stagnation we have witnessed.

### **Mexico’s Growth Relative to its Peers and Possible Explanations**

Referring to Hanson (2010), Verhoogen put Mexican growth in the context of comparable countries from various parts of the world, focusing on GDP per capita growth since 1980. In Latin America, Chile has vastly outperformed Mexico. Mexico compares more favorably with Argentina and Brazil, but Verhoogen noted that both of those governments have had much more heterodox policy regimes. Venezuela is the only country of the five Latin American countries listed (Mexico, Brazil, Venezuela, Argentina, and Chile) that Mexico has clearly outperformed.

When one looks at middle-income countries in other regions in Hanson’s analysis, Mexico fares even worse. Examining some Asian countries, Mexico’s growth rate has been substantially less than those of Thailand, Indonesia, and Malaysia, and lines up much more closely with the Philippines. Turning to Eastern Europe, Mexico trails considerably behind Turkey, Bulgaria, and Hungary; in recent years, even Romania has surpassed Mexico. Taking all of these together, it’s a fair question whether or not NAFTA and, more generally, integration with the other two NAFTA countries has played some role in this—and if so, is that role a positive or negative one?

There are a number of possible alternative explanations as to why Mexico has underperformed in recent decades. Verhoogen cites a few previously mentioned at the conference: Arias et al’s discussion of monopolies and inefficient regulation in Mexico, Haber’s discussion of Mexico’s underdeveloped credit markets, and Levy’s focus on informality and tax evasion. Another major issue that Verhoogen

acknowledged is corruption in Mexico. He goes on to concede that all of these may be contributing, but he instead wants to explore the role (if any) that trade and integration might be playing in Mexico's lackluster economic growth.

### **Evaluation of NAFTA: Two Approaches to Analyzing Mexican Growth**

Verhoogen conceded that evaluating NAFTA is extremely difficult because so many things were changing simultaneously. For example, many steps toward trade liberalization in Mexico actually occurred in the 1980s, and their effects might have been delayed. Moreover, the 1995 peso crisis in Mexico might have overwhelmed any positive NAFTA effects, since the devaluation was much larger than the tariff changes (Krueger 2000). Verhoogen then discussed two different approaches that several studies have taken to evaluate NAFTA: applied general equilibrium modeling, and reduced-form methods (difference-in-difference, most commonly).

For the former, Verhoogen cited Tim Kehoe's paper of 2005. He reiterated that the main advantage of applied general equilibrium (GE) modeling is that it allows us to make theoretically well-grounded statements about general-equilibrium effects as well as about welfare effects.

The main drawback is that the model has to be right in order for these statements to be valid, and that's often not an easy thing to be certain about. In the case of NAFTA, applied GE models did not perform particularly well in predicting the effects of NAFTA that are now observed. One reason for this is the new-goods margin—the growth of new goods or of goods that weren't previously exported much.<sup>26</sup> Another is that the aggregate changes seem to be often driven by total factor productivity (TFP) changes, but applied GE models do not normally endogenize TFP. That is, the models show sectoral shifts central to the analysis, but pay relatively little attention to productivity changes that are endogenous to trade liberalization.

In discussing the reduced-form approach, Verhoogen began by summarizing a USITC piece (De La Cruz et al. 2013). The main advantage of the reduced-form approach, according to Verhoogen, is that it requires weaker assumptions than applied GE modeling does. On the other hand, though, studies using the reduced-form approach are unable to make statements about GE and welfare effects. This approach is best equipped to document productivity changes. Verhoogen then discussed four other papers, López-Córdova (2003), De Hoyos and Iacovone (2013), Iacovone (2012), and Verhoogen (2008), that all look at this from different perspectives.

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<sup>26</sup> See Tim Kehoe's presentation for a discussion of the new-goods margin.

Verhoogen next explored the “old-fashioned idea” he previously mentioned. The idea is that different activities are associated with different inherent rates of innovation and productivity growth. Essentially, some industries tend to generate more innovation, more new ideas, and more productivity growth than others. Moreover, liberalization changes the patterns of specialization that may lead to specialization in non-dynamic activities. To demonstrate this, he first looked at broad sectoral shifts, using figures from Verhoogen (2008). He noted that the sectors with the lowest share of workers having 12 years of education grew the fastest in Mexico from 1988 to 1998. Similarly, he showed that over the same time span, industries with a lower capital-labor ratio grew faster. From 1998 to 2008 the trend reverses, but overall growth is much lower and flatter across sectors in both cases. He went on to show that this expansion of the low-skill and low-capital-intensive sectors from 1988 to 1998 was driven by an increase in maquiladora employment. Verhoogen argued that this is part of the reason why Mexico has not been faring as well as most expected.

### **Possible Explanations of Why Mexico Hasn’t Grown**

So why did this happen? The first explanation Verhoogen explored was one that is commonly cited; Mexico just had bad luck with regard to the emergence of China. The argument is essentially that China entered the metaphorical arena just as Mexico was poised to grow, and this hurt Mexico’s stance tremendously because China specialized in similar types of exports to the United States. Verhoogen went on to cite numerous pieces of research giving evidence in support of this notion: Utar and Torres-Ruiz (2013); Kumler (2014); López-Córdova, Micco, and Molina (2008); Hanson and Robertson (2010); and Hsieh and Ossa (2011). However, Verhoogen felt Mexico would have had significant problems even if China had not emerged. He explored these problems in the next section of his presentation.

Verhoogen looked at a research and development (R&D) survey from Mexico’s National Survey of Employment, Wages, Technology and Training in the Manufacturing Sector (ENESTyC), which shows that innovation was correlated to both high-skill and capital-intensive sectors in Mexico, which is what one would expect to see. By contrast, while the maquiladora industry shows more specialization, it simply isn’t innovative. Knowing that Mexico’s specialization was not occurring where innovation was highest may serve as an explanation for Mexico’s stagnation. He furthered this point by showing Mexico’s decline over time (and extremely low world ranking) with regard to patents per million workers in 1960–2000 (data from Lederman, Maloney, and Serven 2005). Moreover, Verhoogen used an alternative metric of innovation and, on a macro level, showed that Mexico spends less than half as much on R&D as a percentage of GDP as Chile and China do, and significantly less than Korea, the United States, and Canada. See table 1.

**Table 1. A Measure of Innovation: R&D, Percent of GDP, 1998**

Country	R&D Spending / GDP (%) in 1998
United States	2.59%
South Korea	2.34%
Canada	1.76%
Chile	.65%
China	.65%
Mexico	.38%

Source: Data from World Bank World Development Indicators for 1998.

### **Conclusion and Areas of Future Research**

In conclusion, Verhoogen argued that this period of integration (1998–2008) led Mexico to specialize in less capital- and skill-intensive activities, and these sectors are the ones that are normally less innovative in relative terms. Had China not entered the U.S. import market, Verhoogen hypothesized that another country would have eventually, and Mexico’s lack of innovation would have still been a problem that created stagnation. He claimed that, while future research on this is certainly needed, it appears that there may be some tradeoff between static allocative efficiency and long-term productivity growth. Trade liberalization may not bring about sustained economic growth if it leads to specialization in sectors with little innovation. He suggested that policymakers should consider some mechanisms of economic intervention that promote activities that generate innovation and productivity growth. “This argument relies on the idea that innovation generates positive externalities,” he added, noting that this question is the subject of his forthcoming research.

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